DESCRIPTION OF THE PROJECT.

The Umngot H.E. Project as conceived by the Meghalaya Energy Corporation Limited, envisages a storage scheme (within the year storage) for generation of peak power with the setting up of a 3x70 MW power station on the river Umngot, a south flowing river which flows into Bangladesh. The project is intended to ease the acute shortage of peak power in the state during lean season.

The project consists of a 111 metres high concrete dam with a length of 362 metres across river Umngot to impound 71.31 MCum. of water. An Intake will lead the water from the reservoir to a 3.40m diameter head race tunnel of length 5.646 Km and a 2.5m diameter steel lined pressure shaft of length 2.119 Km will then carry the water to three Pelton turbines of 70 MW capacity each in a surface Power House of length 107.5m and width 22m for generation of 210 MW of peak power. The water after discharging from the turbines will be led through three tail race channels of cross sectional dimension 4.40mx2.80 m each which will join into the main Tail Race channel of cross-section 6.60mx2.80m which discharges the tail water into the river Umngot again. A restricted orifice surge shaft which opens into the atmosphere at the top of 10 m diameter and 79.90 m height will be placed at the junction of HRT and pressure shaft for releasing the pressure due to water hammer.

THE PROJECT COMPONENTS

1. INTAKE

The power intake structure is proposed to be located on the right bank at 45m away from the dam. Good granitic gneiss is available at the foundation level. The invert level of the tunnel at intake is kept at EL. 997.8m which is 2.0m above the NZE after 75 years of sedimentation. The silt load of the river is not very high. Moreover, the crest level of the dam has been fixed at El.994.55m i.e, 1.25m below the NZE, and since the crest level of the intake has been taken at 2m above the NZE and also since the intake location is quite close to the dam, therefore no desilting arrangement has been proposed downstream of the intake.

A Fixed Wheel Gate of size 4.0mx3. 6m is proposed at the intake with Rope Drum Hoist to raise or lower the gate. The gates are electrically operated with provision for manual operation.

The hoisting arrangement at the top of the intake structure can be accessed directly from the approach road.

2. DAM

A Concrete Dam of 362m long and 111m high is proposed to be constructed across the Umngot river for the requirements of generating peak power at the powerhouse which has been proposed to be fitted with an installation of 3 Nos. of Pelton Machines of 70 MW capacity each.

A High Ogee Spillway with breast wall fitted with 6(Six) nos. of radial gates of sizes 8.7m x 16.6m is proposed to be adopted for construction in the middle of the dam with a capacity to discharge the PMF of 9760 cumecs. A ski-jump bucket is proposed to be provided as the dissipating arrangement.

3. HEAD RACE TUNNEL

The Head Race Tunnel section adopted is of Modified horse-shoe with a 3.40m finished diameter which is designed for a maximum discharge of 33.2 Cumecs flowing at a velocity of about 3.53 m/sec. The HRT connects the Power Intake at the upstream end and the Pressure Shaft at the downstream end in a length of 5646m.

4. SURGE SHAFT

A surge shaft is located at the junction of the HRT and the Pressure Shaft. The invert level of the tunnel at the Intake is at El.997.8m and with the slope of the tunnel provided in 1in 425, its invert at the Surge Shaft is at El.988.90m. The height of the surge tank upto Ground Level at El.1059.637m is 68.10m. The internal diameter of the surge tank provided is 12.00m and that of the orifice 1.80m.

5. PRESSURE SHAFT

The shaft has been designed for a maximum discharge of 33.20 cumecs at a velocity of about 6.6 m/sec. The internal diameter provided is 2.50 m for the main shaft and 1.61m for the

trifurcations. The length of the inclined limb of the pressure shaft at EL.984.5 to EL.734 is 326.0m, from El.734m to 484 is 326m and from EL.484 to 231.4 is 329.00m .The length of the horizontal limb of the pressure shaft at EL.734 is 300m, at EL.484 is 250m and at EL.231.4 is 587.9m.

The total length is thus 2118m. An inclination of 50° are provided in all the inclined limb to make self-mucking possible. Near the Power House, the pressure shaft is trifurcated into three branches of 1.61m internal diameter and 36mm thickness to feed 3(three) units of Pelton turbines of 70 MW capacity each.

6. SURFACE POWER HOUSE

The 3x70 MW Pelton turbine driven units will be installed in a surface power house with unit spacing of 22m. A service bay of 30m length has been proposed. The floor level of the machine hall and service bay has been kept at El.244.0m.

Generator transformers are located on down stream side of power house at El 244.0 m. 220 kV GIS equipment is located above the transformer hall at El 254.0 m.

220 kV outdoor pothead yard is located on down stream of transformer GIS hall.

Powerhouse Dimensions

The dimensions of the power house are as follows: -

a) Length of Powerhouse = 107.5 m

b) Width of Power House = 22.0 m

c) Height of Power House = 42.0 m

GIS Hall and Pot Head Yard

The GIS Hall is at an elevation of EL. 254.00 m.

The dimensions of the GIS hall are as follows: -

a) Length of GIS Hall = 43.00 m

b) Width of GIS Hall =15.30 m

c) Height of GIS Hall =10.00 m

The Pot Head Yard is at an elevation of EL. 240.00 m.

The dimensions of the Pot Head Yard are as follows:-

a) Length of Pot Head Yard = 81.750 m

b) Width of Pot head Yard = 18.00 m

7. BUTTERFLY VALVE HOUSE

1(One) No. Butterfly valve of 2500 mm diameter would be provided downstream of the surge shaft. Normal flow through the Butterfly valve would be 30.18 m^3/s. The size of the Butterfly valve house cavern shall be 8.0 m wide, 21.0 m long and about 15.0 m high.

8. TAIL RACE

The main Tail Race {(tunnel dia (3.8m)}Channel has a cross section (LxB) of 6.6mx2.8m while each of the three channels coming from the individual units has a cross-sectional dimension of 4.4m x 2.8m. The slope of the Tail Race Channels is kept at 1: 200. The main channel has a discharge capacity of 33.2 cumecs with 0.60m as freeboard for discharging the water from the powerhouse back into the river Umngot.

9. E & M WORKS

The Project envisages an installed capacity of 210 MW with 3 generating units each of capacity 70 MW, driven by vertical shaft Pelton Turbines operating under a net design head of 762.5 m with a total discharge of 33.2 cumecs in a surface power house. The Project is designed to provide 729.47 MU of energy in a 90% dependable year.

Power generated at 11 kV will be stepped-up to 220 kV by a bank of 3 nos. single phase, 33 MVA, 11/220/√3 kV generator transformers and shall be then taken through 220 kV GIS and 220 kV GIS bus duct to the pothead yard located adjacent to the power house. Power evacuation is proposed through two nos. 220 kV outgoing feeders. 220 kV pothead yard shall also have 1no. incoming bay from Umngot-II & 1 No. future outgoing bay.

The 220 kV GIS is proposed to be located above the generator transformers in the transformer hall on the downstream side of the power house at an elevation of EL.254.00 m. There would be total 8 No. of GIS bays with three bays for the incoming circuits from the

generator transformers, one bay for bus coupler, two bays for the outgoing feeders, one bay for incoming from Umngot-II H.E Project & one no. future outgoing bay.

Road transportation constraints are limited to 40R and maximum size of package limited to 12mx2.5mx5.5m (L X B X H).

ENVIRONMENT

In the project area the following major points have been noted :-

- There is no reserve forest area in the project area and hence no National parks or wild life sanctuaries are getting affected due to the project.
- Biosphere reserves and Bird Sanctuaries are also not available in the project area.
- There are no significant monuments in the area. Also no places of archeological, historical, cultural importance are available in the study area..
- No defense installations are noticed in the area.
- No significant inundation noticed in the area even due to maximum floods, in view of the location of the project in deep gorge portion of the river.
- No Endangered flora and fauna species within the project area and no species require special management.

Most of the submergence area falls in the deep gorge area and therefore, submergence area is restricted longitudinally and there would be no major submergence laterally. Mostly, submergence is restricted to river margins. In such conditions, the impacts likely to accrue on land, water, air and biological environments as a result of project construction and operation are not expected to be significant. Further, construction of the H.E Power plant and a reservoir is bound to provide water for wild animals during the dry summer season also. As the reservoir is very small and as the loss of terrestrial vegetation shall be limited to less than 130 ha or 50 % area of submergence (other 50% is river and barren rocky area), loss of carbon sequestration capacity and production shall be negligible. On the other hand, the renewable hydel power, a clean and green source of energy is going to more than compensate for loss of carbon sequestration capacity. Further the reservoir is going to promote growth of hydrophytes and fish production. Hence, the anticipated environmental impacts on the flora and fauna of the study area are

manageable and easily reversible. It is not going to pose any kind of additional environmental stress to the loss of trees in the reservoir since the same can be easily compensated by compensatory afforestation. As there are no ecologically sensitive areas in the impact zone, the project is not going to pose any threat to sensitive ecosystems.

Based on the assessment of environment impacts on land, water, flora and fauna, a detailed Environmental Management Plan (EMP) including Rehabilitation and Resettlement (R&R) has been formulated for protecting the environment and ecology in the core influence zone. Thus the EMP proposed in the study covers land environment including catchment area treatment, biological conservation, public health management plan, air & noise pollution management plan and R & R Plan in the pre and post project periods.

COST ESTIMATES

The detailed estimates of Umngot HE Project include the costs of Civil Works, Electrical works and other allied works required for commissioning the project. The estimates cover the heads of direct charges and indirect charges. The cost estimates under the head of I-works are based on the preliminary design drawings of the various structures. The detailed analysis of rates for principal items of works, rates of construction materials, construction equipment and basic materials etc. have been included in the detailed cost.

The project estimate has been framed on the basis of "Guidelines for preparation of Project Estimates for River Valley Projects", published by Central Water Commission, New Delhi in March, 1997. The rate of the principal item of works have been derived from the input cost of the basic material, cost of construction plant and the equipment, and the cost of labour engaged on the work. Some rates for minor items and lump sum provisions have been made based on the experience gained on other similar projects, like Myntdu Leshka Stage I HEP or schedule rates of Meghalaya State PWD.

The brief summary of allocation of cost under various sub-heads is given in the Abstract Table 4.2.1 and Table 4.2.2 for civil works and Electro -Mechanical works respectively.

While arriving at the cost under various sub-heads, a provision of 5% has been provided for in the estimate for Contingencies and Work Charged Establishment. The hard cost works out to Rs **183788.00** Lakhs.

Total Project Costs:

		Amount in Rs. Crores
A Civil Works		**149537.00 lakhs**
B. Electro Mechanical work		**34251.00 lakhs**
Total		**183788.00 lakhs**
Say	**Rs.**	**1837.88 Crore**

Table 4.2.1 - ABSTRACT OF COST ESTIMATE

CIVIL WORKS

Sl. No.	Item	Amount (Rs in lakhs)
A	Direct Charges	
I	I-Works	
	A. Preliminary	800.00
	B- Land	2869.00
	C - Works	
	i. River Diversion	341.80
	ii. Coffer Dams	263.76
	iii. Dam	64452.88
	iv. Hydro-Mechanical	3446.96
	Sub Total C – Works	68505.41
	J – Power Plant Civil Works	
	i. Power Intake	599.91
	ii. Head Race Tunnel & Adits	11896.28
	iii. Surge Shaft	1064.67
	iv. Pressure Shaft, Valve House & Adits	19985.22
	v. Power House, GIS Hall & Tailrace	10765.02
	x. Hydro-Mechanical	351.68
	Sub Total J - Works	44662.78
	K - Buildings	6766.92
	M - Plantation	30.00
	O - Miscellaneous	1425.00
	P - Maintenance	1292.00
	Q - Special T & P	362.00
	R – Communication	9311.57
	X - Environment, Ecology & Afforestation	3823.07
	Y - Losses on Stock @0.25%	299.84
	Total of I – Works	140147.59
II	Establishment @ 6% of I - Works, -less B-Land, X - Env	8007.33
III	T&P @ 1% of I-Works	1401.48
IV	Suspense	
V	Receipts and Recoveries (-)	-864.00
	Total of Direct Charges	148692.39
B	Indirect Charges	
	(a) Audit & Accounts @ 0.5% of I – Works	700.74
	(b) Capitalized Value of Abatement of Cost of Land Revenue @5% of the Culturable Land	143.45
	Total of Indirect charges	844.19
	Total of Direct + Indirect Charges	149536.58
	Total of Civil Works	149537.00

Table 4.2.2 - ABSTRACT OF COST ESTIMATE

ELECTRO - MECHANICAL WORKS

UMNGOT H.E PROJECT (3 X 80 MW), MEGHALAYA COST ESTIMATES OF ELECTRO- MECHANICAL WORKS (PRICE LEVEL OCTOBER, 2009)		
Sl. No.	**Particulars**	**Amount in lakhs**
1	Preliminary (Model test only)	150.00
2	Generating Plant and Equipment	
a)	Generator, Turbine and Accessories (Annex-S-1)	15197.94
b)	Auxiliary Electrical equipment for power station (Annex-S-2)	4046.03
c)	Auxiliary Mechanical equipment and service for power station (Annex-S-3)	1162.61
d)	Central Sales Tax @ 2% on 2(a), (b) & ©	408.13
e)	Transportation, Handling and Insurance charges @6% of 2(a),(b) & ©	1224.39
f)	Erection and Commissioning charges @8% of 2(a), (b) & © including spares	1632.53
	Total (Generating Plant and Equipment)	23671.63
3	Substation equipment and auxiliary equipment (Price Level October, 2009)	
a)	Auxiliary electrical equipment for 220KV GIS & Pothead yard (Annex-S-4)	3375.52
b)	Central sales tax @ 2% on 3(a)	67.51
c)	Transportation, Handling and Insurance charges @6% of 3(a)	202.53
d)	Erection and Commissioning charges @8% of 3(a) including spares	270.04
	Total (Substation equipment and auxiliary equipment)	3915.60
4	Contingencies @ 1% of items 2 & 3	275.87
5	Tools and Plants @ 0.5% of items 2 & 3	137.94
6	Sub-Sub-total (1 to 5)	28151.04
7	Establishment (6% on items 2 & 3)	1655.23
8	Sub-Sub-total (6 & 7)	29806.28
9	Audit and Account charges @ 0.5% of item 8	149.03
10	Service tax @ 10.3% on erection and commissioning	195.96
	Grand total	30151.27
	Add escalation in prices from Oct,2009 to May,2013 @ 4% per annum excluding L.S. items	4100.17
	Total	**34251.45**
	Say	**34251.00**

(**Rupees Thirty Four Thousand Two Hundred and Fifty One Lakhs) Only**

BENEFITS

The Umngot H.E. Project contributes an annual energy of 838.73 GWh in a Design Year at an economically attractive levelised tariff. With the Official Development Assistance through JBIC at 0.7% rate of interest, the levelized tariff would be Rs 3.03/Kwh at 8% discount for 90% dependable flows and Rs 2.61/Kwh for 50 % dependable flows and with this incentive, economic viability will be an IRR of 10% with 8% discount for a sale rate of Rs 4.25/Kwh in 90% dependable year and 12% IRR in 50% dependable flow year.

The project may be taken up immediately to meet the power requirements in the state. The Project can be implemented in a period of 72 months.

SOCIO ECONOMIC BENEFITS

The impact on the socio-economic condition of the people directly connected with the project and its surrounding areas is expected to be immensely positive with the implementation of this project which would help uplift their economic, educational and health aspirations. The broad outlines of benefits which would be availed through the creation of various infrastructures, as discussed in the foregoing Chapters, are as under :

Road Communication

The people around the project area living on either side of the Umngot river are known to be very close in terms of social, customary and trade ties. The people from the East Khasi Hills side used to travel as far as Jowai in Jaintia Hills District to sell and purchase their goods and wares.Construction of the project roads would help the people to gain easy access to the places through motorized transport which had not been possible for the Govt. to provide throughout all these years. The roads would connect the East Khasi Hills and the Jaintia Hills from the Dam and Powerhouse areas. These roads would make movement of people, goods and agricultural produces much farther and easier, bringing about better strategies in terms of their practices of farming, etc. by taking advantage of the improved road communication and thereby uplift the overall economic condition of the local people.

Educational Upliftment

The project authorities shall work together with the management of the Primary and Upper Primary Schools that are already established in the surrounding areas in providing with the necessary assistance to uplift the standard of imparting education to the children of the area in the form of Scholarship,Books Grants, Teaching Aids, Vocational training, Infrastructure development, etc.

Health Delivery

A Dispensary/CHC is proposed to be set up in the area to meet the emergent needs of not only the people working in the project but also for the local people. The Centre would be equipped with a full fledged medical staff and necessary equipment with facility of 3-4 beds for overnight stay as befitting such centres. The benefits of this centre in such far flung areas will be felt tremendously by the people of the area.

Employment Opportunities

Direct employment

The execution of the Umngot HEP would generate quite a few employment opportunities in the technical and non-technical cadres for the educated unemployed youths of the area and the state as a whole. During the construction period preference would be given to the local people for the construction and maintenance of roads and buildings including services, tree plantations, management of environment, etc. The works for these alone would amount to about Rs.100 crores whereby doors of opportunities are opened for the local people to generate some amount of wealth for their well being in a very short period of time.

Indirect Employment

In the long term, the creation of the Umngot Reservoir is expected, as in other reservoirs, to make the fishes flourish and a means of livelihood for many families would be generated. Besides, the lake would attract a lot of visitiors where recreational facilities would be encouraged to be set up for creation of more avenues of employment. The maintenance of the roads and buildings and other hydraulic structures in the post construction period and the

management of the forests created under compensatory afforestation, if made available in the area, can also provide employment.

Local Area Development

A Local Area Development Committee consisting of representatives of the Govt., the MeECL and of the local durbars would be set up for sustainable development of the area, which will decide the schemes to be taken up in the area in a transparent manner. The funds for this endeavour would be made available @ 1% from the deliverable energy during such period of operation of the Umngot H.E.Project.