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# USAID ENERGY POLICY PROGRAM DUE DILIGENCE REPORT (STEP-II) GOLEN GOL HYDROPOWER PROJECT – CHITRAL, KHYBER PAKHTUNKHWA (KPK)



January 2015

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# USAID ENERGY POLICY PROGRAM

## DUE DILIGENCE REPORT (STEP-II)

### GOLEN GOL HYDROPOWER PROJECT – CHITRAL, KPK

Contract No: AID-EPP-I-00-03-00004

Order No: AID-391-TO-12-00002

©USAID Energy Policy Program  
House 4, Street 88, Sector G-6/3  
Ataturk Avenue, Islamabad, Pakistan  
Tel: +92 (51) 835 7072, Fax: +92 (51) 835 7071  
Email: [jhicks@ep-ep.com.pk](mailto:jhicks@ep-ep.com.pk)

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# EXECUTIVE SUMMARY

USAID has directed AEAI to conduct a due diligence of the 106 MW Golen Gol hydro project for USAID to reach a decision while keeping in consideration the technical feasibility, cost reasonableness and overall impact of the project. The detailed due-diligence involved an analysis of project information, site visit, meetings with WAPDA staff, and assessment of project's technical and financial health and progress.

*Based on our assessment and review, the project is an attractive option, though not without issues that needs to be addressed. It is the first large development in Chitral, Khyber Pakhtunkhwa (KP), and Golen Gol has high visibility and is a high priority for Pakistan to placate a population feeling deprived in a valley lying in close proximity to the Afghan border. Completion of the project will definitely be worth the time and money expended. Subsequent electrification will improve stabilization in the sensitive region, enhance quality of life for locals, especially women and children, and create opportunities for enterprise. The project will also generate annual revenues of over \$33 million and make possible the launch of many new activities leading to socio-economic improvements in Chitral.*

**The project is on the national grid providing 436 GWh of annual energy, and estimated to cost \$313 million (per revised PC-I) of which \$164 million has been committed by the Saudi, Kuwait and OPEC funds while WAPDA's cost share is \$149 million. Based on our discussions with WAPDA and as per progress reports of the consultants, the 106 MW Golen Gol run-of-river Hydropower Project is about 31.6% complete and approximately \$144 million (46%) has been spent by December 2014. WAPDA is exploring options to arrange \$88 million to complete the project by 2017.**

Oversight to the project is provided by a joint venture comprising Fichtner Germany, PES Pakistan, BAK Pakistan, and DMC Pakistan as consultants for the project. Feasibility study was carried out by GTZ Germany. Main contractors for the civil works are Sambo Sarco of Korea, Electrical and Mechanical works are to be done by Andritz Austria, and transmission line by NETRACON Pakistan. **Contracts have been awarded pursuant to international competitive bidding under oversight of the three lending agencies, viz. Saudi, Kuwait and OPEC funds.**

The Executive Committee of National Economic Council (ECNEC) approved PC-I of \$116 million in September 2002, while the revised PC-I of \$313 million is currently in the approval process that is likely to take another three to four months.

Golen Gol Hydropower is the first major power generation project in the remote northwest corner of Pakistan, situated in the fabled valley of Chitral, Khyber Pakhtunkhwa province. It lies on the left bank tributary of Mastuj River flowing through the Chitral valley. Situated about 25 km upstream from the town of Chitral in KP, it is about 365 km from the provincial capital Peshawar and about 380 km from Islamabad and is accessible both by air as well as by 9-hour drive via road.

According to the revised PC-I of the project, the Benefit Cost Ratio (BCR) of 2.35: 1 and Internal Rate of Return (IRR) of 33% of the Golen Gol project are very attractive and annual revenue on sale of power would be over \$33 million, saving fuel oil import of about \$65 million per annum. The project will satiate electric power demand in Chitral, stimulate local businesses, provide job opportunities to locals, and stimulate cottage industry in the remote areas besides connecting Chitral to the national grid by a 132kV Transmission line, strengthening the existing 33KV transmission line. The major construction has neither displaced villagers nor adversely impacted local population.

Main components of the project include 12m high Weir, 80m long headrace Channel, 3.8km long steel lined circular pressure Tunnel with a single surge chamber, leading to a 106 MW Powerhouse with expected annual energy output of 436 GWh. The powerhouse will have three Pelton turbines, each driving a vertical shaft generator of 42 MVA, feeding the grid through 11kV/132 kV unit

transformers and a 132 kV outdoor switchyard. The station will be connected to the grid by a 113 km long double circuit 132 kV transmission line passing over the Lowari Pass and connected to the existing grid station at Timurgharah in Dir and then through an 85km long single circuit 132 kV line onwards to Chakdara in the Swat valley.

USAID, prior to making a decision, needs to look into the following issues that require commitment from GOP/WAPDA:

1. Revised PC-I to be approved by the GOP.
2. Provides USAID with a viable and credible financing plan for the remaining life of the project.
3. Demonstrate commitment to quickly complete the project by clearing the undisputed outstanding bills and claims of consultants and contractor.
4. Ensure environmental compliance at site, and for the transmission line and grid station that may require detailed assessments.
5. Avoid frequent changes in the management of the project
6. For sustainable operation of the power plant, commitment will also be required from WAPDA to allocate funds for the operation and maintenance of the project, and also put in place a Power Purchase Agreement with the power purchaser to have sufficient funds for the sustainable operations.

**The project fits within the least-cost energy generation plan being executed by WAPDA to harness indigenous hydropower resources of the country.** Currently, Chitral with its population of about 500,000 gets 5MW from the grid, 5MW from small hydropower sets and about 1MW from diesel sets. Thus the present capacity is insufficient and only benefits around 100,000 people about 20% of the population. Lack of electricity has stifled businesses and enterprises and is leading to deforestation. Addition of 106 MW of generation capacity will be sufficient to supply electricity to 981,772 individuals.

# OVERVIEW

WAPDA has requested USAID to consider financing the 106MW Golen Gol hydropower project as one of the potential run-of-river projects. Located in Chitral khyber Pakhtunkhwa (KP), the project is currently under construction and expected to complete by 2017. The project is on the national grid and estimated to cost \$313 million of which \$164 million has been committed by the Saudi, Kuwait and OPEC funds, with WAPDA's cost share being \$149 million. Based on our discussions with WAPDA and as per progress reports of the consultants, thus far, approximately \$144 million has been spent by December 2014 of the total \$313 million. At present, WAPDA is exploring options to arrange \$88 million to complete the project by 2017.



Figure 1: Project Location

USAID has directed EPP to conduct a due diligence of the Golen Gol hydro project to reach a decision keeping into consideration the technical feasibility, cost reasonableness and overall impact of the project. For all candidate projects for USG funding, EPP conducts a two-pronged due-diligence. In this regard, a Step-I due-diligence was sent to USAID on December 2014, to quickly provide facts and figures on the project, its status, and to identify issues, if any. A preliminary assessment of the project based on a brief introductory meeting with Director Projects (North) of WAPDA, and review of revised PC-I and progress reports. Subsequently, upon USAID directives, EPP carried out a Step-II due-diligence involving analysis of information, site visits, meetings with WAPDA officials, and assessment of technical and financial progress of the project.

This report is to facilitate USAID take a decision for financing the project. The purpose is to support the GOP in its national development plans and promote investments in high priority, high visibility energy projects.

# GOLEN GOL PROJECT - AT A GLANCE

<b>Location</b>	The 106 MW Golen Gol hydropower project is the first major power generation project in the remote northwest corner of Pakistan, in Chitral District, KPK Province. It is located on the left bank tributary of Mastuj River flowing through the Chitral valley. Situated about 25 km upstream from the town of Chitral town, it is about 365 km from the provincial capital Peshawar and about 380 km from Islamabad. Access is both by air as well as by road (9-hour drive)																						
<b>Features</b>	<p>The project consist of a 12m high Weir, 80m long headrace Channel, 3.8km long steel lined circular pressure Tunnel with a single surge chamber, leading to a 106 MW Powerhouse with expected annual energy output of 436 GWh.</p> <p>The powerhouse will have three Pelton turbines, each driving a vertical shaft generator of 42 MVA, feeding the Grid through 11kV/132 kV unit transformers and a 132 kV outdoor switchyard.</p> <p>The station will be connected to the Grid by a 113 km long double circuit 132 kV transmission line passing over the Lowari Pass and connected to the existing Grid Station at Timurgharah in Dir and then through an 85km long single circuit 132 kV line onwards to Chakdara in the Swat valley.</p>																						
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• The project will provide 436 GWh of energy to the national grid at PKR 8.51 per KWh. At a sale price of PKR 10 per unit, after taking transmission losses, the annual revenue on sale of power will be over PKR 3.3 billion or \$33 million.</li> <li>• The project will satiate electric power demand in Chitral, stimulate local businesses, provide job opportunities to locals and stimulate cottage industry in the remote areas besides connecting Chitral to the national grid.</li> <li>• Fuel oil saving of about \$65 million per annum.</li> </ul> <p>The major construction of the project has neither displaced villages nor adversely impacted the environment.</p>																						
<b>Studies</b>	A feasibility study was carried out by GTZ and WAPDA. PC-1 of \$116 million was approved by ECNEC in September 2002, while the revised PC-1 of \$313 million is undergoing the approval process and might take another 3-4 months.																						
<b>Oversight:</b>	A joint venture of Fichtner of Germany, PES Pakistan, BAK Pakistan and DMC Pakistan are engaged as consultants for the project for a fee of around \$4 million.																						
<b>Estimates</b>	<table> <tr> <td>Civil Works</td> <td>\$110.9 million</td> <td></td> <td></td> </tr> <tr> <td>Electromechanical Works</td> <td>\$57.7 million</td> <td></td> <td></td> </tr> <tr> <td>Transmission Line</td> <td>\$50.0 million</td> <td></td> <td></td> </tr> <tr> <td><u>Supervision and Management</u></td> <td><u>\$94.4 million</u></td> <td></td> <td></td> </tr> <tr> <td><b>Total</b></td> <td><b>\$313 million (per revised PC1– 2014)</b></td> <td></td> <td></td> </tr> </table>			Civil Works	\$110.9 million			Electromechanical Works	\$57.7 million			Transmission Line	\$50.0 million			<u>Supervision and Management</u>	<u>\$94.4 million</u>			<b>Total</b>	<b>\$313 million (per revised PC1– 2014)</b>		
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**Contractors**

Site Logistics – Lot 1	Local Contractors	\$2.5 million
Civil Works – Lot 2	SamboSarco (Korea)	\$75 million
Electrical & Mechanical– Lot 3		
3.1 Civil Works	The Mangla Dam is on the River Jhelum, about 120 km (by road) East of Islamabad in Mirpur District of Azad Jammu and Kashmir (AJK) and was built during 1961 to 1967. Geographic location is 33-08 N and 73-38 E.	\$19 million
3.2 Equipment		\$56.5 million
	<p>The prominent structures at Mangla are the Main Dam and the Jari Dam (a dyke to contain the reservoir), two spillways for out flow regulation, an intake structure with 5 power and irrigation tunnels, a 1,000 MW power station comprising 10 units, with two units on each tunnel, and a tailrace canal called the New Bong Canal. The water from the power station goes back to the river bed through this canal which is 7620 m long.</p> <p><i>Trivia: An 84 MW <b>private hydropower</b> plant is under construction on this New Bong Canal downstream of the Mangla power station. It will utilize the head created by difference in height between the canal close to the power plant and the river bed.</i></p> <p>The power station was completed in four stages. Initially four units of 100 MW each (4 x 100 MW) were commissioned in 1969. Two more units were added (2 x 100 MW) in 1974. Another two (2 x 100 MW) were added 1981. The plant attained its maximum capacity of 1000MW with the small extension of units 9 &amp; 10 (again 2 x 100 MW) in 1994. The power station has since been</p>	

<p><b>Status</b></p>	<p>Overall, the physical and financial progress of the project is about 31.6% and about 46% respectively.</p> <p>Civil works of the project including diversion weir, lateral intake, sand trap, headrace channel, headrace tunnel, surge chamber, pressure shaft &amp; pressure tunnel are about 65% completed and expected to be fully completed by end 2015. Civil works (excavation, foundation and rock support) for the Powerhouse are about 34% completed.</p> <p>For Transmission works, sub soil investigation of grid station at Chitral has been completed while the consultants have also approved the foundation and layout plan. Towers staking along the line has commenced and procurement of materials has been initiated. Overall, 4% of the transmission work has been completed.</p>
<p><b>Issues</b></p>	<ol style="list-style-type: none"> <li>(1) <b>Environmental:</b> As per PEPA 1997, Schedule II, List of projects requiring an EIA (A), Transmission lines (11 KV and above) and grid stations require separate EIA and approval from the EPA department.</li> <li>(2) <b>Security:</b> Security is expected to be an issue given its location in the Chitral district of KPK.</li> <li>(3) <b>Cost Overrun:</b> Due to delays in the release of mobilization advance to the E&amp;M contractor, the cost claims are anticipated to escalate the present cost of \$313 million and delay the completion of the project.</li> <li>(4) <b>Weather:</b> Severe weather conditions in the winter are not favorable for construction activities on site and will delay any construction related work.</li> <li>(5) <b>Sustainability:</b> Given the financial frailty of Pakistan’s energy sector and heavy demand on the GOP budget, sustainability of any investment in the sector must be seen as a risk factor. Sustainability in the operation of power plant shall be ensured by maintaining sufficient funds for the O&amp;M of the power plant.</li> </ol>

# PROJECT BACKGROUND

Golen Gol hydropower project is a highly visible project more for being the first large development in the region and is a high priority for Pakistan to placate a population feeling deprived in a valley close to the Afghan border. Completion of the project will definitely be worth the time and money spent. Completion of the Golen Gol power project and subsequent electrification of the valley will improve the life of locals, especially women and children, and create opportunities for enterprise. The project will make possible the launch of many new activities leading to socio-economic improvement in Chitral.

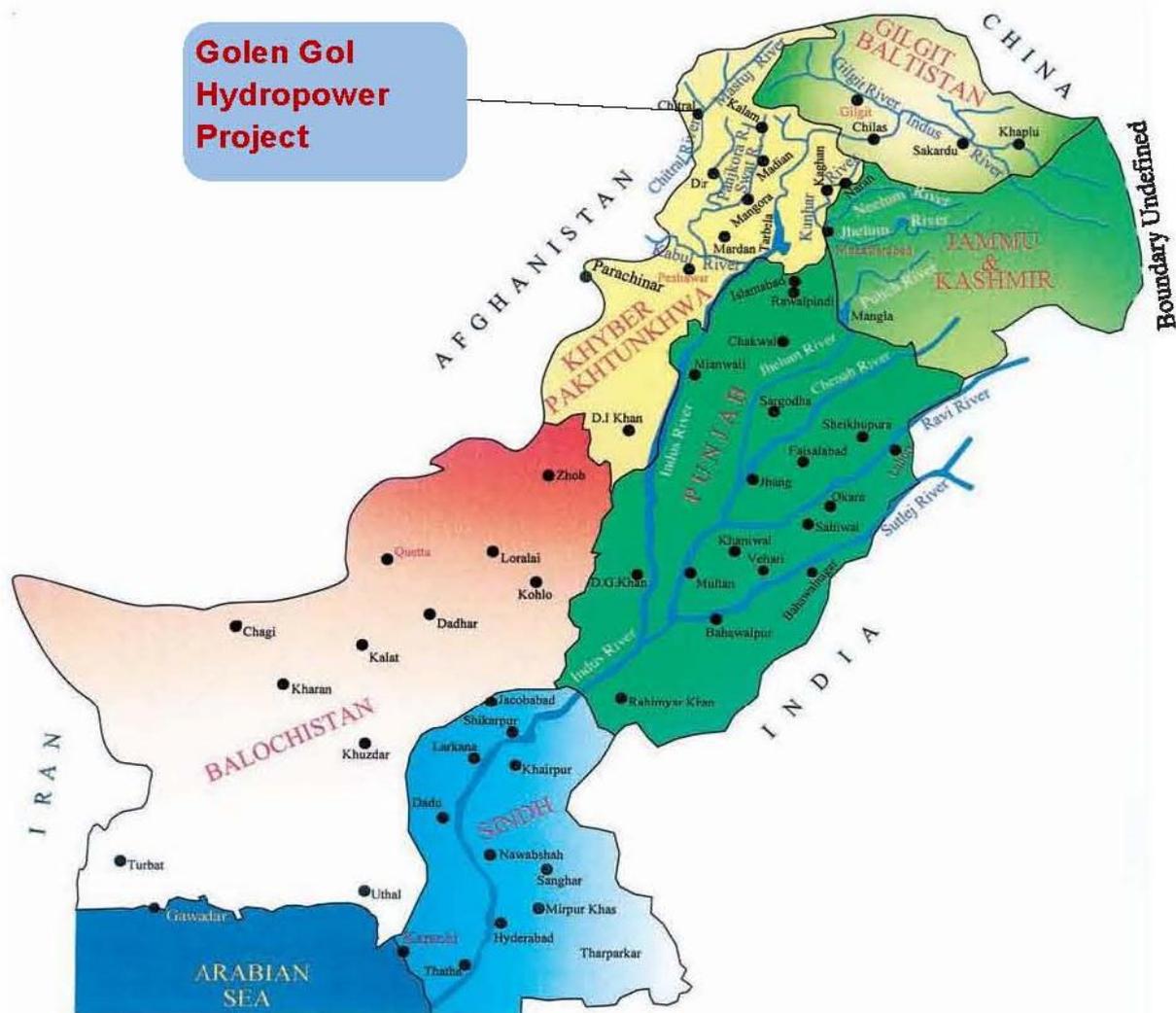


Figure 2: Location of Golen Gol Hydropower Project

The need and potential at Golen Gol for hydropower was always an attractive option for Chitral. In 1992, an 18 MW project costing Rs. 560 million (\$22.5 million @ \$1 = Rs. 25) was approved, however, the feasibility study revealed much greater power potential. By 1995, studies recommended a 30 MW project with revised cost of Rs. 905 million (\$28 million @ \$1 = Rs 32) and by then Chitral was connected to the national grid via Lowari Top. Subsequently, GTZ of Germany

provided technical support and the feasibility study of the 106 MW project to harness optimal potential of river.

The first PC-I for Golen Gol was submitted to the Planning Commission in 2002 under the WAPDA vision 2025 program and was approved by ECNEC for a cost of Rs. 7 billion (\$116 million @ \$1 = Rs 60). Securing funds delayed the project to 2008 (\$1 = Rs. 80) and bids received in 2009 escalated the costs to over \$250 million. Currently, a revised PC-I for Rs. 306 billion (\$313 million @ \$1 = Rs 98) is under process for approval.

The cost is based on signed contracts and prices arrived at after negotiations following an international competitive bidding (ICB) process and approved by three foreign lending agencies, namely Saudi Fund, Kuwait Fund and OPEC. Given many delays in securing funds and resolving disputes among bidders, and the nature of the project, in a remote location which makes it difficult and expensive to transport machinery and materials to site, the cost of about \$3 million per MW capacity with 198 Km long transmission line, although relatively high, is not unheard of and has to be accepted as reasonable. Owing to such delays and consequent cost escalations, WAPDA is facing cash flow problems and has requested USAID for intervention. Work done so far meets good international practice and engineering standards, albeit with some environmental lapses. USAID involvement will require improvement in cleaning up the site and ensuring better environmental compliance.

# PROJECT LOCATION

The run-of-river Golen Gol hydropower project will be fed by water in the Golen Gol—a left bank tributary of the Mastuj River in Chitral district of Khyber Pukhtunkhwa province of Pakistan. The site is about 25 km north of Chitral City, 365 km from the provincial capital Peshawar and 380 km from the Federal Capital Islamabad. Access to Chitral is both by air as well as by road (about 9-hour drive).

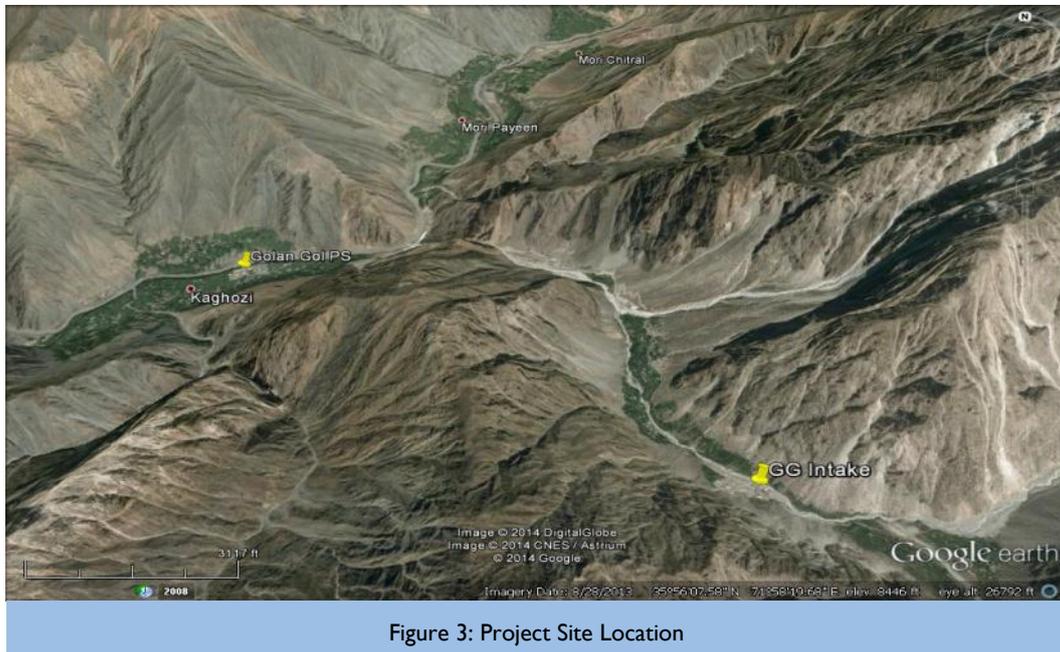


Figure 3: Project Site Location

Chitral, like the rest of Pakistan is facing acute energy shortage. A 33kV transmission line from Timargarah in Dir feeds about 5 MW to Chitral and another about five MW is generated by many small hydropower schemes installed by the KP government and the Aga Khan Rural Support Program (AKRSP). This is sorely insufficient while fuel wood (including fruit trees) is the primary energy source for locals, which in turn has resulted in deforestation—an emergent challenging issue in the district.

Chitral district of KP has an area of just under 15,000 Sq. km. with its population now estimated close to 500,000. It is bordered in the east by Gilgit-Baltistan, southeast by the Swat valley, north and northeast by China and the Wakhan corridor of Afghanistan, and in the west by the Nuristan and Kunar provinces of Afghanistan. In the south of Chitral is situated the Upper Dir district of Khyber Pakhtunkhwa province.

The Chitral River flows through the Chitral valley with many tributaries feeding it along the route, and farming and livestock are the main sustainers of local population. There is practically no industry and many of the growing youth entering the job market converge on Chitral City or look for job outside of Chitral district. Education and literacy level is primitive but is said to be better than the rest of KP.



Figure 4: View of a Chitral River flows through Chitral Valley

# ADDITIONAL PROJECT DETAILS

## SALIENT FEATURES

Table I: Salient Features of Golen Gol Hydropower Project

Weir Type	Concrete gravity Weir
Diversion Weir Length	60 m
Diversion Weir Height	12 m
Headrace Tunnel Length	3.8 km, 3.7 m diameter
Gated Flushing Section Width	19.72 m
Sand Trap Length	83.7 m
Headrace Canal Length	102 m
Vertical Pressure Shaft	970m, 2.5m diameter
Surge Chambers	42 m high, 15m diameter
Design Discharge	30 Cusecs
Number of Units	3 x 35.3 MW each
Head	435 meters
Turbine type	Vertical Pelton Wheel
Installed Capacity	106 MW
Transmission Line	198 km, 132kV to Chakdara
Annual Energy Generation	436 GWh
Plant factor	47%

The project consists of a diversion weir, intake, headrace channel, sand trap, flushing section, tunnel portal, headrace tunnel, surge tank, pressure shaft, pressure tunnel, powerhouse, tailrace, switchyard and transmission line.

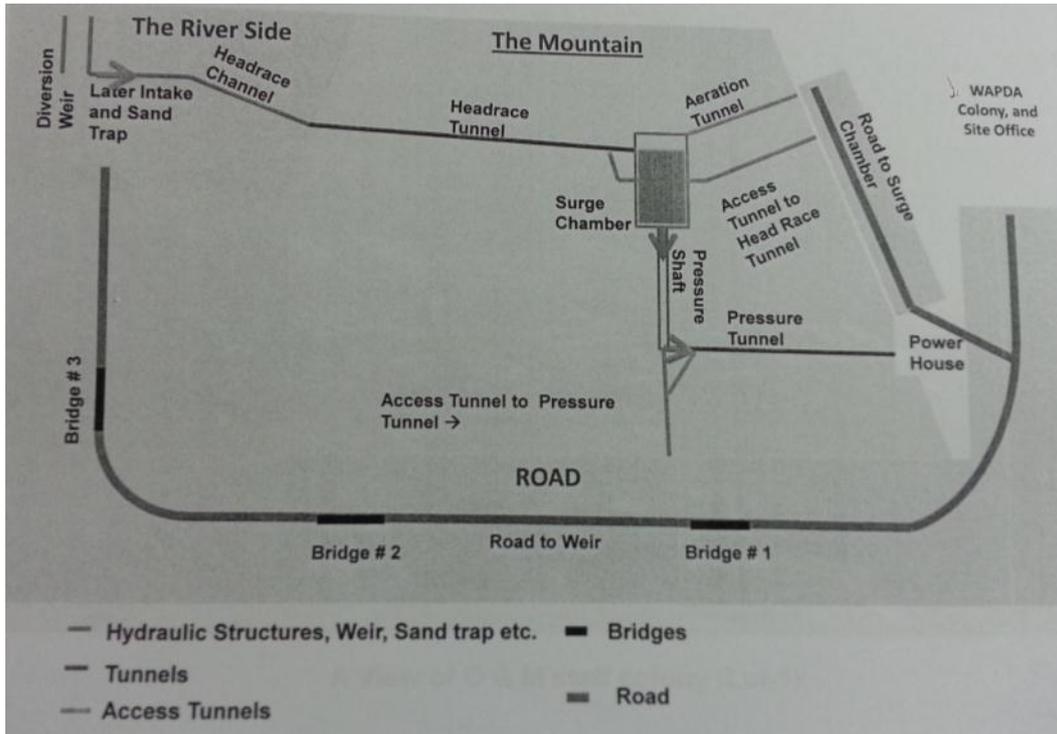


Figure 5: Flow Schematic of the Project

The Intake Weir is about 1 km upstream of Babuka village. From the Intake, there is a headrace channel leading to the tunnel, which will discharge the flow into the pressure tunnel, with a surge chamber, and a combination of vertical and horizontal pressure shafts wherefrom water flows to the surface powerhouse located on the left bank at the confluence of the Golen Gol and Mastuj Rivers.

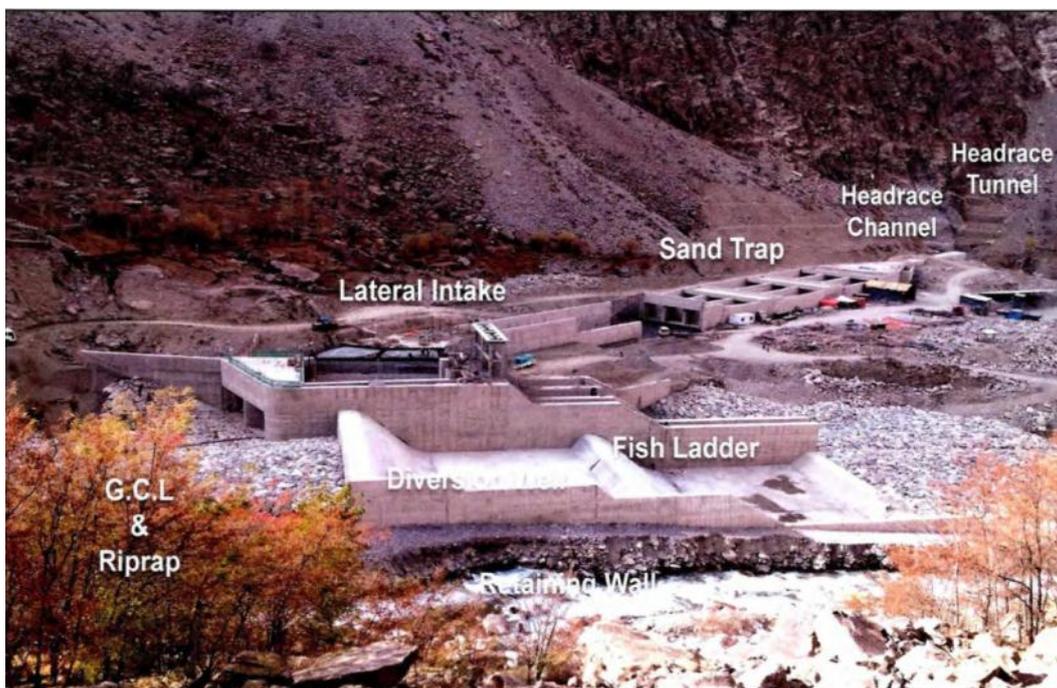


Figure 6: Intake Area of the Project

The 12 m high Weir will divert water of Golen Gol to an 80 m long headrace Channel and then to a 3.8 km long steel lined circular pressure Tunnel, with a single surge chamber, leading to the Powerhouse. The powerhouse will have three Pelton turbines, each driving a vertical shaft generator of 42 MVA, feeding the grid through 11kV/132 kV unit transformers and a 132 kV outdoor switchyard. The station will be connected to the national grid by a 300MVA capacity, 132 kV transmission lines passing over the Lowari Pass to an existing grid station at Timurgharah in Dir and then onwards to an existing 132 kV grid station at Chakdara in the Swat valley. Both grid stations will be expanded to accommodate the new lines. A new 132 kV grid station will also be constructed at Chitral as part of this project.

## IMPLEMENTATION ARRANGEMENT

A joint venture of Fichtner of Germany, PES Pakistan, BAK Pakistan and DMC Pakistan are consultants for the project. WAPDA appointed a consortium of consultants led by FICHTNER of Germany for detailed design, preparation of tender documents and construction supervision of the project.

The contract for civil works was awarded to SAMBU-SARCO Joint Venture (SSJV) comprising a Korean and a Pakistani firm. SSJV won the project in the last quarter of 2010 and initiated construction work in January 2011.

The Electromechanical (E&M) contract was awarded to Andritz Hydro Austria in February 2014, however, due to delays in the release of advance payment to the contractor, resulted in about a ten-month delay in the construction schedule. After the release of partial payment to contractor, the contractor is expected to be mobilized by end of January 2015.

Transmission and grid station works under Package I have been awarded to Netracon-NEIE Holley Joint venture. While Package II have been awarded to Netracon Consortium comprising of Netracon technologies and Iran Electrical Equipment Engineering (IREEE).

The SFD loan shall cater for civil works of the project as well as the consultancy costs, the E&M works are to be adjusted from the KDF loan, while transmission line, grid stations and switchyard will be borne by the OFID loan.

Table 2: List of the Project Contractors & Amount of Contract

Site Logistics – Lot 1	Local Contractors	\$2.5 million
Civil Works – Lot 2	SamboSarco (Korea)	\$75 million
Electrical & Mechanical-Lot 3		
3.1 Civil Works	SamboSarco	\$19 million
3.2 Equipment	Andritz (Austria)	\$56.5 million
Transmission Line – Lot 4		
Package I (113km)	Netracon-NEIE Holley	\$34.5 million
Package II (85 km)	Netracon Consortium	\$14.5 million
	<b>Total</b>	<b>\$202 million</b>

**Lot-1** comprises project offices and residential facilities at Koghuzi, close to the powerhouse including the access road.

**Lot-2** is civil works for the project including river diversion during construction, Diversion Weir, Intake Channel, Sand Trap, Head Race Tunnel, 3.8km Tunnel, Surge Chamber, Pressure Shaft and interconnecting access roads.

**Lot-3.1** is civil works for construction of powerhouse, tailrace and switchyard.

**Lot-3.2** is design, supply, erection, testing and commissioning of Electro-Mechanical Equipment.

**Lot-4** is divided into two packages and covers Transmission.

**Package-I** is for a) 113 km 132 KV double circuit transmission line from 132 KV switchyard at Golen Gol in Chitral up to Chukia Tan in Dir with one circuit in and out along the way at the new 132 kV Chitral Grid Station; b) construction of a new 132 kV grid station at Chitral and c) 132 kV interconnection between the Golen Gol powerhouse and the switchyard at Golen Gol.

**Package-II** covers a) 32km double circuit 132kV transmission line from Chukia Tan and interconnection with Timurgara Grid Station; b) 132 kV Double Circuit Transmission Line from Timurgara Grid Station in Dir to Chakdara grid station (53 Km) in the Swat valley, including interconnections at both stations, and c) addition of bays at Timurgara and Chakdara grid stations.

# PROJECT STATUS

Based on our discussions with WAPDA and as per progress reports of consultants, thus far, approximately \$144 million (**46%**) has been spent by December 2014 out of the total \$313 million, while the overall physical progress of the project is about **31.6%**.

## O&M Colony Lot-1

Construction work on project offices and residential facilities, including roads and services started in 2009 and has been substantially completed. WAPDA's staff occupies most of the houses. There was no ongoing work at this site during the visit in December 2014.



Figure 7: A view of O&M Staff Colony (Lot - 1)

## Civil Works Lot-2

US\$ 75 million contract for construction of civil works was awarded to Joint Venture of Sambo Sarco (SSJV) in early 2011. By WAPDA estimates, thus far about 65% is done, and by 2015, the entire work is expected to complete.

Completion status reported is Diversion Weir 69.53%, Lateral Intake 83.2%, Sand Trap 65%, Head Race Channel 51%, Headrace tunnel 66%, Surge Chamber 56%, Pressure Shaft 28% and Pressure Tunnel 31%. Contractor has a Variation Order Claim pending for about \$5 million owing to increased steel works in the Pressure Tunnel.



Figure 8: Top view of the Weir Site



Figure 9: View from downstream of the Diversion Weir Spillway (Fish Ladder is at right beyond which is structure for Gates/Stop Logs for the Lateral Intake)



Figure 10: In the Lateral Intake (Gates/Stop Log structure in background and Fish ladder on left)

Expansion of 6.3 km of access roads is completed while earth work is in progress. A temporary 3.7 km road to Surge Chamber is also completed. Three bridges from the site of Powerhouse to the site of Weir are in the initial stages of construction. Bridge 1 is at excavation stage while Bridge 2 is ahead with some concrete work already done. Bridge 3 is delayed due to problems related to land acquisition. Temporary access exists for traffic; however, no work was going on during the visit on any of the 3 bridges.



Figure 11: Access Road



Figure 12: Construction of bridge between Power House to the site of Weir

During the site visit in December 2014, in spite of December 25 being a national holiday, the contractor was mobilized at some locations of the project and construction activities were observed at Weir, Intake area, Sand Trap, Headrace Channel, Tunnel, and the Surge Chamber area. Three Batching Plants were operational, one at Intake area, another near headrace tunnel and the third close to the Surge Chamber.



Figure 13: Batching Plant operating at Site for the Construction

It was observed that by and large, the nature and quality of civil work carried out by the contractor followed acceptable good practices. The contractor staff assured that they were committed to deliver a sound project and to get a vital role in other WAPDA projects also. The same contractor is also constructing the Lowari Tunnel and it appears that the firm has taken a strategic stake in the valley and the region as a whole.



Figure 14: Construction of Channel Tunnel in progress

### Civil Works – Lot 3.1

Sambo Sarco (SSJV) is also executing civil works for the Powerhouse at a cost of \$19 million and has completed excavations and base foundation works but since February 2014, awaits design specifications from the E&M contractor to start construction of structures to install Inlet Valves, Turbines and Generators. Overall, 34% of the civil works for the Powerhouse has been completed.

Excavation and rock support for the powerhouse and tailrace is reported to be 79.25% complete. No further work on the Powerhouse and tailrace can take place as the civil works contractor needs approved construction drawings and specifications. The project currently awaits mobilization of the E&M contractor, who per contract, will provide the drawing of powerhouse and the tailrace.



Figure 15: Excavation and Rock Support for the Powerhouse

The contractor explained that Gantry Crane installed at Powerhouse site for erection of equipment is idle for one and half year due to delay of E&M equipment. This will result in claims.



Figure 16: Powerhouse Site Awaiting Construction Drawings



Figure 17: Powerhouse Site Awaiting Construction Drawings

Work at tailrace and switchyard is delayed due to demarcation by E&M contractor and owing to delay in acquisition of land for the switchyard by WAPDA.

### E&M Works – Lot 3.2

The E&M contract was awarded in February 2014 to Andritz for \$56.5 million (after substantial delay because of litigations by competing parties) but owing to concerns of Kuwait Fund (the lender) mobilization advance was delayed. WAPDA stated that very recently the KDF has released \$3,373,907 as the USD portion but the Euro portion of \$2,127,137 awaits transfer owing to errors

in the Bank Code of the E&M contractor. WAPDA is hopeful that Andritz will re-mobilize at site after the season holiday break.

### Transmission Line – Lot 4

Package –I: \$34.4 million contract for construction of a double circuit 132 kV transmission line from Golen Gol to Timargarah in Dir was awarded to Joint Venture of Netracon technologies and NEIE/Holley in February 2014 and work is in progress. The contractor was mobilized in February 2014 and has completed survey/route alignment of the 113 km line to be built between Chitral and Dir over the Lowari Top. Sub soil investigation of grid station at Chitral has been completed while the foundation and consultants have also approved the layout plan. Towers staking along the line has commenced and procurement of materials has been initiated. Site for Golen Gol switchyard is still to be acquired.

Package- II: \$14.6 million contract for augmenting the grid stations at Timargarah and Chakdarah and building an interconnecting 132 kV line has also been awarded to Netracon Consortium comprising of Netracon technologies and Iran Electrical Equipment Engineering (IREEE) by end 2014, signed on November 5, 2014. Contractor is already mobilized in Chitral under Package I and will commence operations in Dir and Swat soon.

# ESTIMATED COSTS AND SCHEDULE

Estimated cost in approved PC-I (Sept 2002) \$116 million

Estimated cost in revised PC-I (Nov 2014) \$313 million

Costs allocated in revised PC-I are:

Table 3: Project Cost as per Revised PC-I

Civil Works	\$ 110.9 million
Electromechanical Works	\$ 57.7 million
Transmission Line	\$ 50.0 million
Supervision and Management	\$ 94.4 million
<b>Total</b>	<b>\$ 313 million</b>

However, the revised PC-I of November 2014, shows \$187 million (equivalent) as total allocations from Public Sector Development Program (PSDP) up to year 2014 (end June) and the total amount 'Released and Disbursed' by December 2014 as **\$144 million** (equivalent). Below is the expenditure up to December 2014:

Table 4: Project Expenditure till December 2014

Expenditure from Committed Loans	\$ 83 million
Expenditure from WAPDA (PSDP)	\$ 61 million
<b>Total Expenditure</b>	<b>\$ 144 million</b>

The Revised PC I is to be approved by GoP, however, a Summary of the Project Costs is attached as ANNEX I.

The project is estimated to cost \$313 million of which \$164 million has been committed by the Saudi, Kuwaiti and OPEC funds while WAPDA's cost share is \$149 million. Detail provided in the table below:

Table 5: Project Financing Arrangement

Source	Amount	Term	Purpose
Saudi Fund	\$ 97 million	20 years	Consultants and Civil
Kuwait Fund	\$ 37.0 million	38 years	E&M Equipment and works
OPEC Fund	\$ 30.0 million	30 years	Transmission Line
WAPDA	\$149.0 million	-	Balance of all costs
<b>Total</b>	<b>\$313 million</b>		

Based on our discussions with WAPDA and also as per progress reports of the consultants, thus far, approximately \$144 million has been spent as of December 2014 out of the total \$313 million. WAPDA portion to complete the financial requirements of the project is about \$88 million. USAID may consider an independent financial audit of \$144 million already spent on the project to verify expenditures and shortfall in the project.

Table 6: Summary of Project Expenditure & Balance Amount

Expenditure till December 2014	\$ 144 million
Balance Project Cost:	<b>\$ 169 million</b>
<b>Balance from Committed Loans</b>	<b>\$ 81 million</b>
<b>Balance from WAPDA (Shortfall)</b>	<b>\$ 88 million</b>

# ENVIRONMENTAL REVIEW

An Environmental Impact Assessment (EIA) was carried out for the project by Pakistan Engineering Services (Pvt.) Limited in 2008. The purpose of assessment was to identify and evaluate any significant environmental impacts in detail, related to the project during the construction and operation phase and to prepare an environmental management plan to minimize adverse effects.

The content of the EIA was designed to meet the standard guidelines of the Pakistan Environmental Protection Agency (PEPA) 2000, the World Bank and the Asian Development Bank. The report was approved by the provincial EPA of KP Government in July 2010, with conditions.

The EIA report concluded that the project will have minimum environmental impact:

- Land was acquired or obtained on lease for three years for disposal of material excavated for construction of project components and will be returned to the owners after the 3-year lease period.
- Per EIA, the proponent must submit monthly compliance report, which is a gray area as there is no record of monthly reports. As such, a full time Environmental Health and Safety Officer is recommended for the consultant and contractor to guide and channelize the activity as per recommendations of the EIA report. S/he should prepare monthly report as per NOC and send it to EPA of KP.
- Wildlife habitat at much higher altitude and at a distance from construction activity will not be affected. However, some noise sensitive avifauna and movement prone birds will migrate into upper parts of the valley.
- Small-scale fisheries in Golen Gol River are not disturbed as biological entities for adaptation to changes in physical, chemical, and other biological factors.
- Forests areas will have no implication during construction or operation phase of the project as they are located far from the project site, and at a higher elevation.
- Per socio economic effects, the implementation of the Project will benefit the local economy by offering employment opportunities during construction.
- No significant loss of any rare or endangered species. At higher altitudes, indigenous trees such as pine etc. are a common sight in the area.
- Snow leopard, brown bear and other wild life are found in the area.
- No change in the sediment pattern.
- No major resettlement issues. Very limited families were displaced with compensations paid accordingly.

In an overall view, the Golen Gol Hydro Power Project does not pose any significant environmental and social impacts. Major social and environmental impacts associated with most of the Golen Gol Hydro Power project are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures in the Environmental Management Plan and by better engineering and environmental practices.

**As per PEPA 1997, Schedule II, List of projects requiring an EIA (A), “Transmission lines (11 KV and above) and grid stations” require separate EIA and approval from the EPA department. WAPDA has been informed of this lapse and needs to address the matter.**

Prior to USAID funding, an Initial Environmental Examination (IEE) of the project would be required in accordance with 22 CFR 216, which will provide a statement of the reasonably foreseeable environmental effects as well as recommend threshold decision for the construction of Hydro power and transmission system. The IEE will cover all activities proposed for USG funding so as to ensure environmentally sound project design, planning and implementation. It will satisfy the

conditions of the environmental procedures and establish requirements for further environmental review and related responsibilities for activities not listed under Categorical Exclusions.

# COST BENEFITS ANALYSIS

Analysis presented in this section is derived from a revised PC-I document prepared by WAPDA in November 2014.

## Unit Cost – Power Generation

Table 7: Unit Cost of Power Generated by project

Installed Capacity	106 MW
Average annual plant factor	47%
Units generated per annum	436 GWh
Losses @ 24%	104.64 GWh
Net Units available for sale	331.36 GWh
Cost per unit generated	8.68 Cents ( Rs. 8.51)
Sale price per unit (KWh)	Rs. 10.0
Revenue on sale of 331.36 GWh of energy per annum.	Rs. 3313.60 million
Project completion cost per KW	\$2,716 (Rs. 266,204)

The project is expected to provide up to 436 GWh of energy to the national grid at Rs 8.5 per Kwh. At a sale price of Rs 10 per unit, after taking transmission losses, annual revenue on sale of power could be well over Rs 3.3 billion or \$33 million, saving fuel oil import of about US\$ 65 million. WAPDA will have to pay \$21 million each year to GOP as repayment of loans (lent to WAPDA by GOP @ 11.79%) and use less than \$2 million as operating expenses. Accordingly, the Golen Gol hydropower project will earn WAPDA about \$10 million a year but contribute around \$50 million per annum to the national economy.

The project will satiate electric power demand in Chitral, stimulate local businesses, provide job opportunities to locals and encourage cottage industry in the remote areas besides adding power and stability to the northern portions of the national grid.

The 300 MVA, 132kV transmission line included in the cost of the Golen Gol project will also provide basis to interlink other incoming hydro power projects in Chitral district by WAPDA/SHYDO. Current plans include 69 MW Lawi, 144 MW Shushal-Zhendoli and 132 MW Shogo-Sin projects.

The PC-I document includes economic analysis and calculates net present value (NPV), benefit-cost ratio (BCR) and internal rate of return (IRR), based on the following assumptions:

1. For conversion of capital cost into economic cost, standard conversion factor (SCF) of 0.9 has been used.
2. Economic O&M cost comes to Rs. 400.9 million by using SCF of 0.9.
3. Life of the project is 30 years including last year of the construction period.
4. Installation of 106 MW hydel project would result in saving of fuel plant @ Rs. 13.38/KWh.

Results of the analysis are given in the table below:

Table 8: Summary of Project Financial Analysis

Net Present Value (NPV)	US\$ 265 million
Benefit Cost Ratio (BCR)	2.35:1
Internal Economic Rate of Return (IERR)	33%

# ISSUES TO BE ADDRESSED:

While the Golen Gol project provides an attractive opportunity, it is not without issues that need to be addressed:

## Environmental

As per the PEPA 1997, Schedule II, List of projects requiring an EIA (A), transmission lines (11 KV and above) and grid stations require separate EIA and approval from the EPA department. WAPDA has been informed of this lapse and needs to address this matter.

Few other issues related to land compensation and environmental lapses, a full time Environmental Health and Safety Officer is also recommended to be placed at the site.

## Security

Project is located in Chitral district of KP. There may also be security issues while commuting by road given the fact that the project is in the sensitive areas of KP. Access to Chitral is over the 11,000 ft elevation, and the road at times gets blocked during winter due to heavy snowing. However, access would become much easier with the completion of 9 km long Lowari Tunnel this year.

## Cost Overrun

Due to delays in the release of mobilization advance to the E&M contractor, the cost claims are anticipated to escalate the present cost of \$313 million and delay the completion of the project. WAPDA's commitment is required to cover the shortfall over and above USAID financing, subject to approval and any cost overruns due to delay in completion of the project. A similar co-financing mechanism was adopted for the Gomal Zam dam project.

## Weather

Severe weather conditions in winter are not favorable for construction activities on site. This will delay any construction related work. The temperature usually falls below freezing point which affects project working conditions.

## Sustainability

Given the financial frailty of the Pakistan energy sector and heavy demand on the GOP budget, the sustainability of any investment in the sector must be seen as risk factor. A commitment from WAPDA needs to be in place to sign Power Purchase Agreement with the power purchaser and allocate O&M funds to have sustainable operation of the power plant.

## Planning and Management

The project has already suffered several months of delay and to complete the project by December 2017, WAPDA needs to provide a financial plan to cover the shortfall and also cost overruns that are anticipated due to delay in the project.

Secondly, frequent management changes at the project-level and also at the senior management positions has always adversely affected implementation of the project. This issue needs to be addressed at the highest level.

# RECOMMENDATIONS

Based on our assessment and review, the project is an attractive option, though not without issues that needs to be managed. Also, being the first large development in Chitral, Khyber Pakhtunkhwa (KP), Golen Gol boasts higher visibility and thus a high priority for Pakistan to placate a population feeling deprived in a valley lying in close proximity to the Afghan border. Completion of the project will definitely be worth the time and money expended. Subsequent electrification will improve stabilization in the sensitive region, enhance quality of life for locals, especially women and children, and create opportunities for enterprise. The project will also generate annual revenues of over \$33 million and make possible the launch of many new activities leading to socio-economic improvements in Chitral.

**USAID, prior to making a decision, needs to look into the following issues that require commitment from GOP/WAPDA:**

1. Revised PC-I to be approved by the GOP
2. Provides USAID with a viable and credible financing plan for the remaining life of the project
3. Demonstrate commitment to quickly complete the project by clearing the undisputed outstanding bills and claims of consultants and contractor within the stipulated time in contract.
4. Ensure environmental compliance at site and for the transmission line and grid station that may require detailed assessments
5. Avoid frequent changes in the management of the project
6. For sustainable operation of the power plant, commitment will also be required from WAPDA to allocate funds for the operation and maintenance of the project, and also put in place a Power Purchase Agreement with the power purchaser to have sufficient funds for the sustainable operations.
7. Require electrification of the Chitral valley

# ANNEX I: GOLEN GOL COST ESTIMATES AS PER REVISED PC I

## Golen Gol Cost Estimate (PCI)

(Rs. million – rounded off)

	Local	Foreign	Total
Preliminary Works	1,435	0	1,435
Civil Works	5,281	3,520	8,801
Hydraulic Steel Structures	379	253	632
Hydro-Mechanical Equipment	384	1,878	2,262
Electrical Equipment	253	3,136	3,389
Transmission System	4,396	508	4,904
<b>Sub-total</b>	<b>12,127</b>	<b>9,295</b>	<b>21,422</b>
Confidence Building	30	0	30
Security	30	0	30
<b>Cumulative Total</b>	<b>12,187</b>	<b>9,295</b>	<b>21,482</b>
Engineering & Supervision	504	617	1,121
Admin & Audit	430	0	430
<b>Cumulative Total</b>	<b>13,121</b>	<b>9,912</b>	<b>23,033</b>
Overheads	518	0	518
<b>Base Cost Total</b>	<b>13,639</b>	<b>9,912</b>	<b>23,551</b>
Escalation	1,237	330	1,567
IDC	3,252	2,301	5,553
<b>Total Cost</b>	<b>18,129</b>	<b>12,543</b>	<b>30,672 *</b>

\* 1\$ = 98 Pak Rupees Conversion Rate ass per revised PC-I

[www.ep-ep.com.pk](http://www.ep-ep.com.pk)  
[info@ep-ep.com.pk](mailto:info@ep-ep.com.pk)