9

Bill of Quantities and Cost Estimates

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9. Bill of Quantities and Cost Estimates

9.1 General

This report summarizes selected key parameters for the estimation of costs of the Madian Hydropower Project and the cost estimate itself for all its major components. During the pre-feasibility stage the Consultant setup a preliminary unit cost data base and carried out the cost estimates for assessment of the alternative project layouts. At the beginning of the feasibility study the Consultant updated all relevant economic key parameter in co-ordination with the Project Sponsor and elaborated a detailed Project unit cost data base. At the time of submission of the draft feasibility report the Consultant escalated the respective unit rates and costs to the level at the end of the fiscal year 2007-2008.

Basic costs of labour, material, consumables and equipment were inquired, unit costs calculated and compared with unit rates of hydropower projects of similar size and type presently under development in Pakistan. These unit rates were used for the optimization of the installed capacity and the dimensions of the major project structures.

Based on the feasibility design as documented by the corresponding design drawings the Consultant determined the quantities of the major civil project structures and equipment components. For minor works provisions in terms of the item miscellaneous are made. In accordance with common practice the cost estimate is based on the concept of direct and indirect costs and provisions for unforeseen items and costs (contingencies). The cost estimate includes the following main plant components and cost elements:

- land acquisition
  (according to Resettlement Action Plan, Feasibility Study, Vol. VI-b);
- land clearing and access;
- mobilisation cost and site infrastructure;
- surveys and investigations (e.g. hydraulic model tests);
- civil works: weir with spillway & flushing outlet, power intake, headrace tunnel, surge tank, pressure shaft and tunnel, powerhouse, and tailrace system;
- material disposal sites;
- manufacturing, transport erection, installation, testing and commissioning of:
  - hydraulic steel structures,
  - electro-mechanical and electrical equipment,
- environmental and social impact mitigation costs;
- taxes and import duties;
- administration and legal costs;
- engineering and supervision costs;
- finance and insurance;
- Sponsor's costs prior to commercial operation; etc.

9.2 Methodology Applied to Estimation of Project Costs

The methodology applied to the estimation of cost for the Madian Hydropower Project is carried out proceeding the following steps in accordance with the requirements of a bankable feasibility study.

1. Define Basis of Cost Estimation

2. Estimate Basic Project Costs expressed in terms of Direct Costs:
2.1 Estimate Direct Costs for Civil Works;
2.2 Estimate Direct Costs for Electro-mechanical Equipment
2.3 Estimate Direct Costs for Electrical Equipment
2.4 Estimate Direct Costs for Steel Structure Equipment

3. Estimate Contingencies and Indirect Costs
3.1. Estimate Costs for Land Acquisition

4. Cost of Project Development
4.1 Estimate Costs of Engineering and Administration
4.2 Estimate Owners Own Costs

5. Determine Bill of Quantities

6. Estimate Total Project Costs

7. Estimate Operation and Maintenance Costs

In addition to the basic cost items of each civil structure in terms of their direct costs, the Consultant considered certain contingencies. These contingencies play an important role for the project viability, they include both physical and price contingencies. Physical contingencies result from the fact that the estimated quantity of certain items might have been underestimated. Additional minor items or quantities and components will ultimately be required which were based on the knowledge available at the particular planning level originally not included in the estimate. Certain adjustments are commonly required with advancing level of planning and during the implementation phase, etc.

Price contingencies are included to account for variation in prices, i.e. inflationary tendencies, during the implementation period. Physical contingencies will be estimated as a percentage of the base price of equipment and engineering services, whereas price contingencies will be determined on the basis of the forecast rate of inflation for both the local and foreign currency portions.

The following sections describe the methodology of the approach to cost estimation described above for each activity in the required detail.

We will split the cost estimate into local and foreign currencies. Moreover, a disbursement plan will be included that provides the necessary information on when particular investment payments are due.

9.3 Basis of Cost Estimation

The following assumptions were made by the Consultant based on his experience in coordination with the Project Sponsor as the basis for the present Feasibility Study:

June 30th 2008 1 US$ = 67.98 Rps. (PAK)

Table 9.1: Basic Exchange Rate for Local to Foreign Currency

All costs will be expressed in the foreign currency US$. Local market prices and rates will be converted to foreign currency applying the exchange rate of the Central Bank of Pakistan at the selected reference dates. In co-ordination with the Project Sponsor the reference date applied to the present feasibility study is June 30th 2008, which corresponds to the end of the fiscal year 2008.

Costs are presented by their local and foreign cost component for the individual unit rates and the overall cost of civil works and equipment.
The composition of the local and foreign cost component was derived from hydropower projects presently under development in Pakistan.

9.4 Estimation of Direct Project Costs

The direct costs of a hydropower project are commonly estimated separated for the following major components based on the major items/elements.

a) Civil works;
b) Hydraulic steel structure equipment;
c) Electro-mechanical and
d) Electrical equipment;

The civil costs comprise more than 70 % of total project costs in the particular case of the Madian HPP. Therefore, determination of the corresponding unit rates is discussed in detail in the following chapter in the required detail.

Cost of permanent equipment is based on tender costs of hydropower and thermal power (electrical equipment only) projects of similar type and magnitude.

In view of the tight market situation the willingness of manufacturers / suppliers to provide quotations for the equipment specified for the Madian HPP has fallen to a low level since most of the established manufacturers state having orders for more than one year of their production capacity.

9.4.1 Estimation of Civil Costs

The cost estimates forms the basis of the economical and financial evaluation of the project. It shall be prepared on the basis of representative unit rates for the various construction activities and the respective quantities. In order to comply with the requirements on accuracy of the cost estimates as established in the Terms of Reference, the Consultant followed the following approach:

1. Collect basic costs of materials, fuel, energy, consumables, labour, equipment etc ex factory and at site (cost of transport).
2. Calculate unit rates for relevant items of civil works for application to the BoQ;
3. Collect unit rates used in feasibility studies and tendering of Hydropower Projects of similar type and magnitude; escalate these unit to the reference data of the cost estimate;
4. Compare, analyse and conclude on most appropriate unit rates for application.

9.4.1.1 Cost of Major Material Items

The Consultant contacted potential manufacturers and suppliers of the major material items required for construction of the Madian HPP such as cement, reinforcement steel, diesel fuel, explosives, gabion mesh, geotextile etc. The Suppliers were requested to provide a unit rate ex-factory/store and at site to account adequately for transport cost.

Material Item	Manufacturer Supplier	Unit	Cost of Material Ex Factory	Freight	At Site	
			Rps.	Rps	Rps	US$
Cement	Askari Cement	Rs / ton	4,350.0	600.0	4,950.0	77.2
	Cherat Cement	Rs / ton	4,500.0	574.0	5,074.0	79.2
Reinforcement Steel	Fazal Steel	Rs / ton	63,600.0	2,190.0	65,790.0	1026.4
	Amreli Steels	Rs / ton	55,500.0	5,000.0	60,500.0	943.9
Explosives	WAH NOBEL	Rs / ton	191,980.0	2,812.0	194,792.0	3039.0
Anfo	WAH NOBEL	Rs / ton	166,440.0	2,812.0	169,252.0	2640.6
Detonator	WAH NOBEL	Rs / 100 units	6,325.0	28.1	6,353.1	99.1
Detonatiung Cord	WAH NOBEL	Rs/1000m	16,820.0	2,812.0	19,632.0	306.3
Geomembran	USA Lining	Rs / m²	125.6	17.5	143.1	2.2
Gabion mesh		Rs / m²	106.2	126.0	232.2	3.6

1 US$ = Rs. 64.31 January 2008

Table 9.2: Material Unit Rates Inquired from Suppliers and Manufacturers

Since the Project Sponsor is a cement manufacturer, cost of at least one alternative supplier has been inquired from the list of potential suppliers. Information such as distance of each factory from project site, capacity of production and type of cement produced has been taken into account in the assessment. The cement factory at Nowshehra is, e.g. within a distance of 275 km from Madian town.

The corresponding quotations for the respective construction materials are given in Annex A-9.1 and are summarized in Table 9.2. For the items listed in Table 9.2 rates were provided in local currency (Rupees) and converted in unit prices in USD.

The Consultant further inquired the cost of bore piling with D = 0.8 m diameter bore piles with two Contractors, a foreign contractor and a Pakistani contractor resulting in the following unit rates :

KELLER, Germany	250 Euro/m²	(single piles)
	350 Euro/m²	(overlapping piles)
	308 US$/m	(incl. concrete and reinforcem.)
	352 US$/m	(including mobilization.)
DEEPWELL, Pakistan	15,000 Rps/m	(drilling only)
	233 US$/m	(drilling only)
	330 US$/m	(incl. concrete and reinforcem.)

For the present cost estimate a unit rate of US$/m 352 is applied.

Drill bits, rods and other drilling consumables will have to be imported which will include custom duties & Govt. Taxes. Cost of these items is shown as under the respective unit rates.

9.4.1.2 Cost of Transportation of Construction Material

Provision for transport of heavy permanent equipments such as turbines generators, transformers & spillway gates, valves, steel liner etc is considered in the cost estimate of the hydraulic steel structure and electro-mechanical and electrical equipment.

Cost of transport of construction equipment if any is considered as part of mobilization (indirect costs). Cost of transport to project site need to be considered for the transport of construction material and consumables. The corresponding cost is estimated based on the distances and specific transport costs as follows:

By Railway & Road:	From Karachi to Dargai be train and from Dargai to Project site by road
By Road:	From Karachi to Project site road
	Total Distance approximately 1,800 km.

Item Description	By Road	By Road
Reinforcement	5.32 Rps/ton km	0.08 US$/ton km
Cement	7.60 Rps /m³ km	0.11 US$/m³ km

Table 9.3: Unit Rates for Transport of Material to Project Site

9.4.1.3 Cost of Labour

The financial cost of labour rate was obtained from basic salaries used for different categories of labours on projects near Swat in NWFP as shown in National Statistical Bulletin issued by the Federal Government of Pakistan. The corresponding rates are shown in table 9.4. At the time of preparation of this feasibility report the figures for the reference date 30. June 2008 were not yet published and, therefore, adequately escalated.

	Description	**Basic Wage**	**Premium %**	**Basic Wage**	**Total D/Shift 1.35**	**Total N/Shift 1.55**	**Foreign**	
		Rps/ hr	**Rps/ hr**	**Rps/ hr**	**Rps/hr**	**Rps/hr**	**D/Shift US$/hr**	**N/Shift US$/hr**
F-1	Foremen 1st Class	122.5	12.25	134.75	182	209	2.99	3.44
EOI	Equipment Operator	62.5	6.25	68.75	93	107	1.53	1.75
HIS	Highly skilled	40.6	4.06	44.66	60.29	69.22	1.00	1.15
SI	Skilled Worker	35.0	3.50	38.50	52	60	0.87	1.00
SSI	Semi Skilled	29.32	2.93	32.25	44	50	0.73	0.83
US	Unskilled Labour	21.88	2.19	24.07	32	37	0.53	0.62

1 US$ = Rs. 60.63 June 2007

Table 9.4: Cost of Local Labour in Pakistan (as per 30. June 2007)

The above given labour costs reflect data on local labour only. The Consultant assumes that in particular foreman, machine operators and skilled workers will be experienced staff of the appointed foreign contractor and thus higher hourly rates apply. The corresponding adjustments are made to the cost of labour to account for a mix of foreign and local labour with largely foreign staff for the highly qualified work and predominantly local staff for the semi and unskilled working activities.

9.4.1.4 Calculation of Unit Rates

Based on the collected cost of labour, materials, consumables and the adjustment of the Consultant's list of equipment, calculation of unit rates for the major construction items was performed. The Consultant used its unit cost data base program and calculated unit rates based on the above mentioned components (labour, material, consumables, equipment) and applying the respective combination of these components required for execution of a unit of all relevant civil work activities in a similar way as a Contractor does in his calculation.

Annex A-9.4 contains the relevant unit rates for the civil cost items of each major project structure together with the corresponding quantities. These rates where then checked with rates arrived at by using hourly rates of labour, equipment, material and fuel cost for common items constituting major part of the structure line excavation, concrete and dewatering, adjusted to site condition and other factors.

The above mentioned cost estimate is based on in-house databases, which have been developed from Fichtner's experience in this field. Also, negotiated prices available from our activities on other projects will be used as reference. The construction costs will be determined on the basis of a quantity survey and adopting unit costs calculated by using material and labour costs valid for the project region. About 70 % of the total construction costs will be computed using a contractor's approach to calculate prices. The remaining 30% of the costs will be estimated based on experience.

9.4.1.5 Unit Rates of Similar Hydropower Projects

There is a large number of hydropower projects under development in Pakistan. The cost estimates and unit rates derived from the tender documents and the Contractor's proposals of other hydropower projects of similar type and magnitude provide a reasonable orientation for the plausibility of the calculated unit rates. Site, contract and other specific conditions may, however, cause significant deviations in the unit rates for the same construction activity from one hydropower project to the other.

The Consultant collected and analysed unit rates of civil works of the following hydropower projects to a reasonable extent similar in type and size to the Madian HPP:

1.) Malakand-III,
2.) Patrind HPP
3.) Golen Gol HPP
4.) Diamer Basha Dam Project
5.) Dubeer Khawar HPP
6.) Khan Khwar HPP

Since the units rates presented in the BoQ of the six above projects refer to different reference dates, they were escalated to the level of June 30, 2008 applying an appropriate inflation rate per annum on local and foreign currency rates and the corresponding currency exchange rate of the Central Bank of Pakistan. The comparison of the individual unit rates of the six hydropower projects for the major activities of civil construction are given in Annex A-9.3. Following the comparison and analysis of the unit rates of other projects, the unit rates given in Table 9.5 are recommended for application**:**

No	Cost Item	Unit	Unit Rate US $
1	Open Excavation in overburden	m³	7.60
2	Open Excavation in rock	m³	15.75
3	Open Excavation in rock for pits and trenches	m³	16.80
4a	Underground rock excavation, Rock Type A incl. Disposal of muck	m³	141.75
4b	Underground rock excavation, Rock Type B incl. Disposal of muck	m³	136.50
4c	Underground rock excavation, Rock Type C incl. Disposal of muck	m³	126.00
5	Backfill with excavation material	m³	5.80
6	Shotcrete	m³	172.00
7	Reinforcement	to	1240.00
8	Concrete lining incl. Formwork	m³	174.00
9	Reinforced Concrete incl. Formwork	m³	170.00

Table 9.5: Unit Rates for Civil Works from Other Hydropower Projects

9.4.1.6 Civil Cost of Madian Hydropower Project

Based on the unit rates established in the Consultants unit cost data base and the detailed Bill of Quantity of the Project (see Annex A-9.4), the cost of the civil works was estimated as given in Table 9.6

MADIAN HYDROPOWER PROJECT	COST IN (USx1000)		COST IN Million US $
	LOCAL	FOREIGN	TOTAL
DIVERSION WORKS	**4.201,2**	**4.588,5**	**8,790**
U/S coffer Dam	920,2	746,2	1,666
D/s Coffer Dam	239,2	185,6	0,425
Diversion Tunnel	3.041,8	3.656,7	6,699
CONCRETE WEIR	**5.895,3**	**7.088,0**	**12,983**
Main Weir Body	4.530,6	3.990,4	8,521
Foundation Treatment (Borepiling)	722,9	2.313,2	3,036
Grouting	641,8	784,4	1,426
RESERVOIR PROTECTION WORKS	**1.771,9**	**869,2**	**2,641**
HEADRACE	**47.015,0**	**66.565,4**	**113,580**
Intake	933,2	912,1	1,845
Tunnel	45.495,8	64.814,5	110,310
Construction adits	586,0	838,8	1,425
Desander Cavern	**9.974,6**	**14.730,5**	**24,705**
Caverns	9.632,6	14.211,2	23,844
Construction adits	341,9	519,3	0,861
PRESSURE SHAFT / TUNNEL	**823,5**	**1.152,7**	**1,976**
Pressure Shaft	339,4	486,3	0,826
Pressure Tunnel	155,4	227,0	0,382
Manifolds	328,7	439,4	0,768
TAILRACE TUNNEL	**1.582,8**	**1.838,2**	**3,421**
Draft tube Extension & Tailrace Tunnel	1.006,6	1.310,7	2,317
Tailrace tunnel & Power Outlet	576,2	527,5	1,104
SURGE TANK	2.482,1	3.487,9	**5,970**
POWERHOUSE CAVERN, TRANSFORMER & SWITCHYARD GALLERY	**4.762,8**	**5.817,1**	**10,580**
Powerhouse Cavern	3.206,1	3.709,6	6.915,7
Transformer & Switchyard Cavern	603,8	732,3	1.336,1
Cable Tunnel	203,8	286,2	490,0
Access Tunnel	749,1	1.089,1	1.838,2
ACCESS ROADS & BRIDGES	489	224	**0,713**
TOTAL	**78.997,8**	**106.361,4**	**185.359,2**

Table 9.6: Costs of Civil Works of Madian Hydropower Project

9.4.2 Estimation of Costs of Hydraulic Steel Structure Equipment

The cost estimate of the hydraulic steel structure equipment for the Madian HPP is based on tender costs of hydropower projects of similar type and magnitude worldwide. In view of the tight market situation the willingness of manufacturers / supplies to provide quotations for the equipment specified for the Madian HPP is low.

Equipment costs were estimated based on the cost of material that international manufacturers pay for purchase of material and the corresponding charges for design and manufacturing, transport, insurance and erection etc. as known from tender prices of similar type of equipment.

In Table 9.7 the major components of the hydraulic steel structure equipment and their corresponding costs are given. A detailed list of equipment part and their corresponding rates and quantities is given in Annex A-9.5. The level of the prices is 30. June 2007.

No.	DESCRIPTION	UNIT RATE		
		Local US$	Foreign US$	Total US$
1	Diversion Tunnel Intake Stoplogs	302.400	100.800	403.200
2	Spillway Gates and Stopglogs	452.484	3.167.391	3.619.875
3	Flushing Outlet - Steel Liner and Gates	317.835	476.753	794.588
4	Power Intake, Gates, Stoplogs, Raking Machine	466.298	1.398.895	1.865.194
5	Desander gates	1.027.688	1.027.688	2.055.375
6	Headrace Tunnel Maintenance Gate	36.094	252.656	288.750
7	Pressure Shaft/Tunnel Steel Liner	1.884.157	332.498	2.216.655
8	Powerhouse	55.420	387.942	443.363
9	Tailrace Outlet	192.938	64.313	257.250
	SUBTOTAL	4.735.314	7.208.935	**11.944.249**

Table 9.7: Cost of Hydraulic Steel Structure Equipment for the Madian HPP

The Consultant inquired/estimated actual rates as per 30. June 2008. An increase of costs of approximately 15 % within one year was observed. In view of establishing additional steel production capacities in China and India, predictions are reported that in the near future escalation of costs will be moderate or even stagnant.

9.4.3 Estimation of Costs of Electro-mechanical Equipment

The cost estimate of the electro-mechanical equipment is based on tender costs of hydropower projects of similar type and magnitude worldwide. In view of the tight market situation the willingness of manufacturers / supplies to provide quotations for the equipment specified for the Madian HPP is low. Leading manufacturers state having orders for more than one year of their production capacity.

The equipment costs were estimated based on recent tender prices of projects of similar type of equipment from qualified manufacturers on the basis of equipment lists broken down into CIF prices, transportation to site, erection and commissioning.

No.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		
				Local US$	Foreign US$	Total US$
1	Turbines	Lumpsum	1	1.872.687	13.108.807	14.981.493
2	Butterfly valve, D=2.5m	Lumpsum	1	382.592	2.678.143	3.060.735
3	Cooling Water System	Lumpsum	1	166.461	1.165.227	1.331.688
4	Drainage and Dewatering System	Lumpsum	1	69.359	485.511	554.870
5a	Low Pressure Compressed Air System	Lumpsum	1	26.356	184.494	210.851
5b	Low Pressure Compressed Air System	Lumpsum	1	33.781	236.469	270.251
6	Air Conditionning and Ventilation System	Lumpsum	1	188.779	1.321.452	1.510.231
7	Oil Treatment Plant	Lumpsum	1	16.579	116.053	132.632
8	Mechanical Workshop Equipment	Lumpsum	1	31.905	223.335	255.240
9	EOT Crane Powerhouse 210 t	Lumpsum	1	118.134	826.935	945.069
9	Elevator	Lumpsum	1	33.281	232.967	266.248
10	Fire Fighting System	Lumpsum	1	99.575	697.022	796.597
11	Auxiliary Francis unit - 520kW	Lumpsum	1	150.799	1.055.592	1.206.390
	Subtotal			3.190.287	22.332.008	**25.522.295**
	-Miscellaneous items	%	2,5			638.057
	TOTAL	in	US$			**26.160.353**

Table 9.8: Cost of Electro-mechanical Equipment for the Madian HPP

In Table 9.8 the major components of the electro-mechanical equipment and their corresponding costs are summarized. A detailed list of equipment parts and their corresponding rates and quantities is given in Annex A-9.6.

The Consultant inquired/estimated actual rates as per 30. June 2008 (one year later) and observed an increase of costs of approximately 20 %. It is difficult to make predictions on future development of equipment prices. The Consultant believes that in the near future escalation of costs will be moderate.

9.4.4 Estimation of Costs of Electrical Equipment

The cost estimate of the electrical equipment is based on the tender costs of hydropower and thermal power projects worldwide. In view of the tight market situation the willingness of manufacturers / supplies to provide quotations for the equipment specified for the Madian HPP is low. Leading manufacturers state having received orders for far more than one year of their production capacity.

The equipment costs were estimated based on recent tender prices of projects with similar type of equipment on the basis of equipment lists from qualified manufacturers and broken down into CIF prices, transportation to site, erection and commissioning.

In Table 9.9 the major components of the electrical equipment and their corresponding costs are summarized. A detailed list of equipment parts and their corresponding rates and quantities is given in Annex A-9.7.

No.	DESCRIPTION	UNIT	QUANTITY	UNIT RATE		
				Local US$	Foreign US$	Total US$
1	Synchronous generators 63 kVA, 333 r	Lumpsum	1	2.525.473	17.678.311	20.203.784
2	Step-up transformer 230/13.8 kV	Lumpsum	1	882.853	6.179.969	7.062.822
3	220 kV SF6 Switchyard	Lumpsum	1	742.180	5.195.259	5.937.438
4	220 kV Terminal Gantry & Auxil.	Lumpsum	1	76.431	535.017	611.448
5	13.8 kV generator busbars & auxil.	Lumpsum	1	353.368	2.473.575	2.826.943
6	Protection Systems	Lumpsum	1	261.487	1.830.407	2.091.894
7	Control and Monitoring System	Lumpsum	1	332.464	2.327.247	2.659.711
8	Electrical Equipment at Dam Site	Lumpsum	1	171.090	1.197.629	1.368.718
9	El. Equipment at Desander Cavern	Lumpsum	1	92.523	647.664	740.188
10	Emergency Diesel 630 kVA	Lumpsum	1	54.576	382.031	436.607
	Subtotal					**43.939.553**
	-Miscellaneous items	%	0			0
		in	US$			**43.939.553**

Table 9.9: Cost of Electrical Equipment for the Madian HPP

The Consultant inquired/estimated actual rates as per 30. June 2008. An increase of costs of approximately 25 % within one year was observed. It is difficult to make predictions on the future development of equipment prices. The Consultant believes that in the near future escalation of costs will be moderate.

9.5 Estimation of Indirect Project Costs and Contingencies

9.5.1 Consideration of Indirect Costs and Contingencies

The cost estimate for a hydropower project comprises major construction activities and cost items with their corresponding unit rates and quantities or where applicable lump sum cost. The total construction cost is determined as the sum of the direct and indirect costs plus contingencies. The basic project cost is calculated as the total construction cost plus charges for engineering, administration and supervision as well as client's own costs, the latter two expressed as a percentage of the total construction costs.

Indirect costs, as outlined below in detail, are costs other than investment and recurrent costs and concern activities which will be required as a result of the construction of the project infrastructure. They will depend on the final project development plan recommended for implementation, and will be determined on the basis of the results provided by the social studies, institutional support requirements and the Environmental Impact Assessment, including necessary compensation or mitigation measures to alleviate negative impacts, where applicable.

9.5.1.1 Consideration of Indirect Costs

As common practice in bankable feasibility studies, the concept of indirect costs is applied to civil costs and includes preparation of the construction sites, camp installation, site administration as well as bonds, insurance and contractor's profits. Indirect costs are taken to 25 % of the direct cost, estimated as follows:

- 10% for site installation cost not included in the direct cost such as:
  - move in, move out, erection, operation, maintenance and repair of general equipment, machinery, work-yards, stores, offices and housing facilities
  - move in and move out and all other relevant cost of personnel
  - general services such as electric power, water, sewage, traffic, communication,
  - camps, canteen, special installations, first-aid, fire fighting, etc.
  - temporarily required roads and bridges

- 15% for the contractors indirect cost consisting of:
  - site overheads for key personnel and local staff expenses 2.0%
  - head office services 2.0%
  - bonds and insurance 2.0%
  - pre-financing cost 5.0%
  - miscellaneous general services 1.0%
  - risk and profit 3.0%

In addition costs related to land acquisition, compensation payments and resettlement are to be taken into account.

Relevant corresponding costs may include:

- Land acquisition costs and compensation payments for loss of agricultural production; these were determined as part of the Resettlement Action Plan (RAP, see Volume VI-b);
- Resettlement costs for households to be resettled due to the construction project components, dumping of excavation material, these were determined as part of the Resettlement Action Plan (see Volume VI-b);

The costs related to land acquisition, compensation payments and resettlement were determined to amount to

RAP Cost: 129.395 million Rupees equivalent to **2.134 million USD**

In addition the Consultant considers some minor additional annual costs for monitoring of water quality and supply of drinking water to affected households as outlined in detail in Volume VI-b of this Feasibility Study. The corresponding costs are included in the estimate of Operation and Maintenance Costs.

9.5.1.2 Consideration of Contingencies

Irrespective of the level of planning, some element of uncertainty will still remain in the estimation of quantities and costs, for which usually physical contingencies are included in the cost estimates to cover, for example, the following:

- unforeseen construction items,
- errors or inaccuracies in the quantity calculations,
- unforeseen deviations from expected geological, topographical or hydrological values.

The percentage additions to the direct cost to account for physical contingencies are defined in the Bill of Quantities. For the feasibility study of the Madian HPP the following values were taken (Contingencies cover both the physical and financial components). For the level of a bankable feasibility study the following provisions are made to account for unforeseen works and costs:

a)	Civil works	10.0 %
b)	Electromechanical Equipment	7.5 %
c)	Electrical Equipment	7.5 %
d)	hydraulic Steel Structure Equipment	7.5 %

9.5.2 Consideration of Import Charges

The Consultant inquired the extent of import charges which would apply for import of electro-mechanical, electrical and particular hydraulic steel structure equipment to be adequately considered in the estimation of costs.

For equipment such as turbines generators and other special equipment not fabricated in Pakistan an import charge of 5.0 % applies. In the estimation of costs excise fees at Karachi harbour are to be taken into account in addition. According to the Consultant's information a national excise fee of 1.0 % will be charged for imported equipment and in addition an excise fee will be charged by the state of Sindh of 0.5 %. For clearance and handling some minor fees will be charged within the harbour area which are estimated as a total amount of 0.5 %.

In total 7.0 % of import charges are therefore applied to the above mentioned imported equipment and considered in the Bill of Quantities and the estimation of costs to account for import and related charges.

9.6 Estimation of Costs for Project Development

9.6.1 Estimate for Cost of Engineering and Administration

The cost of all required activities for Engineering and Administration, setting up the legal and institutional framework of the Project after completion and acceptance of the feasibility study is estimated applying a certain percentage of the total cost of the project cost.

Assuming that tender design, assistance in the tender process and supervision of construction, erection and commissioning will be conducted by a leading international consultant, an estimate of 6 % of civil works and 3 % for hydraulic steel structure, electro-mechanical and electrical equipment cost is made. The assumed rate accounts for the present situation in the market and the particular the conditions of the political instability in Pakistan and the corresponding required provisions for security aspects etc..

9.6.2 Estimate for Cost of Client's Own Costs

The cost of all related expenditures of the Client in the course of developing the Project after completion and acceptance of the feasibility study is estimated applying a percentage of the total cost of the project.

As a common approach an estimate of 1.0 % of the total project cost is made for this bankable feasibility study taking into account the requirements of legal support for negotiation of the Power Purchase Agreement (PPA) and other related activities in the volatile North Western Frontier Province of Pakistan.

9.7 Bill of Quantities

Civil works costs are determined by multiplying the computed quantities of work with the respective compound rates. For civil works (and for selected equipment) element-specific 'miscellaneous costs' are added to cover expenditures for minor items, which have not separately been considered, expressed as a percentage of the total cost of the respective element.

The Consultant determined the quantities of works for each major civil structure based on the feasibility design drawings applied an adequate number of profiles to reflect adequately both the dimensions of the structure, the topographic (as regards excavation) and the geological conditions.

At the headrace tunnel as the major cost item of the project, in the estimation of the quantity of rock excavation provisions are made in addition to excavation of the net tunnel diameter for concrete lining, shotcrete and a certain overbreak. The thickness of lining and shotcrete as well as the length and density of rock bolts vary with the rock classes to be encountered along the tunnel alignment. This variation has been taken into account applying the geological assessment of the headrace tunnel and the allocation of rock classes to the individual tunnel sections. For each tunnel section the corresponding rock support (see report on Geology, Section 3.4) is considered in the estimation of quantities. Table 9.6 summarizes the major quantities of civil works of the Madian HPP

9.8 Total Construction Cost and Basic Project Cost

As discussed in the previous sections the total project cost are calculated applying provisions for indirect costs, contingencies, import charges, engineering and administration and client's own costs as summarized in Table 9.10.

Cost item	(%)
Indirect civil costs (% of direct civil costs)	25
Contingencies (% of direct + indirect costs)	
- civil	10.0
- electro-mechanical	7.5
- electrical	7.5
Engineering and administration	6.0 / 3.0
Client's own costs	1.0

Table 9.10 : Indirect Costs and Contingencies

The corresponding composition of the total costs of the Madian HPP is given in Table 9.12.

9.9 Disbursement of Costs – Cash Flow

Based on his experience the Consultant elaborated a Project cash flow for the construction period to achieve an adequate disbursement of costs and the corresponding estimation of interest during construction.

As a conservative estimate an advance payment of 20 % is assumed for the civil contractor. Further payments are nearly constant since major part of construction activities are underground works with rather constant production rates which are not affected by climatic conditions. A certain variation of the progress of work and the corresponding cash flow is considered with a slightly higher percentage for the summer period compared to the winter period when concrete work, drilling etc. may be affected by climatic conditions.

A slightly distinctive approach is made for the manufacturer/supplier of electro-mechanical and steel structure equipment on one hand and that of the electrical equipment on the other. The Consultant observed that the market situation is intense as regards vacant capacities of manufacturers of transformer and generators. The cost estimate and the percentage of the advance payment were adjusted to account for this situation as shown in the cash flow schedule indicated in Table 9.11.

		year 1				year 2				year 3				year 4				year 5		
Contractor / Month	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	Total
Civil Contractor	20	3	3	4	4	4	5	5	3	3	5	5	3	3	5	5	5	5	10	100
E&M Equipment					10				20		15		15		15		15		10	100
Electrical Equipment					20				15				15		20		20		10	100
Steel Struct. Equipm.					10				20		15		15		15		15		10	100

Table 9.11: Disbursement of Cost during Construction for EPC Contractors

COST CATEGORY	Charges	Local 1000 US$	Foreign 1000 US$	Total 1000 US$	% of Total
CIVIL COSTS		78.998	106.361	185.359	50,6%
CONTINGENCIES	10,00%	7.900	10.636	18.536	5,1%
INDIRECT COST	25,00%	21.724	29.249	50.974	13,9%
ENGINEERING / ADMINISTRATION	6,00%	6.517	8.775	15.292	4,2%
SUBTOTAL CIVIL COSTS		115.139	155.022	270.161	73,8%
STEEL STRUCUTRE EQUIPMENT		4.735	7.209	11.944	3,3%
CONTINGENCIES	7,50%	355	541	896	0,2%
IMPORT CHARGES & FEES	7,00%	542	0	542	0,1%
ENGINEERING	3,00%	153	232	385	0,1%
SUBTOTAL STEEL STRUCTURE EQUIPMENT		5.786	7.982	13.768	3,8%
ELETRO-MECHANICAL EQUIPMENT		3.270	22.890	26.160	7,1%
CONTINGENCIES	7,50%	245	1.717	1.962	0,5%
IMPORT CHARGES & FEES	7,00%	1.722	0	1.722	0,5%
ENGINEERING	3,00%	105	738	844	0,2%
SUBTOTAL ELECTRO-MECH. EQUIPMENT		5.343	25.345	30.689	8,4%
ELECTRICAL EQUIPMENTS		5.492	38.447	43.940	12,0%
CONTINGENCIES	7,50%	412	2.884	3.295	0,9%
IMPORT CHARGES & FEES	7,00%	2.893	0	2.893	0,8%
ENGINEERING	3,00%	177	1.240	1.417	0,4%
SUBTOTAL ELECTRICAL EQUIPMENT		8.975	42.571	51.545	14,1%
SUBTOTAL w/o ENGINEERING		128.290	219.934	348.224	95,1%
SUBTOTAL		**135.243**	**230.920**	**366.163**	**100,0%**
EIA MITIGATION AND RESETTLEMENT		2.134	0	2.134	0,6%
OWNERS OWN COST	1,00%	1.301	2.309	3.610	1,0%
TOTAL		**138.678**	**233.229**	**371.907**	**101,6%**

Table 9.12 : Summary of cost of the Madian Hydropower Project at level of prices 30. June 2008

9.10 Operation, Maintenance and Repair Costs

The Consultant assessed the operating costs for the project based on the technical data elaborated within the scope of previous tasks. These costs will be divided into:

- maintenance costs for all productive assets;
- operation costs;
- personnel costs, including expenses for technical staff required to supervise and to operate the system;
- training costs;
- Administration costs associated with the project, including such cost items as office costs, insurance, equipment and materials.

Recurrent annual fixed costs for operation, maintenance and repairs (OMR) during the period of operation were calculated as a percentage of the initial investment costs.

The following percentages were applied:

- Civil structures : **0.5%,**
- Electro-mechanical equipment, including hydraulic steel structures : **2.0%**

According to common experience in the operation of hydropower plants and in view of the assumed concession period of 30 years, an overhaul of equipment (electro-mechanical, electrical and hydraulic steel structure) will be assumed as follows:

a) Electrical control and protection equipment after 15-20 years of operation (16.6 % of electrical equipment cost);

b) Electro-mechanical equipment components after 20-25 years of operation; (15 % of electro-mechanical equipment cost);

c) Hydraulic Steel structure equipment components (and valves) after 30 years (end of concession period) of operation.

These overhaul does not form part of the annual OMR cost.

ANNEX 9

Billl of Quantities & Cost Estimates

Annex A-9.1: Quotation of Material Unit Prices of Manufacturers /Suppliers

CHERAT CEMENT

CHERAT CEMENT COMPANY LIMITED
3, SUNDER DAS ROAD, LAHORE
TEL : (042) 6286249-6286250
UAN : (042) 111-000-009
FAX : (042) 6286204- 6367523
E -mail: solhr@lhr.comsats.net.pk

Ghulam Faruque Group

CCCL/LHR/ASK/512 *January 25, 2008*

M/s. Fichtner Gmbh & Co. KG,
Madian Hydropower Project Office,
3-Sundar Das Road,
Lahore.

Fax # 6286804
Ph # 6286805

Subject: - **PRICE OF O. P. CEMENT.**

Dear Sir,

Reference to your letter dated: 10-01-08.
Following is our per ton Ex-Factory rate of O. P. Cement alongwith other terms and conditions for your site at **"60-km north of Mingora (Swat)".**

EX-FACTORY PRICE:	@ Rs. 4500/= per ton to be paid in shape of P.O./D.D in favour of CHERAT CEMENT CO. LTD.
LOADING CHARGES:	@ Rs. 10 per ton to be paid to the driver at your site.
OTHER CHARGES:	Other charges (if any) and Unloading to be paid by you at your site.
TRANSPORTATION:	To be arranged by the transport contractor of Cherat Cement Co. Ltd.
DELIVERY/PACKING	As per availability in 50 kg bags
PRICE ESCALATION:	Subject to any increase in Excise Duty, Sales Tax, Local Taxes, Electricity, POL, Freight, or any other Taxes levied or increased by the Government, the price of cement will be increased accordingly from the date of announcement and new prices will be charged on all despatches.
TIME LIMIT FOR CLAIMS :	Claims, if any, must be raised by the purchaser with-in 90 days of despatch of consignment. Thereafter no claim will be entertained.

Contd..P/2..

Head Office : Modern Motors House, Beaumont Road, Karachi. Tel: (021) 5683566-67, 5688348,5682633 Fax: (021) 5683425; Cable: "CHERCEMENT"
Sales Offices : 1st Floor, Betani Arcade, Jamrud Road, Peshawar. Tel: UAN: (091) 111-000-009 Fax: (091) 840447; Cable: "CHERCEMENT"
: Mezzanine Floor, Razia Sharif Plaza, 91- Blue Area, Islamabad. Tel: (051) 2274096,2873720, UAN: (051) 111-000-009, Fax: (051) 2274970
Factory : P.O. Box 28, Nowshera. Tel: (091) 5270531-34 (Four Lines) UAN: (0923) 111-000-009 Fax: (091) 5270536; Cable: "CHERCEMENT"

URS

CHERAT CEMENT COMPANY LIMITED
3, SUNDER DAS ROAD, LAHORE
TEL : (042) 6286249-6286250
UAN : (042) 111-000-009
FAX : (042) 6286204- 6367523
E -mail: solhr@lhr.comsats.net.pk

Ghulam Faruque Group

(P/2)

CCCL/LHR/ASK/512 *January 25, 2008*

C & F PAYMENT: If you wish to make C&F payment then please make separate DD in the name of A. K. Khattak Goods Company, **Peshawar** as per following.

Rs.	530.00	Per Ton	(Freight)
Rs.	10.00	Per Ton	(Loading)
Rs.	30.00	Per ton	(Un-Loading)
Rs.	4.00	Per ton	(District Tax)
Rs.	**574.00**	**Per Ton**	**(TOTAL)**

LANDED RATE: **Rs. 254/= per bag**

FORCE-MAJEURE: The seller shall NOT be liable for failure to supply which may be caused due to an act of God, Fire, Riot, Strikes or Lock-Out by workmen, Factory Expansion, Breakdown or Accident to Machinery of plant which may affect the performance of the Contract beyond the control of the seller.

SALE TAX REGISTRATION NO: **Please Provide (if any)**

We are grateful for your interest in Cherat Cement and would like to fulfil your demand. In case of any further clarification required in this regard please feel free to contact us at the above phone nos.

With Warm Regards

Cordially yours
For Cherat Cement Company Ltd.,

(**AHMED SHOAIB KHAN**)
General Manager Marketing

Head Office : Modern Motors House, Beaumont Road, Karachi. Tel: (021) 5683566-67, 5688348,5682633 Fax: (021) 5683425; Cable: "CHERCEMENT"
Sales Offices : 1st Floor, Betani Arcade, Jamrud Road, Peshawar. Tel: UAN: (091) 111-000-009 Fax: (091) 840447; Cable: "CHERCEMENT"
: Mezzanine Floor, Razia Sharif Plaza, 91- Blue Area, Islamabad. Tel: (051) 2274096,2873720, UAN: (051) 111-000-009, Fax: (051) 2274970
Factory : P.O. Box 28, Nowshera. Tel: (091) 5270531-34 (Four Lines) UAN: (0923) 111-000-009 Fax: (091) 5270536; Cable: "CHERCEMENT"

ASKARI CEMENT

ARMY WELFARE TRUST

HEAD OFFICE:
Marketing Division, 5th Floor, AWT Plaza, The Mall, Rawalpindi. Tel: 9271949, 9271959, 9272439-41 Fax: 9272412, 9270476

MA/DPC/601/00/96
Jan 15, 2008

Dr. Jorg Grossmam
Project Manager
M/s Fichtner GmbH & co, KG
Madian Hydropower Project Office
3 Sunder Das Road, Off Davis Road, Lahore
Tel No: 042-6286805
Fax No: 042-6286804

Subject: **Price of Askari Cement for Madian Hydropower Project**

Dear Sir,

Kindly refer to your letter no 7166P01-grm-001 dated Jan 10, 2008
We are pleased to quote following **price** of Ordinary Portland Cement **(OPC)** for above-mentioned station:

- **Bagged Cement**

Ex-Factory Price	:	Rs. 4350.00 Per Ton
Freight	:	Rs. 600.00 Per Ton
C&F Price	**:**	**Rs. 4950.00 Per Ton**

Other terms and conditions are as under: -

1. **PAYMENT: -**	Advance
2. **SPECIFICATIONS: -**	As per BS 12:1989, PS: 232/1983 (R)
3. **QUALITY: -**	ISO 9001:2000 certified
4. **PRICE VALIDITY: -**	valid for 30 Days.
5. **FORCE-MAJEURE: -**	The Company shall not be liable for failure to supply, which may be caused due to natural calamity, strike in factory, and break down in factory or any other reason, which is beyond control of the company.
6. **PACKING: -**	50 Kg Polypropylene Bag/Paper Bag.
7. **DELIVERY SCHEDULE: -**	As and when required
8. **SOURCE OF SUPPLY: -**	Askari Cement Nizampur/Askari Cement Ltd Wah
9. **WITHHOLDING TAX: -**	Exempted

We appreciate your interest in "**Askari Cement** " and assure you of our fullest cooperation in meeting your requirements. For further details you may call the undersigned anytime.

Yours faithfully,

Khalid Mehmood
General Manager (Mktg)

MARKETING OFFICES:
PESHAWAR : City Towers Plaza, Jamrud Road, University Town, Jahangirabad, Peshawar. Tel: 091-844394, 091-5701859
MULTAN : Room No. 12, 1st Floor, Trust Plaza, L. M. Q. Road, Near Chowk Dera Adda, Multan. Tel: 061-518290

ISO 9001-2000 Certified Company

FAZAL STEEL (PVT) LIMITED

Plot No. 410 - 421 Industrial Area, I-9, Islamabad - Pakistan
UAN : 111-375-786
Tel : +92-51-4434 813, 4443 612
: +92-51-4448 886, 4100 926
Fax : +92-51-4433 597
e-mail: info@fazalsteel.com
karim@fazalsteel.com
Web : www.fazalsteel.com

M/S. Fichtner GmbH & Co. KG
Madian Hydropower Project Office
3 Sunder Das Road
Off Davis Road,
Lahore, Pakistan.

Ref: 18896 / 07
Date. 11.01.2007

Attn: **Dr. Jorg Grossmann, Project Manager,**
Fichtner GmbH, Germany.
Tel/Fax: 042-6286805 / 6286804.

Subject: ***QUOTATION FOR SUPPLY OF STEEL REBARS DEFORMED GRADE-40, AND GRADE-60 CONFORMING TO ASTM 615A STANDARD, HAVING MINIMUM YIELD STRESS AND BSI 4449, ASSHTO M-31***

Dear Sir,

Reference: Your inquiry # 7166P01grm 001 dated 10.01.2008.

We are pleased to submit our most competitive prices for the material according to your requirements and specification, which are BSI 4449, AASHTO M-31 and ASTM 615-A, Grade-40, Grade-60.

We assure you will find our material up to the quality mark and standard with most reasonable Cost for such quality material as compared in the market.

You would appreciate that we always try our best to continue supply according to your schedule and on time despatch to your costly and prestigious projects.

PRICE:	(Ex-Factory)		
Sizes	**Grade**	**Description**	**Rates / PMT**
NO. 4 TO NO. 6	Grade-60 ASTM A615	Deformed Bars	Rs. 59,850/-
NO. 7 TO NO. 9	Grade-60 ASTM A615	Deformed Bars	Rs. 60,850/-
NO. 10 TO NO. 11	Grade-60 ASTM A615	Deformed Bars	Rs. 62,850/-
NO. 14	Grade-60 ASTM A615	Deformed Bars	Rs. 70,850/-

6360

LENGTH OF BARS: i) Standard Commercial Length 38 ft. to 42 ft. end chopped.
ii) Required Length size extra Rs. 800.00 per Metric Ton.

Contd. On P/2.

And Deformed Steel Bars for Reinforcement of Concrete according to ASTM 615A, ASTM A36.

Manufacturers of Quality Cold Twisted Bars according to BSI Standards

WEIGHMENT: Weighment of steel rebar on computerized weigh bridge having 90 Metric Tons capacity, purchased from **PFISTER COMPANY OF GERMANY** and installed by their engineers.

PACKING. Each bundle of steel bars will packing weight in 2 tons and dispatch by trailer having loading capacity of 25 tons for straight bars.

PAYMENT: Against Cash Payment or Inland Letter of Credit at sight in our favour from a first class scheduled bank.

PRODUCT CAPACITY: We have three units for steel re-rolling with 200 Metric Tons daily and 6,000 Metric Tons per month of production capacity.

TESTING: We have our own testing machine of 100 tons capacity **AVERY ENGLAND** in our factory on which we can give Stress/strain curves of the material with each consignment.

REJECTION: According to Section 17, Clause 7.1 of ASTM 615M, the purchaser shall report any rejection to manufacturer within five working days from the receipt of sample (consignment).

ESCALATION: Rates agreed have been computed on the basis of prevalent tax rates, power tariff and prices of Pakistan Steel Mills billets. If during the execution of this agreement, Central / Provincial Government imposes any new duty, changes sales tax rate for steel bars / billets, changes Sui Gas, electricity tariff etc. the prices will be increased / decreased accordingly.

VALIDITY FOR PRICE: Above rates are valid for **07 days** from the date of quotation.

DELIVERY PERIOD: Within 7 working days. Delivery schedule will be given to us in advance so that we ensure supplies for your prestigious project.

We use prime quality steel billets selected from best sources and manufactured under renowned international standards like ASTM 615A, AASHTO M-31 and BSI 4449 & 4461.

Kindly let us know your requirement of steel for this project accordingly, "to preparing our schedule of Steel supply", especially for continue supply to your prestigious project.

Please freely contact us for further inquiry if any.

Thanks.

Yours Truly,

KARIM AZIZ MALIK
DIRECTOR SALE
Mobile: 0333-5252310 & 0304-5589999

Amreli Steels (Pvt) Ltd.
(Downstream Industry of Pakistan Steel)

(ISO 9001:2000 CERTIFIED)

January 17, 2008
Ref: ASL/Mktg/Q 08-0049

Mr. Riaz-ul-Haq Qurashi
PES
M/s. Fichtner GmbH & Co. KG
Madian Hydropower Project Office
3 Sunder Das Rd
Off Davis Rd
Lahore
Tel: 042-6286805
Fax: 042-6286804

Dear Sir,

SUBJECT: **QUOTATION FOR SUPPLY OF STEEL BARS FOR YOUR MADIAN HYDROPROJECT**

We are pleased to quote our best competitive prices for your project as under:

Products	Size / Dia	Ex-Factory Prices Inclusive all Taxes
Deformed Steel Bars G-60	10mm	Rs. 56,000/- Pmt
Deformed Steel Bars G-60	12mm-25mm	Rs. 55,000/- Pmt
Deformed Steel Bars G-60	28mm	Rs. 55,500/- Pmt
Deformed Steel Bars G-60	32mm	Rs. 55,500/- Pmt
Deformed Steel Bars G-60	40mm	Rs. 56,000/- Pmt

SPECIFICATIONS:

Deformed Grade-60 Steel Bar	**Deformed Steel Bars** (ends cut) conforming to ASTM A615/A615M, having minimum yield stress of 60,000 psi, rolled exclusively from prime M. S. Billets of Pakistan Steel Mills Corporation Limited, Bin Qasim / imported billets / bars.
DELIVERY	To be mutually agreed upon.
PAYMENT	Advance before delivery by Demand Draft in favour of Amreli Steels Mill (Pvt.) Ltd. We hold a valid Income Tax

Head Office & Factory :
D/89, Shershah Road, S.I.T.E., Karachi-75730 (Pakistan.)
Tel : 2561150-4 (5 Lines), Fax : (92-21) 2587240 E-mail: info@amrelisteels.com
URL : www.amrelisteels.com

WAH NOBEL (PVT) LTD.

ISO – 9001:2000, 14001, 17025 & OHSAS18001 Certified

G.T. Road Wah Cantt

EX- WORKS Price List Effective AUGUST 06, 2007

S.NO	PRODUCTS	SIZE	Standard Packing	A/U Per	Rate (Rs.)	Sales Tax @ 15%	S.E.D @ 1%	Value (Rs.)
A	**EXPLOSIVES:**							
	EMULSION EXPLOSIVES							
1	EMULITE - 150	25 & 32 mm dia X 200mm	25Kg/box	1000 Kg	134,000	20,100	1,340	155,440
2	EMULITE - 150 S	25 & 32 mm dia X 200mm	25Kg/box	1000 Kg	129,000	19,350	1,290	149,640
3	EMULITE - 150	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	125,000	18,750	1,250	145,000
4	EMULITE - 150 G	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	117,000	17,550	1,170	135,720
5	EMULITE - 100	25 & 32 mm dia X 200mm	25Kg/box	1000 Kg	116,000	17,400	1,160	134,560
6	EMULITE - 100	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	96,000	14,400	960	111,360
7	EMULITE - 100 G	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	82,000	12,300	820	95,120
	SEISMIC EXPLOSIVES							
8	S-3	50mm dia X 0.5 Kg	25Kg/box	1000 Kg	177,000	26,550	1,770	205,320
9	S-3	50mm dia X 1.0 Kg	25Kg/box	1000 Kg	177,000	26,550	1,770	205,320
10	E-3	50mm dia X 1.0 Kg	25Kg/box	1000 Kg	156,000	23,400	1,560	180,960
	SPECIAL GELATINE							
11	WABOX - 80 %	25 & 32 mm dia X 200mm	25Kg/box	1000 Kg	177,000	26,550	1,770	205,320
12	WABOX - 80 %	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	154,000	23,100	1,540	178,640
	POWDER EXPLOSIVES:							
13	WABOFITE - 70%	25 & 32 mm dia X 200mm	25Kg/box	1000 Kg	115,000	17,250	1,150	133,400
14	WABOFITE - 70%	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	99,000	14,850	990	114,840
15	WABONITE	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	72,000	10,800	720	83,520
16	WABONITE	Bulk	25Kg/bag	1000 Kg	70,000	10,500	700	81,200
17	WAPRIL (ANFO)	50,63&75 mm dia X 500mm	25Kg/box	1000 Kg	59,000	8,850	590	68,440
18	WAPRIL (ANFO)	Bulk	25Kg/bag	1000 Kg	55,000	8,250	550	63,800
19	AMM. NITRATE PRILLED	Bulk	25Kg/bag	1000 Kg	36,000	5,400	0	41,400
B	**ACCESSORIES:**							
20	SAFETY FUSE		250 M/ Roll	1000 Mtr.	5,250	787.5	52.5	6,090
21	WABOCORD (Detonating Cord) 10 gms/Mtr		250 M/ Roll	1000 Mtr.	14,500	2175	145	16,820
22	DETONATOR NO. 8 (Plain)		100Nos/box	100 Nos	1,000	150	0	1,150
23	DETONATOR NO. 8 (Electric) 3.0 MWL		500Nos/box	100 Nos	5,500	825	0	6,326
24	H.S/M.S DELAY DETONATORS – Wah Nobel 03 MWL		500Nos/box	100 Nos	10,500	1675	0	12,075
25	H.S/M.S DELAY DETONATORS – France 03 MWL		500Nos/box	100 Nos	12,600	1890	0	14,490
26	DELAY RELAYS		500Nos/box	100 Nos	14,500	2175	0	16,675
27	FIRING CABLE		90 M/ Roll	90 Mtr	2,100	315	0	2,415
28	CONNECTING WIRE		1000M/ Roll	1000 Mtr	4,000	600	0	4,600

NOTES:

1. Terms of payment: 100% advance with the order by bank draft / cash/ crosa choque.
2. The above prices are subject to change without notice.
3. The rates prevalent on the day of lifting would be charged, in case of partial supplies also.
4. For special sizes of explosives, special rates will be charged.
5. Any additional Tax levy by Local Govt/ Provicinal Govt/Federal Govt of Pakistan or change in Sales Tax will be charged at actual at the time of lifting.

17/01/08

(GOHAR ALAM)

Manager Marketing & Blasting Services

USA LINING INC.
Head Office:
914 SW 5TH STREET OKLAHOMA CITY, OK 73109 USA
TEL (405)235-2900 FAX (405)235-2901
TOLL Free 1-888-560-3200
sales@usalining.com Web: www.usalining.com

SHAHZADA INDUSTRIES
Country Office:
22 km Off Ferozpur Road, Rohi Nala, DuluKalan, Lahore, 53100 Pakistan.
Tel: (042) 526-0305-06, 840-2195Fax: 526-0307
E-mail: shahzada_industries@yahoo.com
Web: www.shahzada.pk

January 10, 2008
SI/08/616

The Project Manager
Fichtner Gmbh & Co. KG
Madian Hydropower Project.

Subject: QUOTATION FOR Geotextile.

Dear Sir,

Reference to your e-mail dated January 10, 2008 and our Tele discussion please find below the subject quote.

Sr. No.	Material Description	Unit Price Rs.
1	**Supply of Geotextiles 100g /Sq m**	**3.89/Sq.Ft**
2	**Supply of Geotextiles 200g / Sq m**	**7.78/Sq.Ft**
3	**Supply of Geotextiles 300g / Sq m**	**11.67/Sq.Ft**

TERMS & CONDITIONS

- Payment 50% advance, balance at delivery.
- Price Validity is for 30 days.
- Delivery with in 2 weeks after confirming order.
- Freight will be added in quote at quantity confirmation.

Thank you, and for any other assistance or clarification, please contact us.

Best Regard

Najib Ahmed Bajwa
GM

Mian Shahzada Ahmed Ali
CEO

1

Annex A-9.2a: Cost of Construction Equipment - Monthly Rental

No.	Description of Equipment	Rental Price / Month	
		Pak Rps.	US $
1	Excavator face shovel 0.5 – 1.1 m³	250000	3906
2	Front end loader 0.75 m³	124500	1945
3	Dozer D-7 (Compatible)	280950	4390
4	Dozer D-8 (Compatible)	386000	6031
5	Dozer 3.5 m³	195100	3048
6	Rock drilling equipment other than drill jumbo	515550	8055
7	Mucking truck with rock body 14 tonne	85750	1340
8	Dump truck 7.5~20 m³	114400	1788
9	Vibratory roller 15 tonne	250600	3916
10	Grader cat D-12	192400	3006
11	Tamping foot roller 15 ton	275000	4297
12	Scraper 15 m³ capacity	251000	3922
13	Air compressor diesel – 800 cfm	91750	1434
14	Air compressor electric 250 lb	145600	2275
15	Concrete breaker (Pneumatic hammer)	165500	2586
16	Concrete batch plant 22 m³	540800	8450
17	Concrete transit mixer	190000	2969
18	Concrete pump static (40 m³/hr)	300000	4688
19	Concrete mobile pump (40 m³/hr)	291200	4550
20	Grouting equipment	93600	1463
21	Dewatering pump (1 cusec)	165500	2586
22	Concrete vibrator	55000	859
23	Tractor trolley	105000	1641
24	Water sprinkler 1000~3000 gal	92560	1446
25	Diesel generator 250 kVA	130000	2031

Annex A-9.2b: Cost of Construction Equipment – Operating Cost

Sr. #	Equipment	Rps/hr
1	Excavator 1.1 m³	950
2	Dumper 35 m³	550
3	Dozer 23.5 Ton	1740
4	Grader (190 HP)	925
5	Rock drilling machine	3300
6	Air compressor 800 cfm	580
7	Transit mixer 4 m^3	900
8	Concrete pump static 45 m^3/hr	1400
9	Vibrator	250
10	Flat bed truck	550

Annex A-9.3: Comparative Statement of Unit Rates of 6 Hydropower Projects

S/No	Item Description	Unit	Project Unit Rates --- Year Used / in Currency as Shown						Project Unit Rates Escalated to 30/06/2007 in US $									
			Malakand -III HPP	Dubeer Khawar HPP	Patrind HPP	Basha Diamer Dam Project	Khan Khawar HPP	Golen Gol HPP	Malakand -III HPP		Dubeer Khawar HPP		Patrind HPP		Basha Diamer Dam Project	Khan Khawar HPP	Golen Gol HPP	
			Jun-2000	June- 2003	May-2007	July - 2003	June-2003	January-1997										
			PKR	PKR	PKR	US $	US $	US $	PKR	Final US $	PKR	Final US $	PKR	Final US $	US $	US $	US $	US $
1	Open excavation in soil / rock not requiring blasting	M^3	351	155.61	361.26	4.28	4.82	5.35	530	8.83	200	3.33	365	6.08	4.56	5.14	6.3	
2	Open excavation in rock requiring blasting all classes of rock i/c disposal of material	M^3	626	537.41	658.25	9.15	8.8	15.35	940	15.67	680	11.33	665	11.08	9.76	9.39	18	
3	Rock excavation pits + trenches	M^3	-	765.7	-	-	-	-	-	-	970	16.16		-	-	-	-	
4	Underground excavation in rock Type A i/c disposal of muck	M^3	1693	3620.94	7511.6	119.47	36.87	120	2550	42.5	4570	76.16	7590	126.5	127.55	39.4	141.33	
5	Underground excavation in rock Type B	M^3	1370	2801.31	7511.6	-	43.02	120	2060	34.33	3535	58.92	7590	126.5	-	-	141.33	
6	Underground excavation in rock Type C	M^3	1106	2174.14	7073.21	-	43.02	145	1670	27.83	2750	45.83	7150	119.2	-	-	170.78	
7	Backfill with excavation material/m^3	M^3	354	237.04	228.65	-	-	4	532	8.86	300	5	231	3.85	-	-	4.7	
8	Shotcrete /m^3	M^3	9480	7771.67	5092.6	-	58.8	110	14250	237.5	9810	163.5	5145	85.75	-	62.77	129.55	
9	Steel Lining 17.9mm thick	Per Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	62.77	-	
10	Reinforcement for Shotcrete Welded steel mesh (Kg)	Per Kg	43.65	37.9	50	-	0.474	1	65.65	1.09	47.85	0.8	51	0.85	-	0.506	1.18	
11	Rock bolts with plate washers L=2-4 m non-tensioned	Per No.	444	2138	3177.9	-	21.2	26	700	11.67	2700	45	3210	53.5	-	22.63	30.6	
12	Rock bolts L=2-4 m tensioned	Per No.	622	2445	-	-	-	26	940	19.67	3085	51.42	3210	53.5	-	-	30.6	
13	Rock bolt intake structure 200 KN, L = 2 - 5m - No	Per No.	-	-	6355.8	-	24.747	26	-	-	-	-	6420	106.83	-	26.41	-	
14	Steel ribs for rock support	kg	61.48	48.21	85	-	-	-	92.5	1.54	60.84	1.01	86	1.43	-	-	-	
15	Roller Compacted Concrete 2000 Psi i/c formwork	M^3	-	-	3350	-	-	150	-	-	-	-	3383	96.4	-	-	176.7	
16	Concrete lining i/c formwork B. 25	M^3	-	7170	7615.3	-	100.39	140	-	-	9050	150.83	9610	160.2	-	107.18	164.9	
17	Concrete Class C for lining in flushing tunnel i/c formwork	M^3	-	6186	7615.3	-	74	150	-	-	7810	130.2	9610	160.2	-	79	176.7	
18	R.C.C. 20 Mpa i/c formwork	M^3	6744	7170	6082.95	221.77	74	225	10140	169	9050	150.8	7200	120	236.77	79	265	
19	R.C.C. in Power House First Stage	M^3	-	-	6082.95	209.07	74	225	-	-	-	-	9610	160.2	223.3	79	265	
20	R.C.C. in Linings + Plugs	M^3	-	-	-	203.51	117.14	-	-	-	-	-	-	-	217.26	125.06	-	
21	Supply, bending and fixing deformed steel G-60	Per Kg	44295	35.2	63	1.306	0.51	1	66.6	1.11	44.45	0.74	64	1.07	1.395	0.54	1.18	
22	Concrete block masonry of different thickness - m^3	M^3	-	6256.8	8759.5	-	-	-	-	-	7900	131.7	8850	147.5	-	-	-	
23	Concrete Class C as Second Stage Concrete for Embedment of Electro Mechanical Equipment	M^3	-	10584	10209.75		-	-	-	-	13360	222.7	10310	171.8	-	-	-	

Annex 9.4: Bill of Quantities of Madian Hydropower Project

1. Diversion Works

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
UPSTREAM ROCKFILL COFFERDAM

Calculated physical parameters

Elevation COFFERDAM crest	1496 m asl	Maximum height of cofferdam	20,5 m
Width of dam crest	6 m	Length of dam crest	60 m
Embankment slope UPSTREAM	2,0	Total cofferdam volume	35514 m3
Embankment slope downstream	2,0		
Hauling distance rock	0,5 km		
Hauling distance impervious material	0,5 km		

COST ESTIMATE FOR U/S COFFERDAM

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	Total US$
1	CO0001	Excavation cofferdam base	m3	3.577,0	6,03	4,94	10,97	21.582	17.658	39.240
2	CO0002	Preparation rock foundation	m3	0,0	8,66	7,09	15,75	0	0	0
3	CO0003	Extra for transport	m3 km	29.900,0	0,75	0,42	1,18	22.504	12.658	35.162
4	CO0004	Crushed rockfill S quantity	m3	25.850,0	7,21	5,90	13,10	186.306	152.432	338.738
5	CO0005	Dumped rock slope protection	m3	4.050,0	10,67	8,73	19,40	43.222	35.364	78.586
6	CO0006	Concrete slab at crest	m3	117,0	65,45	53,55	119,00	7.658	6.265	13.923
		Subtotal						281.272	224.378	505.650
		Miscellaneous items	15	%				42.191	33.657	75.847
		Total						323.463	258.034	**581.497**

COST ESTIMATE FOR COFFERDAM GROUTING

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	Total US$
1	CO0022	percussion drilling open	m	4.247,0	53,13	43,47	96,60	225.643	184.617	410.260
2	CO0025	grouting open incl. cement	to	774,0	287,02	234,83	521,85	222.152	181.760	403.912
3	CO0029	rotary drilling (check hole)	m	162	61,22	50,09	111,30	9.917	8.114	18.031
4	CO0030	rotary drilling (drain hole)	m	999	61,22	50,09	111,30	61.154	50.035	111.189
		Subtotal						518.865	424.526	943.391
		Miscellaneous items	15	%				77.830	63.679	141.509
		Total						596.695	488.205	**1.084.900**

COST ESTIMATE FOR D/S COFFERDAM

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	Total US$
1	CO0001	Excavation cofferdam base	m3	1.303,0	6,03	4,94	10,97	7.862	6.432	14.294
2	CO0002	Preparation rock foundation	m3	0,0	7,09	8,66	15,75	0	0	0
3	CO0003	Crushed rockfill S quantity	m3	2.217,0	7,21	5,90	13,10	15.978	13.073	29.052
4	CO0004	Extra for transport	m3 km	3.309,0	0,76	0,41	1,18	2.529	1.362	3.891
5	CO0005	Gabions	m3	780,0	21,46	7,15	28,61	16.738	5.579	22.318
6	CO0006	Borepile wall D = 0.8 m	m	875,0	142,87	116,90	259,77	125.015	102.285	227.301
7	CO0007	Concrete for bore piling	m³	439,82	63,24	51,74	114,98	27.813	22.756	50.569
8	CO0008	Reinforcement for bore piling	to	15,4	785,98	643,07	1429,05	12.099	9.899	21.999
		Subtotal						208.035	161.387	369.423
		Miscellaneous items	15	%				31.205	24.208	55.413
		Total						239.240	185.596	**424.836**

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
INTAKE FOR LEFT BANK DIVERSION TUNNEL

Calculated physical parameters

Design discharge	129 m³/s	Freeboard	1,5 m
Elevation of dam crest	1496 m asl	Inner conduit diameter	9 m
Maximum flood level	1495 m asl	Width of entrance	18,9 m

COST ESTIMATE FOR DIVERSION TUNNEL INTAKE

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	Total US$
1	IN0001	Underground rock excavat. class 4	m3	1.571,0	43,11	52,69	95,80	67.723	82.773	150.496
2	IN0002	Shortcrete lining > 20 m2	m3	176,3	77,40	94,60	172,00	13.645	16.677	30.323
3	IN0003	Concrete lining > 20 m2	m3	228,0	65,68	80,27	145,95	14.974	18.302	33.277
4	IN0004	Steel reinforcement	ton	17,1	786,50	643,50	1430,00	13.449	11.004	24.453
5	IN0005	Mesh reinforcement	ton	2,0	1056,83	864,68	1921,50	2.114	1.729	3.843
6	IN0006	Formw.intake struc.tunn. 120m2	m²	3.757,0	7,73	9,44	17,17	29.024	35.474	64.498
7	IN0007	Rockbolt	m	470,0	17,50	14,32	31,82	8.224	6.729	14.953
8	IN0008	Excavation open cut	m³	11.650,0	4,18	3,42	7,6025	48.713	39.856	88.569
9	IN0009	Concrete in superstructure	m³	1.310,0	58,12	71,03	129,15	76.134	93.053	169.187
10	IN0010	Reinforcement superstructure	ton	157,2	786,50	643,50	1430,00	123.638	101.158	224.796
		Subtotal						397.639	406.755	804.394
		Miscellaneous items	15	%				59.646	61.013	120.659
		Total						457.285	467.769	**925.053**

COST ESTIMATE FOR DIVERSION TUNNEL OUTLET

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	IN0001	Rock excavat. class 4	m3	1.571,0	43,11	52,69	95,80	67.723	82.773	150.496
2	IN0002	Shortcrete lining > 20 m2	m3	176,3	77,40	94,60	172,00	13.641	16.673	30.314
3	IN0003	Concrete lining > 20 m2	m3	228,0	65,68	80,27	145,95	14.974	18.302	33.277
4	IN0004	Steel reinforcement	ton	17,1	786,50	643,50	1430,00	13.449	11.004	24.453
5	IN0005	Mesh reinforcement	ton	2,0	1056,83	864,68	1921,50	2.114	1.729	3.843
6	IN0006	Formw.intake struc.tunn. 120m2	m²	2.854,2	7,73	9,44	17,17	22.050	26.950	48.999
7	IN0007	Rockbolt	m	410,0	17,50	14,32	31,82	7.174	5.870	13.044
8	IN0008	Excavation open cut	m³	4.420,0	4,18	3,42	7,6025	18.482	15.121	33.603
9	IN0009	Concrete in superstructure	m³	1.210,0	58,12	71,03	129,15	70.322	85.949	156.272
10	IN0010	Reinforcement superstructure	ton	145,2	786,50	643,50	1430,00	114.200	93.436	207.636
		Subtotal						344.129	357.807	701.937
		Miscellaneous items		15 %				51.619	53.671	105.291
		Total						395.749	411.478	**807.227**

MADIAN HYDRO POWER PROJECT
LEFT BANK DIVERSION TUNNEL

MADIAN HYDRO POWER LTD

FICHTNER GMBH

Calculated physical parameters

Design discharge	656 m³/s	Number of tunnels	1
Inner tunnel Dimnsions Height	9,2 m	Tunnel length	265 m
Inner tunnel Dimnsions Width	8 m	Flow velocity	10 m/s
Design head	9 m	Lining thickness	0,6 m
Equivalent roughness (k-value)	0,6 mm	Shotcrete	0,1 m
		Equivalent internal Dia	9,25
		Excavated Diameter	10,95

COST ESTIMATE FOR DIVERSION TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	TU0013	Tunnel exc. cl.1-2-3, 60m2, 500m	m3	24.955,4	31,77	59,00	90,76	792.750	1.472.249	2.264.999
2	TU0033	Tunnel excavat. cl.4, 60m2, 500m	m3	0,0	33,53	62,27	95,80	0	0	0
3	TU0053	Tunnel excavat. cl.5, 60m2, 500m	m3	0,0	34,03	63,20	97,23	0	0	0
4	TU0062	Shotcrete > 20 m2	m³	903,3	51,60	120,40	172,00	46.608	108.753	155.361
5	TU0064	Concrete lining > 20m2	m³	6.243,9	74,43	71,52	145,95	464.763	446.537	911.299
6	TU0065	Reinforcement	ton	405,9	786,50	643,50	1430,00	319.205	261.167	580.372
7	TU0066	Mesh reinforcement	m3	22,8	1056,83	864,68	1921,50	24.096	19.715	43.810
8	TU0070	Formwork tunnels 500m, 60m2	m2	5.580,8	11,59	7,73	19,32	64.693	43.129	107.822
9	TU0087	Rockbolt	m	6.976,0	18,45	13,36	31,82	128.727	93.216	221.943
10	TU0091	Concrete for plug	m²	1.570,0	94,87	51,08	145,95	148.942	80.200	229.142
		Subtotal						1.989.782	2.524.965	4.514.747
		Miscellaneous items		10 %				198.978	252.496	451.475
		Total						2.188.761	2.777.461	**4.966.222**

2. Weir Structure

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
CONVENTIONAL CONCRETE GRAVITY WEIR

Calculated physical parameters

Elevation dam crest	1496 m asl	Maximum height of cofferdan	31 m
Width of dam crest	4,5 m	Length of dam crest	88 m
Embankment slope UPSTREAM	0,0	Total dam volume	17795 m3
Embankment slope downstream	0,8	Average depth of excavation	11,1 m
Hauling distance concrete aggregates	3 km		

COST ESTIMATE FOR WEIR

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	WE0001	Site clearing light jungle	ha	1,5	339,89	183,02	522,90	510	275	784
2	WE0002	Common excavation	m3	117.582,0	3,42	4,18	7,60	402.263	491.654	893.917
3	WE0003	Rock excavation	m3	35.274,6	7,09	8,66	15,75	250.009	305.566	555.575
4	WE0004	Preparation of foundation	m²	2.273,0	7,09	8,66	15,75	16.110	19.690	35.800
5	WE0005	Backfill	m3	10.713,0	2,60	3,18	5,78	27.840	34.027	61.868
7	WE0007	Concrete to structures	m3	39.811,0	71,03	58,12	129,15	2.827.875	2.313.716	5.141.591
8	WE0008	Extra transport crushed stone	m3 km	109.428,0	0,76	0,41	1,18	83.647	45.041	128.687
9	WE0009	Bar reinforcement complete	to	534,5	786,50	643,50	1430,00	420.375	343.943	764.318
10	WE0010	Formwork S	m²	9.545,0	9,44	7,73	17,17	90.125	73.739	163.864
		Subtotal						4.118.753	3.627.650	7.746.403
		Miscellaneous items	10	%				411.875	362.765	774.640
		Total						4.530.628	3.990.415	**8.521.044**

COST ESTIMATE FOR WEIR GROUTING

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	DA0046	Percussion drilling open	m	3.191,0	43,47	53,13	96,60	138.713	169.538	308.251
2	CO0025	Grouting open incl. cement	to	1.534,0	234,83	287,02	521,85	360.233	440.285	800.518
3	CO0029	rotary drilling (check hole)	m	165	50,09	61,22	111,30	8.264	10.100	18.365
4	CO0030	rotary drilling (drain hole)	m	1015	50,09	61,22	111,30	50.836	62.133	112.970
		Subtotal						558.046	682.056	1.240.103
		Miscellaneous items	15	%				83.707	102.308	186.015
		Total						641.753	784.365	**1.426.118**

COST ESTIMATE FOR BORE PILING - WEIR

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	DA0046	pile drilling	m	5.540,0	38,97	220,81	259,77	215.871	1.223.268	1.439.139
2	CO0025	concrete for piles	m³	2.784,7	63,24	51,74	114,98	176.094	144.077	320.172
3	CO0029	reinforcement for piles	to	62,7	785,98	643,07	1429,05	49.296	40.333	89.628
		Subtotal						441.261	1.407.678	1.848.939
		Miscellaneous items	10	%				44.126	140.768	184.894
		Total						485.387	1.548.446	**2.033.833**
		Specific cost per m2 grout area	US$/m²	229						

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
POWER INTAKE

Calculated physical parameters

Design discharge	129 m³/s	Freeboard	1 m
Elevation of dam crest	1496 m asl	Inner conduit diameter	7 m
Maximum flood level	1494,5 m asl		

COST ESTIMATE FOR POWER TUNNEL INTAKE

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	IN0001	Common excavat.	m3	18.000,0	3,80	3,80	7,60	68.423	68.423	136.845
2	IN0002	Rock excavation	m3	1.343,0	7,88	7,88	15,75	10.576	10.576	21.152
3	IN0003	Shotcrete	m3	84,0	51,60	120,40	172,00	4.334	10.113	14.448
4	IN0004	Backfill	m3	926,0	4,33	1,44	5,78	4.011	1.337	5.348
5	IN0005	Formw.intake struc.tunn. 120m2	m²	2.116,0	6,87	10,30	17,17	14.531	21.796	36.326
6	IN0006	Rockbolt	m	754,0	18,45	13,36	31,82	13.913	10.075	23.989
7	IN0007	Concrete in superstructure	m³	4.160,8	65,87	63,28	129,15	274.057	263.310	537.367
8	IN0008	Reinforcement superstructure	ton	499,3	786,50	643,50	1430,00	392.696	321.297	713.993
9	IN0009	-tunnel excav. cl.4, 60m2, 500m	m³	1.963,0	33,53	62,27	95,80	65.817	122.231	188.048
		Subtotal						848.358	829.158	1.677.516
		Miscellaneous items	10	%				84.836	82.916	167.752
		Total						933.194	912.074	**1.845.268**

3. Power Waterways – Headrace Tunnel & Desander Cavern

MADIAN HYDRO POWER PROJECT
HEADRACE TUNNEL

MADIAN HYDRO POWER LTD

FICHTNER GMBH

Calculated physical parameters

number of tunnels	1	
tunnel Length	11821	m
in good rock	35,7%	%
in fair rock	57,9%	%
in poor rock	6,1%	%
in very poor rock	0,4%	%
Flow velocity	3,35	m/s
Discharge in Tunnel	129	m^3/s

Inner dia	**7,00**	Overbreak,	Lining	Shotcrete	Excavated
Length	m		Thickness	Thickness	Diameter
in very good	0	0,10	0,00	0,05	7,20
in good rock	4215	0,10	0,30	0,08	7,80
in fair rock	6840	0,15	0,50	0,10	8,30
in poor rock	716	0,20	0,60	0,15	8,60
in very poor	50	0,20	0,60	0,20	8,60
	11821				

COST ESTIMATE FOR HEADRACE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PT0017	Tunnel exc. cl.1-2-3	m3	571494	31,77	59,00	90,76	18.154.464	33.715.434	51.869.898
2	PT0018	Tunnel exc. cl.4	m3	41591	33,53	62,27	95,80	1.394.493	2.589.772	3.984.265
3	PT0019	Tunnel exc. cl.5	m3	2904	29,17	68,06	97,23	84.718	197.675	282.394
4	PT0062	Shotcrete (7.5-20 cm thickness)	m3	28408	51,60	120,40	172,00	1.465.786	3.420.166	4.885.952
5	PT0064	Concrete lining	m3	132656	74,43	71,52	145,95	9.874.190	9.486.966	19.361.156
6	PT0065	Reinforcement	to	3980	786,50	643,50	1430,00	3.130.020	2.560.926	5.690.946
7	PT0066	Mesh Reinforcement	to	232	1056,83	864,68	1921,50	245.183	200.605	445.788
8	PT0071	Formwork tunnels	m2	258390	7,73	11,59	19,32	1.996.838	2.995.257	4.992.095
9	PT0087	Rockbolt 3-4 m long, 25mm	m	199941	18,45	13,36	31,82	3.689.457	2.671.676	6.361.133
10	PT0088	Steel rib	to	1214	825,83	675,68	1501,50	1.002.552	820.269	1.822.821
11	PT0089	Steel lagging	to	390	825,83	675,68	1501,50	322.072	263.513	585.585
		Subtotal						41.359.773	58.922.260	100.282.033
		Miscellaneous items	10	%				4.135.977	5.892.226	10.028.203
		Total						45.495.750	64.814.487	**110.310.237**

COST ESTIMATE FOR DESANDER CAVERN

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PH0007	Excavationcavern cl.1-2-3	m^3	201024	22,56	41,89	64,45	4.534.529	8.421.267	12.955.796
2	PH0008	Rock bolt	m	69300	18,45	13,36	31,82	1.278.772	926.007	2.204.780
3	PH0015	Wire mesh	ton	123	1056,83	864,68	1921,50	129.910	106.290	236.200
4	PH0016	Shotcrete lining	m^3	7450	51,60	120,40	172,00	384.409	896.954	1.281.363
5	PH0017	Concrete to cavern	m^3	21000	65,68	80,27	145,95	1.379.228	1.685.723	3.064.950
6	PH0018	Reinforcement to cavern	ton	1260	786,50	643,50	1430,00	990.990	810.810	1.801.800
7	PH0019	Formwork to covern lining	m^2	7115	8,31	10,15	18,46	59.099	72.233	131.332
		Subtotal						8.756.937	12.919.284	21.676.221
		Miscellaneous items	10	%				875.694	1.291.928	2.167.622
		Total						9.632.630	14.211.212	**23.843.843**

MADIAN HYDRO POWER PROJECT
SURGE TANK

MADIAN HYDRO POWER LTD

FICHTNER GMBH

Calculated physical parameters

number of Surge Tanks	1	
Inner diameter	21	m
Excavated diameter	23,2	m
Height of surge tank	83	m
in overburden	3	%
Spacing of Rock Bolts	3	m^2
Discharge in Tunnel	129	m^3/s
Provisions for maintenace gate	9,9	m^2

Inner diameter	**21,00**	Overbreak,	Lining	Shotcrete	Excavated
Tunnel		m	Thickness	Thickness	Diameter
in fair rock		0,30	0,60	0,20	23,20

COST ESTIMATE FOR PRESSURE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	ST0003	Shaft excavation	m3	35087	31,77	59,00	90,76	1.114.592	2.069.957	3.184.549
2	ST0010	Shotcrete (15-20 cm thickness)	m2	1199	60,20	111,80	172,00	72.205	134.096	206.301
3	ST0011	Concrete in Surge Tank	m3	5785	74,43	71,52	145,95	430.588	413.702	844.290
4	ST0012	Reinforcing steel	to	260	786,50	643,50	1430,00	204.738	167.513	372.251
5	ST0013	Mesh reinforcement	to	17	1056,83	864,68	1921,50	18.283	14.959	33.242
6	ST0014	Formwork	m2	5613	10,63	8,69	19,32	59.644	48.799	108.443
6	ST0019	Rockbolt	m	13097	18,45	13,36	31,82	241.675	175.006	416.681
7	ST0024	Excavation open cut	m3	3368	4,94	2,66	7,60	16.642	8.961	25.604
		Subtotal						2.158.368	3.032.993	5.191.361
		Miscellaneous items	15	%				323.755	454.949	778.704
		Total						2.482.123	3.487.942	**5.970.065**

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
PRESSURE SHAFT

Calculated physical parameters

number of tunnels	1	
tunnel Length	112	m
in good rock	60	%
in fair rock	30	%
in poor rock	10	%
Flow velocity	4,88	m/s
Spacing of Rock Bolts	3	m²
Discharge in Tunnel	129	m^3/s

Inner diamete Tunnel	**5,80**	Overbreak, m	Lining Thickness	Shotcrete Thickness	Excavated Diameter
in good rock		0,05	0,30	0,10	6,70
in fair rock		0,08	0,50	0,15	7,25

COST ESTIMATE FOR PRESSURE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PS0005	Shaft excavation	m3	4254	31,77	59,00	90,76	135.129	250.954	386.084
2	PS0019	Shortcrete lining (15cm thickness)	m2	373	51,60	120,40	172,00	19.249	44.915	64.164
3	PS0020	Concrete lining	m3	754	74,43	71,52	145,95	56.123	53.922	110.045
4	PS0022	Reinforcement	to	34	786,50	643,50	1430,00	26.686	21.834	48.520
5	PS0023	Mesh Reinforcement	to	1	1056,83	864,68	1921,50	1.057	865	1.922
6	PT0071	Formwork tunnels	m2	1530	7,73	11,59	19,32	11.824	17.736	29.560
7	PS0024	Rockbolt 3m long, 25mm	m	2443	18,45	13,36	31,82	45.085	32.648	77.732
		Subtotal						295.153	422.873	718.026
		Miscellaneous items	15	%				44.273	63.431	107.704
		Total						339.426	486.304	**825.730**

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
PRESSURE TUNNEL

Calculated physical parameters

number of tunnels	1	
tunnel Length	67	m
in good rock	50	%
in fair rock	20	%
in poor rock	15	%
in very poor rock	15	%
Flow velocity	5,63	m/s
Spacing of Rock Bolts	3	m
Discharge in Tunnel	129	m^3/s

Inner diameter Tunnel	**5,40**	Overbreak, m	Lining Thickness	Shotcrete Thickness	Excavated Diameter
in good rock		0,05	0,30	0,10	6,30
in fair rock		0,08	0,50	0,15	6,85

Steel Linning Thickness 0,028 m

COST ESTIMATE FOR PRESSURE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PT0017	Tunnel exc. cl.1-2-3	m3	2257	31,77	59,00	90,76	71.708	133.172	204.880
2	PT0062	Shotcrete (15cm thickness)	m3	130	51,60	120,40	172,00	6.693	15.618	22.312
3	PT0064	Concrete lining	m3	421	74,43	71,52	145,95	31.343	30.113	61.456
4	PT0065	Reinforcement	to	0	786,50	643,50	1430,00	0	0	0
5	PT0066	Mesh Reinforcement	to	1	1056,83	864,68	1921,50	1.057	865	1.922
6	PT0071	Formwork tunnels	m2	0	7,73	11,59	19,32	0	0	0
7	PT0087	Rockbolt 3m long, 25mm	no	1318	18,45	13,36	31,82	24.323	17.614	41.937
		Subtotal						135.124	197.382	332.506
		Miscellaneous items	15	%				20.269	29.607	49.876
		Total						155.393	226.989	**382.382**

MADIAN HYDRO POWER PROJECT — MADIAN HYDRO POWER LTD — FICHTNER GMBH
MANIFOLD

Calculated physical parameters

Number of units	3	
Flow velocity	6,08	m/s
Spacing of Rock Bolts	3	m
Discharge in Tunnel	129	m^3/s
Steel Linning Thickness	0,028	m

Inner diameter Tunnel	Length	Overbreak, m	Lining Thickness	Shotcrete Thickness	Excavated Diameter
5,40	19,3	0,20	0,50	0,10	7,00
4,25	18,4	0,20	0,50	0,10	5,85
3,00	131	0,20	0,40	0,10	4,40

COST ESTIMATE FOR PRESSURE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PT0017	Tunnel exc. cl.1-2-3	m3	3552	31,77	59,00	90,76	112.839	209.559	322.398
2	PT0062	Shotcrete (15cm thickness)	m3	252	51,60	120,40	172,00	13.005	30.345	43.350
3	PT0064	Concrete lining	m3	1483	74,43	71,52	145,95	110.383	106.054	216.437
4	PT0065	Reinforcement	to		786,50	643,50	1430,00	0	0	0
5	PT0066	Mesh Reinforcement	to	2	1066,43	855,07	1921,50	2.133	1.710	3.843
6	PT0071	Formwork tunnels	m2	0	9,66	9,66	19,32	0	0	0
7	PT0087	Rockbolt 3m long, 25mm	m	2573	18,45	13,36	31,82	47.486	34.387	81.873
		Subtotal						285.847	382.055	667.901
		Miscellaneous items	15	%				42.877	57.308	100.185
		Total						328.724	439.363	**768.086**

MADIAN HYDRO POWER PROJECT
DRAFTTUBE EXTENSION

MADIAN HYDRO POWER LTD

FICHTNER GMBH

Calculated physical parameters

number of units	3	
Flow velocity	3,17	m/s
Spacing of Rock Bolts	3	m
Discharge in Tunnel	129	m^3/s

Inner diamete Tunnel	Length	Overbreak, m	Lining Thickness	Shotcrete Thickness	Excavated Diameter
7,20	19,3	0,20	0,50	0,15	8,90
5,60	18,4	0,20	0,50	0,15	7,30
4,20	131	0,20	0,40	0,10	5,60

COST ESTIMATE FOR PRESSURE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PT0017	Tunnel exc. cl.1-2-3	m3	5197	31,77	59,00	90,76	165.102	306.618	471.720
3	PT0062	Shotcrete	m2	368	51,60	120,40	172,00	18.985	44.297	63.282
3	PT0064	Concrete lining	m3	1775	74,43	71,52	145,95	132.157	126.974	259.131
65	PT0065	Reinforcement	to	89	786,50	643,50	1430,00	69.821	57.126	126.947
66	PT0066	Mesh Reinforcement	to	10	1056,83	864,68	1921,50	10.320	8.444	18.764
71	PT0071	Formwork tunnels	m2	2489	9,66	9,66	19,32	24.042	24.042	48.083
87	PT0087	rockbolt 4m long, 25mm	no	3733	18,45	13,36	31,82	68.887	49.884	118.770
		Subtotal						489.313	617.385	1.106.697
		Miscellaneous items	15	%				73.397	92.608	166.005
		Total						562.710	709.992	**1.272.702**

MADIAN HYDRO POWER PROJECT
TAILRACE TUNNEL

MADIAN HYDRO POWER LTD

FICHTNER GMBH

TAILRACE TUNNEL STRUCTURE

Calculated physical parameters

		Inner diameter	Overbreak,	lining Thickness,	Excav diameter
number of tunnels	1	**7,2** m			
tunnel Length	95 m				
in very good rock	0 %	0,0	0,100	0	7,4 m
in good rock	20 %	19,0	0,075	0,3 m	7,95 m
in fair rock	50 %	47,5	0,100	0,5 m	8,4 m
in poor rock	30 %	28,5	0,100	0,6 m	8,6 m
Flow velocity	3,17 m/s				
Spacing of Rock Bolts	3 m^2				

COST ESTIMATE FOR TAILRACE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PT0017	Tunnel exc. cl.1-2-3	m3	3575	31,77	59,00	90,76	113.581	210.937	324.518
2	PT0018	Tunnel exc. cl.4	m4	1656	33,53	62,27	95,80	55.507	103.085	158.592
3	PT0019	Tunnel exc. cl.5	m5	0	34,03	63,20	97,23	0	0	0
3	PT0062	Shotcrete	m2	251	51,60	120,40	172,00	12.936	30.183	43.119
3	PT0064	Concrete lining	m3	1397	74,43	71,52	145,95	103.967	99.889	203.856
65	PT0065	Reinforcement	to	56	786,50	643,50	1430,00	43.942	35.952	79.894
66	PT0066	Mesh Reinforcement	to	2	1056,83	864,68	1921,50	2.114	1.729	3.843
71	PT0071	Formwork tunnels	m2	1937	7,73	11,59	19,32	14.969	22.454	37.423
87	PT0087	rockbolt 4m long, 25mm	no	2507	18,45	13,36	31,82	46.261	33.499	79.760
88	PT0088	steel rib	to	12	825,83	675,68	1501,50	10.240	8.378	18.619
		Subtotal						403516	546107	949623
		Miscellaneous items	10	%				40.352	54.611	94.962
		Total						443.868	600.718	**1.044.585**

COST ESTIMATE FOR TAILRACE TUNNEL OUTLET

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	OL0001	common excavation in open cut	m3	48.120,0	4,18	3,42	7,60	201.208	164.625	365.832
2	OL0002	rock excavation in open cut	m3	5.230,0	8,66	7,09	15,75	45.305	37.068	82.373
2	OL0002	Shortcrete lining > 20 m2	m3	123,0	51,60	120,40	172,00	6.347	14.809	21.155
3	OL0003	Concrete lining > 20 m2	m3	511,0	74,43	71,52	145,95	38.036	36.544	74.580
4	OL0004	Steel reinforcement	ton	46,0	786,50	643,50	1430,00	36.179	29.601	65.780
5	OL0005	Mesh reinforcement	ton	1,0	1056,83	864,68	1921,50	1.057	865	1.922
6	OL0006	Formw.intake struc.tunn. 120m2	m^2	710,0	9,44	7,73	17,17	6.704	5.485	12.189
7	OL0007	Rockbolt	m3	1.220,0	18,45	13,36	31,82	22.512	16.302	38.814
9	OL0009	Concrete in superstructure	m^3	750,0	65,87	63,28	129,15	49.400	47.463	96.863
10	OL0010	Reinforcement superstructure	ton	75,0	786,50	643,50	1430,00	58.988	48.263	107.250
11	OL0011	Formwork in superstructure	m^2	810,0	9,44	7,73	17,17	7.648	6.258	13.906
12	OL0012	-tunnel excav. cl.4, 60m2, 500m	m^3	871,0	31,77	59,00	90,76	27.669	51.385	79.054
		Subtotal						501.052	458.666	959.717
		Miscellaneous items	15	%				75.158	68.800	143.958
		Total						576.209	527.465	**1.103.675**

4. Powerhouse, Transformer and Switchyard Cavern

COST ESTIMATE FOR POWERHOUSE CAVERN

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PH0007	Excavationcavern cl.1-2-3	m^3	38184	26,42	38,02	64,45	1.008.984	1.451.953	2.460.937
2	PH0008	Rock bolt	m	6188	18,45	13,36	31,82	114.185	82.686	196.871
3	PH0009	Wire mesh	ton	53	1056,83	864,68	1921,50	56.012	45.828	101.840
4	PH0010	Shotcrete lining	m^3	1487	51,60	120,40	172,00	76.701	178.969	255.671
5	PH0011	Concrete to cavern	m^3	8019	65,68	80,27	145,95	526.668	643.705	1.170.373
6	PH0012	Reinforcement to cavern	ton	802	786,50	643,50	1430,00	630.694	516.023	1.146.717
7	PH0013	Formwork to cavern lining	m^2	18923	19,80	16,20	36,00	374.666	306.545	681.210
		Subtotal						2.787.910	3.225.708	6.013.618
		Miscellaneous items	15	%				418.186	483.856	902.043
		Total						3.206.096	3.709.564	**6.915.661**

COST ESTIMATE FOR TRANSFORMER CAVERN

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PH0007	Excavationcavern cl.1-2-3	m^3	4630	26,42	38,02	64	122.344	176.055	298.399
2	PH0008	Rock bolt	m	2418	18,45	13,36	32	44.619	32.310	76.929
3	PH0009	Wire mesh	ton	7	1056,83	864,68	1922	7.398	6.053	13.451
4	PH0010	Shotcrete lining	m^3	257	51,60	120,40	172	13.261	30.942	44.203
5	PH0011	Concrete to cavern	m^3	331	65,68	80,27	146	21.739	26.570	48.309
6	PH0012	Reinforcement to cavern	ton	40	786,50	643,50	1430	31.240	25.560	56.800
7	PH0013	Formwork to covern lining	m^2	1703	10,63	8,69	19	18.096	14.806	32.902
		Subtotal						258696	312296	570992
		Miscellaneous items	15	%				38.804	46.844	85.649
		Total						297.500	359.140	**656.641**

COST ESTIMATE FOR SWITCHYARD CAVERN

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	PH0007	Excavationcavern cl.1-2-3	m^3	5080	26,42	38,02	64	134.234	193.167	327.401
2	PH0008	Rock bolt	m	2606	18,45	13,36	32	48.086	34.821	82.907
3	PH0009	Wire mesh	ton	7	1056,83	864,68	1922	7.398	6.053	13.451
4	PH0010	Shotcrete lining	m^3	250	51,60	120,40	172	12.900	30.099	42.999
5	PH0011	Concrete to cavern	m^3	309	65,68	80,27	146	20.294	24.804	45.099
6	PH0012	Reinforcement to cavern	ton	37	786,50	643,50	1430	29.163	23.861	53.024
7	PH0013	Formwork to cavern lining	m^2	1405	10,15	8,31	18	14.260	11.667	25.927
		Subtotal						266335	324472	590807
		Miscellaneous items	15	%				39.950	48.671	88.621
		Total						306.286	373.142	**679.428**

COST ESTIMATE FOR ACCESS TUNNEL POWERHOUSE

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	TU0009	Tun.exc. cl.1-2-3, 30m2, 500m	m3	7201	31,77	59,00	90,76	228.747	424.816	653.562
2	TU0029	Tun.excavat. cl.4, 30m2, 500m	m3	3086	33,53	62,27	95,80	103.472	192.162	295.634
3	TU0061	Shotcrete < 20 m2	m3	653	51,60	120,40	172,00	33.701	78.635	112.336
3	TU0063	Concrete lining < 20m2	m3	1804	74,43	71,52	145,95	134.273	129.007	263.280
65	TU0065	Reinforcement	to	81	786,50	643,50	1430,00	63.845	52.237	116.081
66	TU0066	Mesh reinforcement	to	4	1056,83	864,68	1921,50	4.227	3.459	7.686
71	TU0069	Formwork tunnels 500m, 30m2	m2	2431	9,66	9,66	19,32	23.485	23.485	46.971
87	TU0087	Rockbolt	m	3233	18,45	13,36	31,82	59.658	43.201	102.859
		Subtotal						651.408	947.001	1.598.409
		Miscellaneous items	15	%				97.711	142.050	239.761
		Total						749.119	1.089.052	**1.838.170**

COST ESTIMATE FOR CABLE TUNNEL

No.	CODE	DESCRIPTION	UNIT	QUANTITY	UNIT RATE Local US$	UNIT RATE Foreign US$	UNIT RATE Unit Price US$	TOTAL COST Local US$	TOTAL COST Foreign US$	TOTAL COST Total US$
1	TU0009	Tun.exc. cl.1-2-3, 30m2, 500m 2	m3	1882	31,77	59,00	90,76	59798,11	111053,63	170.852
2	TU0029	Tun.excavat. cl.4, 30m2, 500m	m3	807	33,53	62,27	95,80	27049,24	50234,29	77.284
3	TU0061	Shotcrete < 20 m2	m3	183	51,60	120,40	172,00	9447,27	22043,64	31.491
3	TU0063	Concrete lining < 20m2	m3	517	74,43	71,52	145,95	38511,00	37000,76	75.512
65	TU0065	Reinforcement	to	23	786,50	643,50	1430,00	18311,41	14982,06	33.293
66	TU0066	Mesh reinforcement	to	1	1056,83	864,68	1921,50	1395,01	1141,37	2.536
71	TU0069	Formwork tunnels 500m, 30m2	m2	561	9,66	9,66	19,32	5419,26	5419,26	10.839
87	TU0087	Rockbolt	m	1373	18,45	13,36	31,82	25339,07	18348,98	43.688
		Subtotal						185.270	260.224	445.494
		Miscellaneous items	10	%				18.527	26.022	44.549
		Total						203.797	286.246	**490.044**

Annex A-9.5: Cost Estimate of Hydraulic Steel Structure Equipment

Part	Description	No. / Lot	Unit Price FOB USD	FOB USD	Transport Insurance USD	Erection USD	Installed USD
1,1	Spillway						
	Radial Tainter gate	2	682.500	1.365.000	68.250	273.000	1.706.250
	Radial Tainter Gate with Flap Gate	1	756.000	756.000	37.800	151.200	945.000
	Stoplogs	lot	409.500	409.500	20.475	40.950	470.925
	Gantry crane	lot	414.750	414.750	20.738	62.213	497.700
1,2	Power Intake & Waterways						
	Stoplogs	lot	346.500	346.500	17.325	34.650	398.475
	Trash rack	3	157.500	472.500	23.625	70.875	567.000
	Trash rack Cleaning Machine	lot	262.500	262.500	13.125	39.375	315.000
	Intake Roller gate	3	155.925	467.775	23.389	93.555	584.719
	Flushing gate	2	110.250	220.500	11.025	44.100	275.625
	Stoplogs for Flushing Gate	lot	154.350	154.350	7.718	30.870	192.938
	Steel Lining Flushing Channel	lot	241.500	241.500	12.075	72.450	326.025
1,3	Desander						
	Roller gate Outlet	3	182.700	548.100	27.405	109.620	685.125
	Sliding gate Inlet	3	168.000	504.000	25.200	100.800	630.000
	Desander Mechanical Equipment	3	165.900	497.700	24.885	99.540	622.125
	Sluice Valve	6	15.750	94.500	4.725	18.900	118.125
1,4	Waterways						
	Bulkhead at Surge Tank	1	231.000	231.000	11.550	46.200	288.750
	Pressure Shaft Steel Liner	lot	1.430.100	1.430.100	71.505	715.050	2.216.655
1,5	Miscellaneous						
	Tailrace Outlet Stoplog	1	205.800	205.800	10.290	41.160	257.250
	Draft tube flap gate	3	118.230	354.690	17.735	70.938	443.363
	Lost Stoplog Diversion Tunnel	lot	336.000	336.000	16.800	50.400	403.200
	Total Equipment Part	US$				**11.944.249**	

Costs: Equipment installed, commissioned, spare parts included, without contingencies.

Annex A-9.6: Cost Estimate of Electro-Mechanical Equipment

Item	Description		No. / Lot	Unit Price FOB	FOB USD	Transport & Insurance USD	Erection USD	Installed USD
	Turbines, Governors and Main Inlet Valves							
	P=60,8 MW, n=333,3 rpm, Hn=151,7m							
1,1	Turbines incl. Governors		3	4.161.526	12.484.578	624.229	1.872.687	14.981.493
1,2	Main Inlet Valves							
	Butterfly valve, D=2.5m		3	894.952	2.684.855	107.394	268.486	3.060.735
	Total Part 1							***18.042.228***
	Power Plant Mechanical Equipment							
2,1	Cooling Water System		3	357.981	1.073.942	42.958	214.788	1.331.688
2.2	Drainage and Dewatering System		lot	447.476	447.476	17.899	89.495	554.870
2.3a	Low Pressure Compressed Air System		lot	170.041	170.041	6.802	34.008	210.851
2.3b	Low Pressure Compressed Air System		lot	217.944	217.944	8.718	43.589	270.251
2.4	Air Conditionning and Ventilation System		lot	1.208.185	1.208.185	60.409	241.637	1.510.231
2,5	Oil Treatment Plant		lot	116.344	116.344	4.654	11.634	132.632
2,6	Mechanical Workshop Equipment		Lot	205.839	205.839	8.234	41.168	255.240
2,7	EOT Crane Powerhouse 210 t		1	787.558	787.558	39.378	118.134	945.069
2,8	Elevator		2	111.869	223.738	8.950	33.561	266.248
2,9	Fire Fighting System		lot	617.517	617.517	24.701	154.379	796.597
2,10	Mandatory release generating unit, 520kW, H=16m, Q=3.6 m3/s, complett with generator and electrical/mechnical auxiliary systems		Lot	1.005.325	1.005.325	50.266	150.799	1.206.390
	Total Part 2							**7.480.067**
	Grandotal Equipment Parts 1&2,							***25.522.295***
	Misellaneous items 2.5 %							638.057
	Grandtotal							**26.160.353**

Costs: Equipment installed, commissioned, spare parts included, without contingencies.

Annex A-9.7: Cost Estimate of Electrical Equipment

MADIAN HYDROPOWER PROJECT
Cost Estimate for Electro-mechanical Equipment

Item	Description	Unit	No. / Lot	Unit Price FOB US$	Transp. + Ins FOB US$	Transp. + Ins US$	Erection US$	Installed US$
	Main Generators, Excitation Systems and Associated Auxiliary Equipment							
1.01	Generator 63 MVA, 333.3 rpm, 18 poles		3	5.707.284	17.121.851	1.027.311	2.054.622	20.203.784
1.02	Static Excitation System		in item 1.01					
1.03	Fire Protection System for Generator		in item 1.01					
	Total Part 1				**17.121.851**	**1.027.311**	**2.054.622**	**20.203.784**
	Electrical Equipment within / at Power Cavern					0,0600	0,3000	
2.01	220 kV Terminal Gantry to OHLs & Surge Arrestors		Lot	93.180	93.180	5.591	27.954	126.725
2.02	220 kV XLPE cable connection OHL terminal gantry - GIS switchgear	km	0,3	931.801	279.540	16.772	83.862	380.175
2.03	220 kV XLPE cable connection GIS switchgear - Main Transformers	km	0,12	640.613	76.874	4.612	23.062	104.548
2.04	220 kV GIS Switchgear	Bays	6	838.621	5.031.728	301.904	603.807	5.937.438
2.05	Main Single-Phase Transformer 230/13.8kV, 24 1/3 MVA		10	582.376	5.823.759	349.426	698.851	6.872.035
2.06	Fire Protection System for Transformers		Lot	151.418	151.418	9.085	30.284	190.786
2.07	13.8 kV generator busbars system		3	359.559	1.078.677	64.721	161.801	1.305.199
2.08	13.8 kV generator circuit-breakers		2	326.130	652.261	39.136	78.271	769.668
2.09	Unit Auxiliary Transformer 13.8/0.42 kV 1250 kVA		2	19.859	39.718	1.986	4.766	46.470
2.10	400 V AC Switchgear incl. Sub-Boards		Lot	407.663	407.663	20.383	101.916	529.962
2.11	UPS Systems (110 V, 48 V, 24 V, Safe AC 400 V)		Lot	135.111	135.111	6.756	33.778	175.645
2.12	Emergency Diesel Generator Set 630 kVA		1	366.897	366.897	14.676	55.035	436.607
2.13	Protection System							
	Unit Protection System		3	58.238	174.713	8.736	17.471	200.920
	GIS Switchgear & Transformer Protection System		6	58.238	349.426	17.471	34.943	401.839
2.14	Power, Control & Instrum. Cables + Cable Trays		Lot	465.901	465.901	46.590	186.360	698.851
2.15	Grounding and Lightning Protection System		Lot	267.893	267.893	13.395	133.946	415.234
2.16	Illumination and Small Power		Lot	267.893	267.893	13.395	93.763	375.050
2.17	Control and Monitoring System							
	Plant Control and Monitoring System		Lot	582.376	582.376	17.471	58.238	658.085
	Unit and Common Control System		4	209.655	838.621	25.159	83.862	947.642
	GIS Switchgear Control System		6	46.590	279.540	8.386	27.954	315.881
	Dam Site & Desander Cavern Control Systems		2	209.655	419.311	12.579	41.931	473.821
2.18	Communication System		Lot	151.418	151.418	4.543	45.425	201.386
2.19	Electrical Workshop Equipment		Lot	58.238	58.238	1.747	2.912	62.897
	Total Part 2				**17.992.153**	**1.004.518**	**2.630.192**	**21.626.863**
	Electrical Equipment at Dam Site							
3.01	11 kV Switchgear		Lot	34.943	34.943	1.747	6.989	43.678
3.02	Auxiliary Transformer 11/0.42 kV 630 kVA		1	17.937	17.937	717	2.691	21.345
3.03	400 V AC Switchgear incl. Sub-Boards		Lot	93.180	93.180	4.659	23.295	121.134
3.04	UPS Systems (110 V, 48 V, 24 V, Safe AC 400 V)		Lot	83.862	83.862	4.193	20.966	109.021
3.05	Emergency Diesel Generator Set 150 kVA		1	94.345	94.345	3.774	14.152	112.270
3.06	Auxiliary Synchronous Hydrogenerator 650 kVA, 400 V, 1500 rpm		1	227.127	227.127	9.085	34.069	270.281
3.07	Protection Systems, Power, Control & Instrum. + Cable Trays, and Small Power Grounding and Lightning Protection System		Lot	611.495	611.495	18.345	61.149	690.989
3.08	Control and Monitoring System		in item 2.17					
3.09	Communication System		in item 2.18					
	Total Part 3				**1.162.888**	**42.520**	**163.310**	**1.368.718**
	Electrical Equipment at Desander Cavern							
4.01	11 kV Switchgear		Lot	34.943	34.943	1.747	6.989	43.678
4.02	Auxiliary Transformer 11/0.42 kV 630 kVA		1	11.647	11.647	466	1.747	13.860
4.03	400 V AC Switchgear incl. Sub-Boards		Lot	81.533	81.533	4.077	20.383	105.992
4.04	UPS Systems (110 V, 48 V, 24 V, Safe AC 400 V)		Lot	83.862	83.862	4.193	20.966	109.021
4.05	Emergency Diesel Generator Set 150 kVA		1	94.345	94.345	3.774	14.152	112.270
4.06	Protection Systems, Power, Control & Instrum. + Cable Trays, Small Power, Grounding and Lightning Protection System,		Lot	314.483	314.483	9.434	31.448	355.366
4.07	Control and Monitoring System		in item 2.17					
4.08	Communication System		in item 2.18					
	Total Part 4				**620.813**	**23.691**	**95.684**	**740.188**
	Total Electrical Equipment Part 1 to Part 4				**36.897.704**	**2.098.041**	**4.943.809**	**43.939.553**

Costs: Equipment installed, commissioned, spare parts included, without contingencies.