And We have made from water Every living thing

Hydro Potential in Pakistan

Pakistan Water And Power Development Authority

July 2009
## CONTENTS

### DESCRIPTION

<table>
<thead>
<tr>
<th>Project</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>04</td>
</tr>
<tr>
<td><strong>HYDROPOWER PROJECTS</strong></td>
<td>05</td>
</tr>
<tr>
<td>Diamer Basha Dam Project</td>
<td>06</td>
</tr>
<tr>
<td>Munda Dam Project</td>
<td>14</td>
</tr>
<tr>
<td>Tarbela 4&lt;sup&gt;th&lt;/sup&gt; Extension</td>
<td>15</td>
</tr>
<tr>
<td>Kohala Hydropower Project</td>
<td>16</td>
</tr>
<tr>
<td>Bunji Hydropower Project</td>
<td>18</td>
</tr>
<tr>
<td>Kurram Tangi Dam Multipurpose Project</td>
<td>19</td>
</tr>
<tr>
<td>Keyal Khwar Hydropower Project</td>
<td>20</td>
</tr>
<tr>
<td>Golen Gol Hydropower Project</td>
<td>22</td>
</tr>
<tr>
<td>Dasu Hydropower Project</td>
<td>23</td>
</tr>
<tr>
<td>Lower Spat Gah Hydropower Project</td>
<td>24</td>
</tr>
<tr>
<td>Lower Palas Valley Hydropower Project</td>
<td>25</td>
</tr>
<tr>
<td>Akhori Dam Project</td>
<td>26</td>
</tr>
<tr>
<td>Thakot Hydropower Project</td>
<td>27</td>
</tr>
<tr>
<td>Pattan Hydropower Project</td>
<td>28</td>
</tr>
<tr>
<td>Phandar Hydropower Project</td>
<td>29</td>
</tr>
<tr>
<td>Basho Hydropower Project</td>
<td>30</td>
</tr>
<tr>
<td>Lawi Hydropower Project</td>
<td>31</td>
</tr>
<tr>
<td>Harpo Hydropower Project</td>
<td>32</td>
</tr>
<tr>
<td>Yulbo Hydropower Project</td>
<td>33</td>
</tr>
<tr>
<td>Suki Kinari Hydropower Project</td>
<td>34</td>
</tr>
<tr>
<td>Matiltan Hydropower Project</td>
<td>35</td>
</tr>
<tr>
<td><strong>REGIONAL DAMS</strong></td>
<td>36</td>
</tr>
<tr>
<td>Nai Gaj Dam Project</td>
<td>37</td>
</tr>
<tr>
<td>Hingol Dam Project</td>
<td>38</td>
</tr>
<tr>
<td>Ghabir Dam Project</td>
<td>39</td>
</tr>
<tr>
<td>Naulong Dam Project</td>
<td>40</td>
</tr>
<tr>
<td>Sukleji Dam Project</td>
<td>41</td>
</tr>
<tr>
<td>Winder Dam Project</td>
<td>42</td>
</tr>
<tr>
<td>Bara Multipurpose Dam Project</td>
<td>43</td>
</tr>
</tbody>
</table>
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 tantamounts to a crisis situation. The hydropower potential in Pakistan is over 100,000 MW with identified sites of 55000 MW. Currently, studies under way include Diamer Basha (4500 MW), Bunji (5400 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, its share 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.

HYDROPOWER PROJECTS
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 ground breaking ceremony of the project. Detailed engineering design of the dam and allied structures is completed and tender documents are ready. Prequalification of contractors has been started and contract for project implementation through five lots shall be advertised soon.

**THE PROJECT**

The project is located on Indus River, about 315 km upstream of Tarbela Dam, 165 km downstream of the Northern Areas 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 8.1 million 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 up to Raikot Bridge on Karakoram Highway (KKH).

The dam is located at the boundary of Northern Areas (NA) and North Western Frontier Province (NWFP) in such a way that the right abutment and the right Power House is in NA while the left bank of the dam and the left Power House is in NWFP. WAPDA offices and Colony including that of the Consultants shall be in the Thor Nullah Valley in NA while the Contractor’s Camp and fabrication yard and workshop shall be in NWFP.

**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 at 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 Diamer Basha Dam will go a long way in alleviating this situation.

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 1800 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 7.5 years

ENVIRONMENT AND CULTURAL HERITAGE IMPACT ASSESSMENT

- No. of villages affected 31
- No. of Houses Affected 3100
- Population affected 28,560
- Agricultural land submerged 2660 acres
- Area under reservoir 151 km²
- Length of KKH submerged 100 km
- Suspension bridges, Electric and Telephone Lines etc.
- Pre-historic rock carvings 33000
- Historic DC House

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. Effectees would be resettled in 9 model villages in the close vicinity, with better living condition. Their means of livelihood would be ensured. Effectees would be provided 5 Marla plots free of cost in developed model villages with all the facilities and also 6 Kanal agricultural land for cultivation. The total cost of resettlement is estimated US$ 1.8 billion.

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 US$ 10 million.

GEOLOGY, LAND AND SOILS

- Reservoir Impounding
- Construction of dams and appurtenant Structures
- Temporary camps
- Dumping of soil or waste
• **CLIMATE AND AIR**
  o Change of local climate through Air pollution

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

• **FLORA AND FAuna**
  o Loss/degradation of natural plants
  o 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.

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

• **SAFETY AND HEALTH**
  o Casualties by usage of explosive material

• **ROCK CARVINGS**
  o Protection of damage to rock carvings at the dam site and in the quarry areas.
  o Physical relocation of most important rock carving objects, where feasible;
  o Documentation of all important rock carving objects;
  o Production of replicas of carvings for exhibition;
  o Establishment of Northern Areas Rock Carvings Exhibition Centre.

**PROPOSED CONTRACT LOTS**

LOT 1. Concrete Dam and Related Structures Including Diversion Tunnels and Permanent Access Bridge (US$1.827 Billion)

LOT 2. Underground Works and Related Structures (Left and Right Banks) (US$ 0.685 Billion)

LOT 3. Hydro-Mechanical Equipment and Hydraulic Steel Structures (US$ 0.422 Billion)

LOT 4. Power Plant Generation Equipment (Left and Right Bank) (US$ 1.030 Billion)

LOT 5. Electrical High Voltage Equipment and Power Plant Electrical Equipment (Left and Right Bank) (US$ 1.063 Billion)

**PRESENT STATUS**

• Detailed Engineering Design & Tender Documents completed.
• Hydraulic Model Studies completed.
• PC-I of Land Acquisition and Resettlement of Rs.60 billion approved by ECNEC on 6.11.2008.
• PC-I of Construction stage has been cleared by CDWP in 2nd week of July 2009.
• During March-April-May 2009 ADB reconnaissance Mission has met WAPDA Authority for looking into possibility to finance DBDP. The Bank Draft Aide Memorie has been received. WAPDA & GoP are intact with ADB for further action.
• Documents for pre-qualification of contractors received on 27.11.2008. Pre-Evaluation report has been submitted by M/s DBC to WAPDA. However, further action is hold up to follow ADB guidelines if funding is agreed by ADB.
• EOI documents already issued to the purchasers/firms has been cancelled. Modified EOI based on ADB guidelines shall be re-advertised after vetting by ADB.
• Draft Pre-qualification documents for Lot-1 to 3 and Draft EOI have been sent to ADB for vetting.
Bidding Documents for Lot-1 to 5 are being reframed as per ADB guidelines.
Environmental Management Plan (EMP) and Resettlement Action Plan (RAP) are being modified as per ADB guidelines.
Construction of KKH By-pass at Dam Site and Upgradation of KKH are under process by National Highway Authority.
GoP has allocated budget Rs. 8 billion for land acquisition and resettlement and Rs. 15 billion for construction of the main project in 2009-10. Requests for anticipatory approval for Rs. 1 billion each activity have been forwarded by WAPDA to Ministry Water & Power to meet immediate expenses of the ongoing activities.

SALIENT FEATURES

1. **LOCATION**: 40 km downstream of Chilas

2. **MAIN DAM**:
   - Maximum Height: 272 m
   - Type: Roller Compacted Concrete (RCC)

3. **DIVERSION SYSTEM**:
   - 2 No. Diversion tunnels
   - 1 No. Diversion channel
   - Upstream and Downstream Cofferdams

4. **MAIN SPILLWAY**:
   - No. of gates: 14
   - Size of gate: 11.5 X 16.24 m

5. **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

6. **OUTLETS**:
   - Low level: 2
   - Sluicing: 5

7. **POWERHOUSE(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: 18,000 Gwh/year

8. **ESTIMATED COST**: US$ 11.34 Billion

9. **EIRR**: 18.1%

10. **Benefit/Cost Ratio**: 2.49
### TENTATIVE TIMEFRAME FOR OVERALL IMPLEMENTATION

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Activity</th>
<th>CALENDAR YEAR (JAN-DEC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Feasibility Study Stage-I (Completed by NEAC)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Preparation of Tender Documents and Detail Engineering (Nearing Completion by DBC)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Additional Investigation Studies and Model Testing</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pre-construction Activities, Land Acquisition, Up-gradation / Relocation of KKH, WAPDA’s Camp in Thor Valley</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Tendering Process Up to Award</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mobilization of Contractor(s)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Main Construction Activities (Lot 1 to 5)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reservoir Impounding (Between EL.1060 to 1160)</td>
<td></td>
</tr>
</tbody>
</table>

### PROJECT LAYOUT

![Project Layout Image]
# DIAMER BASHA DAM PROJECT COST ESTIMATE

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated Cost (US$ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
</tr>
<tr>
<td><strong>A. Base Cost</strong></td>
<td></td>
</tr>
<tr>
<td>1. Direct Costs</td>
<td>1862</td>
</tr>
<tr>
<td>2. Indirect Costs</td>
<td>1249</td>
</tr>
<tr>
<td>3. Engineering and Project Management</td>
<td>112</td>
</tr>
<tr>
<td>4. Physical Contingency</td>
<td>56</td>
</tr>
<tr>
<td><strong>5. Total A (1+2+3+4)</strong></td>
<td>3279</td>
</tr>
<tr>
<td><strong>B. Duties and Taxes</strong></td>
<td>86</td>
</tr>
<tr>
<td><strong>C. Escalation During Construction</strong></td>
<td>937</td>
</tr>
<tr>
<td><strong>D. Interest During Construction</strong></td>
<td>3066</td>
</tr>
<tr>
<td><strong>E. Total Financial Cost (A+B+C+D)</strong></td>
<td>7368</td>
</tr>
<tr>
<td><strong>Say (US $ billion)</strong></td>
<td>7.37</td>
</tr>
</tbody>
</table>
# FINANCIAL OUTLAY OF DIAMER BASHA DAM

<table>
<thead>
<tr>
<th>Financial year</th>
<th>Expenditure (US$ Million)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
<td>Foreign</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td><strong>I. Pre-Construction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008-09</td>
<td>32</td>
<td>0</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>2009-10</td>
<td>496</td>
<td>114</td>
<td>610</td>
<td></td>
</tr>
<tr>
<td><strong>Sub Total - I</strong></td>
<td>528</td>
<td>114</td>
<td>642</td>
<td></td>
</tr>
<tr>
<td><strong>II. Construction Period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-11</td>
<td>524</td>
<td>105</td>
<td>629</td>
<td></td>
</tr>
<tr>
<td>2011-12</td>
<td>679</td>
<td>196</td>
<td>875</td>
<td></td>
</tr>
<tr>
<td>2012-13</td>
<td>563</td>
<td>530</td>
<td>1093</td>
<td></td>
</tr>
<tr>
<td>2013-14</td>
<td>680</td>
<td>540</td>
<td>1220</td>
<td></td>
</tr>
<tr>
<td>2014-15</td>
<td>781</td>
<td>656</td>
<td>1437</td>
<td></td>
</tr>
<tr>
<td>2015-16</td>
<td>890</td>
<td>668</td>
<td>1558</td>
<td></td>
</tr>
<tr>
<td>2016-17</td>
<td>895</td>
<td>465</td>
<td>1360</td>
<td></td>
</tr>
<tr>
<td>2017-18</td>
<td>795</td>
<td>276</td>
<td>1071</td>
<td></td>
</tr>
<tr>
<td>2018-19</td>
<td>841</td>
<td>208</td>
<td>1049</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-Total II</strong></td>
<td>6648</td>
<td>3644</td>
<td>10292</td>
<td></td>
</tr>
<tr>
<td><strong>III. Post Construction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019-20</td>
<td>192</td>
<td>213</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td><strong>IV. Total (I+II+III)</strong></td>
<td>7368</td>
<td>3917</td>
<td>11339</td>
<td></td>
</tr>
</tbody>
</table>
TRANSMISSION SCHEME FOR DISPERASAL 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.
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)
Construction Period: 7 Years

PRESENT STATUS

- Feasibility completed in March 2000.
- Revised PC-II for developing the Feasibility Studies/Detailed Engineering Design amounting to Rs.652.000 million cleared for approval of ECNEC by CDWP in its meeting held on October 11, 2008.
- RFP documents for invitation of technical & financial proposals of consultants finalized.
TARBELE 4TH EXTENSION PROJECT

LOCATION
Tarbela Dam

Existing Installed Capacity
3470 MW

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)
• 4th Extension estimated installed Capacity
960 MW

PRESENT STATUS

Nine (9) Consulting Firms / JVs submitted EOIs by 24.3.2009 (cutoff date)
Project Steering Committee 2nd meeting held in the o/o Director Technical (PMPIU) Islamabad on 27.4.2009 for deliberation on various components under WCAP
Secretary W&P directed Add. Secretary PD WCAP to process Summary for component B-4 through Planning Commission within 3 days. Action initiated.
Five (5) Consulting Firms/JVs proposed for short-list. Justification sent to World Bank on 01.6.2009
World Bank Rep. Mr. Masood visited Tarbela Dam on 24.5.09 with Country Director W.B. and Member (Water).
On WB advice, RFP prepared on Time Based Format and sent to W/Bank on 01.6.09.
Budget estimate for US$ 4.294 Million prepared on WB format and e-mailed to WB on 01.6.2009 for approval.
World Bank Supervision Mission Meeting for Progress Review of WACAP held in WB Office Islamabad on 03.6.2009.
Certain clarifications asked by WB about nature of proposed JVs obtained from concerned firms.
Additions / modifications proposed by W.B. incorporated in RFP & Revised RFP sent to W.B. on 11.6.09
WB Rep. (Mr. Masood) recent comments dt. 28.6.2009 being incorporated in RFP
Three (3) out of five (5) proposed short-listed firms asked on 01.7.2009 to re-form their JVs as suggested by WB
4th Progress Review Meeting held on 02.7.2009 in the o/o Dir (Tech) PMPIU Islamabad
Case initiated on 04-7-09 for re-submission of summary for approval of CDWP/ECNEC to include the project under WCAP as desired by PM Sectt:
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, 174 km from Islamabad and powerhouse is located 7 km upstream from Kohala Bridge.

SALIENT FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>1100</td>
</tr>
<tr>
<td>Gross Head (m)</td>
<td>320</td>
</tr>
<tr>
<td>Design Discharge (m^3/sec)</td>
<td>420</td>
</tr>
<tr>
<td>Mean Annual Energy (Gwh)</td>
<td>4800</td>
</tr>
<tr>
<td>No. &amp; Type of Turbines</td>
<td>4 (Francis)</td>
</tr>
<tr>
<td>Type of Dam</td>
<td>RCC</td>
</tr>
<tr>
<td>Height of Dam (m)</td>
<td>57</td>
</tr>
<tr>
<td>Estimated Project Cost (Billion US$)</td>
<td>2.155</td>
</tr>
<tr>
<td>Estimated construction period (years)</td>
<td>6</td>
</tr>
<tr>
<td>EIRR (%)</td>
<td>19.9</td>
</tr>
<tr>
<td>Benefit Cost Ratio</td>
<td>3.10</td>
</tr>
</tbody>
</table>

PRESENT STATUS

- ECNEC approved PC-II of the project for Feasibility Study, Detailed Design and Tender Documents for Rs.545.732 million including FEC 209.199 million on 23.08.2006.

- Consultancy Contract Agreement signed on 26.06.2007 at a cost of Rs.312.467 million for study period of 24 months with a Joint Venture of:
  - M/s. SMEC International Australia as a Lead Firm.
  - M/s. Sogreah, France.
  - M/s. Scot Wilson, UK.

- Final Feasibility Report received from Consultants, after incorporation of comments, received from WAPDA formations.
• Estimates for geotechnical investigation at dam site were approved and funds transferred. Four rigs are working at site. Investigation work is in progress and 2345 m drilling has been completed to date against 3440 m.

• Two number adits are being excavated.

• Draft report on Detailed Engineering Design and Tender Documents received and circulated to WAPDA formations for comments and final Design Report will be available by August 2009.

• During the visit of President of Pakistan to China from 14 to 17th October 2008, an MOU was signed with M/s. CWE to implement the project under EPC-Turnkey or BOOT basis with preferential supplier credit through Chinese Bank by the Contractor (copy of MOU enclosed as Annex-I).

• Private Power Infrastructure Board (PPIB) has issued LOI to China International Water and Electric Power Company (CWE) on 15.01.2009.

• A meeting was held on 17.02.2009 in Ministry of Water & Power, Islamabad, the following decisions were made:
  
  i) WAPDA will hand over Feasibility Study along with all supporting/ raw data regarding hydrology, subsurface investigations and geology etc. till 21st February, 2009.

  ii) CWE will review/ check and may request further data if required.

  iii) The existing Consultants may continue till the stage of Detailed Engineering Design.

• Feasibility report along with supporting/ raw data supplied to CWE. A joint site visit was conducted by Engineers from WAPDA, PPIB and CWE.
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 (MW) 7100
- Gross Head (m) 450
- Design Discharge (m$^3$/sec) 1900
- Mean Annual Energy (GWh) 24088
- No. & Type of Turbine 20 (Francis)
- Type of Dam RCC
- Height of Dam (m) 190
- Estimated Project Cost 6.83 (Billion US$)
- Estimated construction period 9 Years
- EIRR (%age) 15

PRESENT STATUS

- Hydro Planning Organization in association with short term consultants has finalized a 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.
- 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
- The Inception Report comprising of 2 volumes was submitted by Consultants on August 10, 2007.
- Survey and field investigations through core drilling, geological mapping, geophysical survey and hydrologic survey in progress.
- Draft Feasibility report was submitted by the Consultants in March, 2009.
- The final feasibility report is under finalization with due consideration of comments from WAPDA.
- Detailed design and tender documents are scheduled to be completed in August 2010.
KURRAM TANGI DAM MULTIPURPOSE PROJECT

LOCATION
The proposed project site is located across Kurram river in North Waziristan Agency about 22 KM upstream of Kurram Garhi Head works and 32 KM North of Bannu City in NWFP.

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

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.

PC-II Cost: Rs.125.60 Million

Approving Authority:
Approved by ECNEC on 25.02. 2005

PC-I Cost: Rs. 19.445 Billion (including Rs. 5.75 Billion FEC)
(Equivalent to US$ 324 Million)

CONSULTANTS:
M/s Pakistan Engineering Services (PES) JV appointed as Consultants for the preparation of feasibility and Detailed Engineering Design of the project.

PRESENT STATUS
- PC-I (Rs 17.025 Billion) approved by ECNEC in its meeting held on February 25, 2005. revised PC-I of Rs. 19.445 billion in process of preparation.
- Detailed Engineering Design and Tender Documents completed in March, 2005.
- Re-designing works for raising of dam height to accommodate 1.2 MAF of water has been completed in July, 2007.
- Modified tender documents sent to FWO on August 08, 2007. Bid for construction of the Project by FWO is in progress.
- The survey work for demarcation of Dam site/Reservoir area (for land acquisition) is completed.
KEYAL KHWAR HYDROPOWER PROJECT

LOCATION

The project is located in the North-West Frontier Province (NWFP) 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 tributary of Indus River.

SALIENT FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>122</td>
</tr>
<tr>
<td>Gross Head (m)</td>
<td>732</td>
</tr>
<tr>
<td>Design Discharge (m$^3$/sec)</td>
<td>22</td>
</tr>
<tr>
<td>Mean Annual Energy (GWh)</td>
<td>426</td>
</tr>
<tr>
<td>No. &amp; Type of Turbine</td>
<td>2, Pelton</td>
</tr>
<tr>
<td>Type of Dam</td>
<td>Concrete gravity</td>
</tr>
<tr>
<td>Height of Dam (m)</td>
<td>42.5</td>
</tr>
<tr>
<td>Estimated Project Cost (million EURO)</td>
<td>179.9</td>
</tr>
<tr>
<td>EIRR (%)</td>
<td>15.5</td>
</tr>
</tbody>
</table>

PRESENT STATUS

- Project is being undertaken under KfW grant and Loan in Two Stages such as:
  - Stage-I: Feasibility Study under grant.
  - Stage-II: Detailed Engineering Design, Tender Document and Construction Supervision under loan.

Stage-I: Feasibility Study

- Study is being carried out under Kfw grant.
- The study to be taken in two step:
  - Phase-1: Collection of data and Inception Report (April 2006 to October 2006)
  - Phase-2: Feasibility Study (February 2007 to December 2007)
- The final Feasibility report has been finalized in Jan 2008.
- Selection and final design of the preferred road route, EMP and RAP have been completed by 25.06.2008.
Stage-II: Detailed Engineering Design, Tender Document and Construction Supervision and Project Construction

- Loan agreement for Euro 77 Million has been signed between Govt. of Pakistan and KfW on November 11, 2008 for implementation of project.

- A supplementary loan agreement for Euro 20 Million has been signed between Govt. of Pakistan and Kfw on April 3, 2009.

- After having approval of prequalification of Consultants from WAPDA and KfW, Request For Proposal (RFP) for preparation of Detailed Engineering Design, Tender Document and Construction Supervision has been issued to the following 4 number Joint Ventures for submission of their Technical and Financial Proposal by 06.04.2009.
  - M/s. ILF Consulting Engineers, Germany
  - M/s. Lahmeyer International Gmbh, Germany
  - M/s. Fichtner, Germany
  - M/s. Mott MacDonald Limited, UK

- The following firms/ JVs submitted Technical and Financial Proposal on 06.04.2009.
  - M/s. Mott MacDonald Limited, UK
  - M/s. ILF Consulting Engineers, Germany
  - M/s. Lahmeyer International Gmbh, Germany

- Evaluation of Technical Proposals has been completed and report submitted to GM (P&D) for further processing/ approval of Authority.
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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>106</td>
</tr>
<tr>
<td>Gross Head</td>
<td>435</td>
</tr>
<tr>
<td>Design Discharge (m³/sec)</td>
<td>30</td>
</tr>
<tr>
<td>Mean Annual Energy (GWh)</td>
<td>436</td>
</tr>
<tr>
<td>No. &amp; type of Turbine</td>
<td>3, Pelton</td>
</tr>
<tr>
<td>Estimated Project Cost (Mill. US$)</td>
<td>130</td>
</tr>
<tr>
<td>Implementation Period (Months)</td>
<td>48</td>
</tr>
</tbody>
</table>

PRESENT STATUS
- Feasibility Study completed by HEPO/GTZ in 1997 is updated in 2005.
- Construction of boundary wall for O&M colony started on 8.7.2006.
- Consultants, a joint venture of PES, FICHTNER, Engineering Associates appointed for Detailed Design and preparation of Tender Documents.
- Pre-qualification documents for Construction of Lot:2, Lot:3.1, Lot:3.2 & Lot:4 finalized after vetting from GM (CCC) and CE (NTDC).
- Tender submission date 10.04.2008 for Construction of O&M Staff colony.
- Study for Detailed Design and Preparation of Tender Documents will be completed during this month.
- Tender Document for Lot:2 Civil Work received from Consultants and sent to GM(CCC) for vetting. Comments from Hydro Planning are sent for incorporation.
- Advertisement for pre-qualification of Contractors for Lot-2, Lot-3.1, 3.2 & 4 has been placed. About 43 firms submitted the pre-qualification documents. Evaluation of EOI is in progress.
- Hiring of Consultants for construction supervision is in progress. Request for Technical & Financial Proposal (RFP) is being sent to pre-qualified Consultants.
- Pre-qualification of Contractors/ Firms is in progress.
- 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, 69 km downstream of Diamer Basha Dam and 345 km from Islamabad.

SALIENT FEATURES

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>River</td>
</tr>
<tr>
<td>2</td>
<td>Capacity (MW)</td>
</tr>
<tr>
<td>3</td>
<td>Annual Energy (GWh)</td>
</tr>
<tr>
<td>4</td>
<td>Gross Head (m)</td>
</tr>
<tr>
<td>5</td>
<td>Design Discharge (m$^3$/s)</td>
</tr>
<tr>
<td>6</td>
<td>Dam Height (m)</td>
</tr>
<tr>
<td>7</td>
<td>Type of Dam</td>
</tr>
<tr>
<td>8</td>
<td>Gross Storage Capacity (MAF)</td>
</tr>
<tr>
<td>9</td>
<td>Power Tunnel (Km)</td>
</tr>
<tr>
<td>10</td>
<td>Powerhouse Type</td>
</tr>
<tr>
<td>11</td>
<td>Type of Turbines</td>
</tr>
<tr>
<td>12</td>
<td>No. of Units</td>
</tr>
<tr>
<td>13</td>
<td>Dam Crest Level</td>
</tr>
<tr>
<td>14</td>
<td>Normal Reservoir Level (m)</td>
</tr>
<tr>
<td>15</td>
<td>Spillway Crest (m)</td>
</tr>
<tr>
<td>16</td>
<td>Tail Water Level (m)</td>
</tr>
<tr>
<td>17</td>
<td>Estimated Project Cost (Billion US$)</td>
</tr>
<tr>
<td>18</td>
<td>Estimated Construction period (years)</td>
</tr>
<tr>
<td>19</td>
<td>EIRR (%)</td>
</tr>
</tbody>
</table>

PRESENT STATUS
- PC-II Proforma approved by ECNEC on September 29, 2003 for Rs. 796.87 million with FEC Rs.100.00 million.
- A Joint Venture of the following 2-Foreign & 2 Local firms signed agreement on 15.02.2006 for Consultancy Cost of Rs.343.861 million:
  - M/s. NESPAK
  - M/s. ACE
  - M/s. Colenco
  - M/s. MWH
- The Feasibility Study has been completed on 28th February, 2009.
- Prequalification of Consultants for preparation of Detailed Engineering Design and Tender Documents completed.
- RFP issued to pre-qualified firms for Detailed Design and Tender Documents for submission by 08.09.2009.
LOWER SPAT GAH HYDROPOWER PROJECT

LOCATION

Spat Gah is the left bank tributary of Indus River in Kohistan District, NWFP. The confluence of Spat Gah is located 8 km downstream of Dasu town, 35 km upstream of Patan town. The project is located 365 km from Islamabad.

SALIENT FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>567</td>
</tr>
<tr>
<td>Gross Head (m)</td>
<td>740</td>
</tr>
<tr>
<td>Design Discharge (m³/sec)</td>
<td>96</td>
</tr>
<tr>
<td>Mean Annual Energy (Gwh)</td>
<td>2189</td>
</tr>
<tr>
<td>No. &amp; Type of Turbine</td>
<td>3, Pelton</td>
</tr>
<tr>
<td>Type or Dam</td>
<td>Concrete gravity</td>
</tr>
<tr>
<td>Height of Dam (m)</td>
<td>80</td>
</tr>
<tr>
<td>Estimated Project Cost (million US$)</td>
<td>614</td>
</tr>
<tr>
<td>EIRR (%)</td>
<td>15.5</td>
</tr>
</tbody>
</table>

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 is providing the finance for feasibility study of Palas Valley through 5.00 Million Euro grant.
- The consultancy contract for Pre-Feasibility and subsequent Feasibility Studies of Palas Valley and Spat Gah HPPs were awarded in August 2006 to a Joint Venture: ILF (Germany), Verbundplan (Austria), EWE (Switzerland) and ACE (Pakistan).
- A report comprising of 13 volumes for Ranking of Identified Project has been submitted by Consultants.
- Field investigations and office studies for preparation of Feasibility Study are in progress.
- Phase-II: Feasibility Study will be completed in October 2009.
• LOWER PALAS VALLEY HYDROPOWER PROJECT

LOCATION

Palas Valley Hydropower Project is located on the left bank tributary of Indus River in Kohistan District, NWFP. The confluence of Chor nullah (Palas Valley) is located 12 km upstream of Patan town and 335 km from Islamabad.

SALIENT FEATURES

- Installed Capacity (MW): 621
- Gross Head (m): 757
- Design Discharge (m³/sec): 101
- Mean Annual Energy (GWh): 2448
- No. & Type of Turbine: 3, Pelton
- Type of Dam: Concrete gravity
- Height of Dam (m): 85
- Estimated Project Cost (million US$): 667
- EIRR (%): 15.34

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 is providing the finance for feasibility study of Palas Valley through 5.00 Million Euro grant.
- The consultancy contract for Pre-Feasibility and subsequent Feasibility Studies of Palas Valley and Spat Gah HPPs were awarded in August 2006 to a Joint Venture: ILF (Germany), Verbundplan (Austria), EWE (Switzerland) and ACE (Pakistan).
- A report comprising of 13 volumes for Ranking of Identified Project has been submitted by Consultants.
- Field investigations and office studies for preparation of Feasibility Study are in progress.
- Phase-II: Feasibility study will be completed in November, 2009.
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Earth &amp; Rock fill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>400 feet</td>
</tr>
<tr>
<td>Gross Storage</td>
<td>7.6 MAF</td>
</tr>
<tr>
<td>Live Storage</td>
<td>6.00 MAF</td>
</tr>
</tbody>
</table>

Saddle Dam

| Height        | 213 feet          |
| Length        | 4.78 Miles        |

Conveyance Channel

| Length         | 23 Miles (37 Km)  |
| 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) |

Environmental and Resettlement

- No of Affectees: 55800
- No of Houses: 9270
- Land Submergence: 65976 Acres
- Estimated Cost: US $ 4.40 Billion
- Construction Period: 5 Years

PRESENT STATUS

- 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.
- 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 Qila. Distance from Islamabad is about 240 km.

SALIENT FEATURES
- Installed Capacity (MW) 2800
- Gross Head (m) 138
- Design Discharge (m³/sec) 2900
- Mean Annual Energy (Gwh) 14095
- Height of Dam (m) 60
- Tunnel Length (km) 19.8
- Estimated Project Cost (Billion US$) 6
- Study period (month) 24

PRESENT STATUS
- Identified by MONENCO in “Inventory and Ranking Study” in November 1984 and reviewed by Hydro Planning Organization (HPO), WAPDA
- Capacity reviewed and updated by Hydro Planning Organization (HPO).
- PC-II for Feasibility Study has been prepared and submitted to Ministry of Water & Power for processing.
- Cost of Feasibility study is Rs.719.628 Millions.
  - Local Cost Component Rs.416.488 Millions
  - Foreign Cost Component Rs.303.139 Millions
- The Feasibility Study period will be 24 months after engagement of consultants.
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 Qila and 275 km from Islamabad.

SALIENT FEATURES

- Installed Capacity (MW) 2800
- Gross Head (m) 150
- Design Discharge (m$^3$/sec) 2600
- Mean Annual Energy (GWh) 15230
- Height of Dam (m) 104
- Tunnel Length (km) 18.0
- Estimated Project Cost (Billion US$) 6
- Study Period (month) 24

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.
- PC-II of the Project has been submitted to Ministry of Water & Power for approval by Planning Commission.
- Cost of Feasibility study is Rs.731.233 Millions.
  - Local Cost Component Rs.373.731 Millions
  - Foreign Cost Component Rs.357.502 Millions
- The Feasibility Study period will be 24 months after engagement of consultants.
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

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>80</td>
</tr>
<tr>
<td>Gross Head (m)</td>
<td>237</td>
</tr>
<tr>
<td>Design Discharge (m$^3$/sec)</td>
<td>40</td>
</tr>
<tr>
<td>Mean Annual Energy (Gwh)</td>
<td>350</td>
</tr>
<tr>
<td>No. &amp; Types of Turbine</td>
<td>4, Pelton</td>
</tr>
<tr>
<td>Estimated Project Cost (million US$)</td>
<td>70</td>
</tr>
<tr>
<td>EIRR (%)</td>
<td>23.43</td>
</tr>
<tr>
<td>Study Period (months)</td>
<td>18</td>
</tr>
<tr>
<td>Implementation Period (months)</td>
<td>36</td>
</tr>
</tbody>
</table>

PRESENT STATUS

- Feasibility was completed by HEPO, WAPDA with GTZ under Technical Assistance Program in 2003.
- PC-II for Detail Engineering Design and preparation of Tender Documents approved by CDWP on 30.04.2007 for Rs. 120.376 million.
- 7 No. Firms/Joint Ventures submitted their EOI Documents for Pre-qualification.
- 5 No Firms/Joint Ventures were prequalified and RFP issued to them on QBS method.
- The evaluation of Technical Proposals was submitted to Authority for vetting the ranking and to allow for opening of Financial Proposals.
- On 19/02/2009, Authority directed to revise evaluation of proposals on the basis of Quality and Cost Based Method (QCBS) in addition to taking into account the previous performance of consulting firms specifically on WAPDA projects.
- The RFP has been revised on QCBS duly verified by CCC and issued to already pre-qualified firms/JV’s.
- The last date for submission of RFP was 16-06-2009.
- The evaluation of RFP document is under progress.
- Study will be completed in 18 months after engagement of consultants.
BASHO HYDROPOWER PROJECT

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

SALIENT FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>28</td>
</tr>
<tr>
<td>Gross Head (m)</td>
<td>949</td>
</tr>
<tr>
<td>Design Discharge (m³/sec)</td>
<td>3.5</td>
</tr>
<tr>
<td>Mean Annual Energy (GWh)</td>
<td>135</td>
</tr>
<tr>
<td>No. &amp; Type of Turbine</td>
<td>3, Pelton</td>
</tr>
<tr>
<td>Type of Weir</td>
<td>Tyrolean Weir</td>
</tr>
<tr>
<td>Estimated Project Cost (million US$)</td>
<td>40.01</td>
</tr>
<tr>
<td>EIRR (%)</td>
<td>20.66</td>
</tr>
<tr>
<td>Study Period (month)</td>
<td>18</td>
</tr>
<tr>
<td>Implementation Period (months)</td>
<td>48</td>
</tr>
</tbody>
</table>

PRESENT STATUS

- Feasibility report has been completed by HEPO (WAPDA) with technical collaboration of GTZ of Germany.
- PC-II for Detail Design and Tender Documents has been approved by CDWP in its meeting held on 27-11-06 for Rs. 91.243 million.
- 7 No Firms/Joint Ventures submitted their EOI Documents for Pre-Qualification.
- 5 Firms/Joint Ventures were prequalified & RFP documents were issued on QBS method.
- On 19/02/09 Authority directed to revise the evaluation of proposals on Quality Cost Based Selection (QCBS) in addition to evaluating the technical proposals taking into account the previous performance of firms specifically on WAPDA projects.
- The RFP has been revised by Hydro Planning Organization.
- Revised RFP (QCBS) duly vetted by CCC has been received in this office in July 2009.
- Study will be completed in 18 months after engagement of consultants.
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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity (MW)</td>
<td>70</td>
</tr>
<tr>
<td>Gross Head (m)</td>
<td>413</td>
</tr>
<tr>
<td>Design Discharge m³/sec</td>
<td>20</td>
</tr>
<tr>
<td>Mean Annual Energy (Mil. KWh)</td>
<td>303</td>
</tr>
<tr>
<td>No. &amp; Type of Turbine</td>
<td>3 (Pelton)</td>
</tr>
<tr>
<td>Estimated Project Cost (MilUS$)</td>
<td>120</td>
</tr>
<tr>
<td>EIRR (%)</td>
<td>18.51</td>
</tr>
<tr>
<td>Implementation Period (Years)</td>
<td>4</td>
</tr>
</tbody>
</table>

PRESENT STATUS

- PC-II to carry out the feasibility study was approved by CDWP on 22.03.2004 for Rs. 90.585 million.

- Feasibility study completed.

- PC-I for preparation of Detailed Engineering Design and Tender Documents and project construction is being processed for approval from WAPDA Standing Review Committee (SRC).
HARPO HYDROPOWER PROJECT

LOCATION

The proposed scheme is identified along 2.5 km lower stretch of Harpo 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
- Channel Length: 410 m
- Penstock Length: 2885 m
- No. of Units: 3 Pelton
- Energy Generated: 187 GWh
- Estimated Project Cost: 44.608 million US$
- Updated 2009
- Study Period: 18 months
- Implementation Period: 48 months

PRESENT STATUS

- Feasibility study of the project completed with the technical collaboration of GTZ of Germany in February 2002.
- PC-II for detailed Design and preparation of Tender Documents has been approved by CDWP on 22-11-2008.
- Cost of the project has been updated. Economic and financial analysis will be revised on the basis of new updated cost.
- Request for EOI published in Newspapers on 30-04-09. Last date for submission of application by consulting firms was 15-06-2009.
- 9 firms/JV submitted the EOI documents.
- The evaluation of EOI documents is under progress.
- Request for EOI published in Newspapers on 30-04-09. Last date for submission of application by consulting firms is 15-06-2009.
YULBO HYDROPOWER PROJECT

LOCATION
The dam site is located on the Indus River. The powerhouse is about 9 Km upstream of the village of Shengus, midway between Skardu town and confluence of rivers Indus and Gilgit. The project area is about 660 km from Islamabad.

SALIENT FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Indus</td>
</tr>
<tr>
<td>Gross Head</td>
<td>238 m</td>
</tr>
<tr>
<td>Head Water Level</td>
<td>1920 m</td>
</tr>
<tr>
<td>Tail Water Level</td>
<td>1682 m</td>
</tr>
<tr>
<td>Average Flow</td>
<td>990 m$^3$/s</td>
</tr>
<tr>
<td>Capacity</td>
<td>3000 MW</td>
</tr>
<tr>
<td>Project Cost</td>
<td>6 billion US$</td>
</tr>
</tbody>
</table>

PRESENT STATUS

- Desk study and field reconnaissance initiated by Hydro Planning Organization, WAPDA.
SUKE KINARI HYDROPOWER PROJECT

LOCATION
The Suki Kinari hydropower project is located in NWFP 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 x 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 Licence is under process in NEPRA
- LOS issuance is in process in PPIB
MATILTAN HYDROPOWER PROJECT

LOCATION

The Matiltan hydropower project is located on Ushu River (a 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 x 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 NWFP 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.

- In the last meeting held on 14-04-2008 under the chairmanship of Chief Minister, NWFP to discuss the implementation of the project, WAPDA offered to implement the project with the collaboration of the Government of NWFP. The GONWFP was to negotiate with the sponsors for an amicable solution for implementation of the project.
REGIONAL DAMS
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

(i) Irrigation
(ii) Hydropower Generation
(iii) Flood Control

SALIENT FEATURES

i. Type of Dam Earth and rock fill dam.
ii. Height of Dam 150 Ft
iii. Live Storage 0.130 MAF
iv. Gross Storage 0.174 MAF
v. Dead Storage 0.044 MAF
vi. Fuse Plug Capacity 74000 Cusecs
vii. Spillway Capacity 253000 Cusecs
ix. Command Area 56320 Acres (GCA)
     40,000 Acres (CCA)
ix. Power House Installed Capacity 2.3 MW
xii. EIRR 12.05%
liii. B/C Ratio 1 : 1

CURRENT STATUS

- PC-II amounting to Rs.115.02 million approved by CDWP in its meeting held on October 19, 2006 for detailed engineering design and tender documents.
- M/s NESPAK commenced the study w.e.f. September 10, 2007.
- The engineering study of the Project is scheduled to be completed in September, 2009.
- PC-I cleared by CDWP for approval of ECNEC.
HINGOL DAM PROJECT

LOCATION
The dam site is located in District Lasbela near Aghor on Hingol river in Balochistan Province at a distance of 145 miles North West of Karachi and about 8 Kms North of Kund Malir where the river falls into the sea.

OBJECTIVES
- Irrigation of 100,000 acres of Balochistan.
- Hydropower generation of 650 KW.

SALIENT FEATURES
Type of Dam Random rockfill with clay core.
Maximum height of Dam 170 ft
Length of Dam 1,430 ft
Normal conservation level. 145 ft. ASL
Gross Storage Capacity 2,107,389 AF
Dead Storage Capacity 1,291,517 AF
Live Storage Capacity 815,872 AF
Installed capacity 738 KW
Command Area 90,000 acres
Project Cost Rs. 15.615 Billion
EIRR = 19.46%
B/C Ration = 1.95:1

CURRENT STATUS
- PC-I submitted for approval of Planning Commission.
- The Prime Minister has directed to study the new site to avoid the submergence of sacred places of Hindu Community.

LOCATION
The dam site is located in District Lasbela near Aghor on Hingol river in Balochistan Province at a distance of 145 miles North West of Karachi and about 8 Kms North of Kund Malir where the river falls into the sea.

OBJECTIVES
- Irrigation of 100,000 acres of Balochistan.
- Hydropower generation of 650 KW.

SALIENT FEATURES
Type of Dam Random rockfill with clay core.
Maximum height of Dam 170 ft
Length of Dam 1,430 ft
Normal conservation level. 145 ft. ASL
Gross Storage Capacity 2,107,389 AF
Dead Storage Capacity 1,291,517 AF
Live Storage Capacity 815,872 AF
Installed capacity 738 KW
Command Area 90,000 acres
Project Cost Rs. 15.615 Billion
EIRR = 19.46%
B/C Ration = 1.95:1

CURRENT STATUS
- PC-I submitted for approval of Planning Commission.
- The Prime Minister has directed to study the new site to avoid the submergence of sacred places of Hindu Community.
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.

SALIENT FEATURES

Reservoir
- Gross Storage Capacity 81.66 MCM
- Dead Storage Capacity 49.59 MCM
- Live Storage Capacity 32.07 MCM

Dam
- Type With Central impervious clay zone
- Height 42 m (El: 397 masl)

Spillway
- Type Ogee
- Width 100 m
- Capacity 1200 cumecs

Irrigation System
- Cultureable Command Area 6070 Ha

PRESENT STATUS

- Feasibility study completed in January 2007.
- PC-I is under approval of Planning Commission.
NAULONG STORAGE DAM PROJECT

LOCATION
The proposed Naulong Storage Dam Project is located on Mula river at Sunt about 30 Kms from Gandawa City in Tehsil and District Jhal Magsi of Balochistan.

OBJECTIVES
i. Irrigation of 34,000 acres of land.
ii. Hydropower Generation.
iii. Flood Mitigation.

SALIENT FEATURES
- Dam Type: Zoned, 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 (new + existing): 36,000 Acres
- Installed Capacity: 3.5 MW

CURRENT STATUS
- Feasibility Study completed in 1996.
- Detailed Engineering Design & Tender Documents are due in July, 2009.
- PC-I cleared by CDWP for approval of ECNEC.
SUKLEJI DAM PROJECT

LOCATION

Sukleji Dam is located across Sukleji River about 70 kms west of Shoran, Tehsel Sunny of Bolan District in Kachhi Plain of Balochistan.

OBJECTIVES

(i) Irrigation
(ii) Flood Control

SALIENT FEATURES

- Dam Type: Earth Fill / Rock Fill
- Dam Height: 110 Ft
- Dam Length: 1,466 Ft
- Live Storage: 34,000 A.F
- Gross Storage: 42,000 A.F
- Average Annual Runoff: 41,350 AF
- Catchment Area: 780 Sq. miles
- Canal Capacity: 50 Cusecs
- Command Area: 12,000 Acres

PROJECT COST & ECONOMICS

- Cost: Rs. 3.63 Billion
- EIRR: 10.07%
- B/C Ratio: 1.01

CURRENT STATUS

- Feasibility Study for Alternate-A completed. Project is marginally feasible and fraught with geotechnical problems.
- Decision to investigate Alternate Site-C is made.
- PC-II for study of Alternate-C is prepared and under submission to Ministry of Water and Power for approval of Planning Commission.
WINDER DAM PROJECT

LOCATION
Across Winder River about 100 Km from Karachi in District Lasbela, Balochistan.

MAIN DAM
- Type: Earth Core Rock Fill
- Height: 102 Ft.
- Length: 1696 Ft.
- Dam Crest Level: 361 Ft.

AUXILLARY DAM
- Type: Earth Core Rock Fill
- Height: 47 Ft.
- Length: 1271 Ft.

RESERVOIR
- Reservoir Area: 1056 Acres
- Gross Storage: 36,483 AF
- Live Storage: 36,167 AF
- Conservation El.: 354 Ft. SPD

SPILLWAY (GATED)
- Width: 510 Ft.
- Crest Level: 333 Ft.
- Discharge: 152,000 Cusecs

FUSE PLUG
- Height: 27 Ft.
- Length: 269 Ft.
- Discharge: 108,000

IRRIGATION SYSTEM
- Conduit Diameter: 6ft.
- Main Canal Capacity: 50 Cusecs
- Main Canal Length: 12.4 Miles
- Distributaries: 04
- Distributaries Length: 10 Miles
- Command Area (CCA): 10,000 Acres

PROJECT COST
- Cost: Rs. 2,571 M

PRESENT STATUS
- PC-I amounting to Rs. 2571.00 M submitted to Ministry of Water and Power on 19-12-2007 for obtaining the approval of ECNEC, which is awaited.
- Tenders for Winder Dam on EPC/Turnkey basis will be opened on June 30, 2009.
- Consulting firms had submitted their proposals for appointment of Management Consultants by 15 Dec 2007. M/s. NESPAK ranked 1st and approved by Authority. Financial proposal of M/s. NESPAK opened by a Committee and is under process.
BARA MULTIPURPOSE DAM PROJECT

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

OBJECTIVES
- Assured irrigation supplies to the existing irrigation schemes.
- Hydropower generation
- Water supply.

SALIENT FEATURES

Main Dam
Type: Earthcore Rock fill Dam
Height: 92 m
Crest Length: 450 m
Gross Storage Capacity: 85,363 Aft (105 MCM)
Live Storage Capacity: 63,071 Aft
Dead Storage: 22,292 Aft
Power Houses Installed Capacity: 5.8 MW (38.1 GWh)

Dyke
Height: 9 m
Crest Length: 320 m

Spillway
Type: Overflow Ogee
Capacity: 284,670 Cusecs (PMF)

Intake
Capacity: 330 Cusecs

Command Area
Bara River Canals Scheme: 36,420 Acres
Bara Canals Irrigation Scheme: 6,308 Acres
Cropping Intensity: 161%

Project Cost & Economics
Cost: Rs.11 Billion
EIRR: 15.25
B/C Ratio: 1.47:1

PRESENT STATUS
- FATA Development Authority requested WAPDA to take up detailed engineering design and construction.
- PC-II for Detailed Engineering Design is prepared and submitted to FATA Development Authority for clearance and submission to MoW&P for approval of Planning Commission.