-TERMS OF REFERENCE-

CONSULTANCY SERVICES FOR FEASIBILITY STUDY FOR BAWGATA LOWER HYDROPOWER PROJECT IN MYANMAR

1. BACKGROUND

The Client is desirous to undertake a feasibility study to further develop the project identified and evaluated in the Bawgata HPP Pre-feasibility study (PFS). The proposed Bawgata Lower Hydropower (BLHP) is located approximately 14 kilometres east-southeast from Kyaukkyi town, Bago Division in Myanmar (Map reference- 94 B/ 15 46 4217).

Previously, a hydropower project in Bawgata River project has been identified and investigated by the Union Government. In February 2016, Thoolei Company Ltd., a company owned by Karen National Union (KNU), signed a MoU with the Ministry of Electric Power, which gives Thoolei Company the right to conduct a feasibility study for Bawgata Hydropower Project.

The project has been identified on the desk level already in the 1950's, but only recently studied in more detail. The latest study is conducted by Norconsult AS for Thoolei in 2016-17. The findings and conclusions in this Pre-Feasibility Study (PFS) shall form the basis for the Feasibility Study to be undertaken. The PFS recommends proceeding with a 3-step cascade development in Bawgata River.

The Feasibility Study to be undertaken now is for only the Bawgata Lower Hydropower Development which was identified in the PFS as the most promising single project in the PFS.

The location and layout of the Bawgata Lower Hydropower Project are shown in the Drawings:

Drawing No.	Title
A200	Location Map
A201	Existing and Proposed Road Network Overview
A202	Power Transmission System Overview
A210	General Layout Plan 3 – Step Cascade Development

Note: Drawing A210 shows all three steps of the cascade development, only the lower stage is to be studied under these Terms of Reference.

2. OBJECTIVES

The Feasibility Study entails a comprehensive investigation program and an in-depth analysis with the aim to bring the project to a bankable standard with the aim to carry the project forward to detailed design and construction phase.

The Feasibility Study should demonstrate whether the Bawgata Lower Hydropower Project is technically, economically, financially, environmentally and socially feasible and justifiable under the anticipated conditions, and in particular compatible with the on-going peace-building process between the KNU and the GoM. The Feasibility Study should also define the specific engineering and implementation plan.

Other objectives of the Feasibility Study are:

- Provide detailed records and analyses of the topographical, hydrological and geological/geotechnical conditions at the site.

- Provide a technical design of the project based on prevailing site conditions
- Provide detailed cost estimates
- Provide estimates of production, revenue and benefits
- Coordinate the technical study with the simultaneously conducted Environmental and Social Impacts Assessment so that the project is being planned with due consideration to the environmental and social aspects.
- Demonstrate the robustness of the project through risk and sensitivity analyses
- Provide a plan for design and implementation of the project

3. SCOPE OF WORK

3.1 General

The Pre-feasibility Study (PFS) conducted by Norconsult in 2016-17 has recommended developing the hydropower potential in Bawgata River in a 3-step cascade development, and has recommended to develop the Bawgata Lower Project first as this project appears the most promising in the PFS.

It is envisaged that an Environmental and Social Impact Assessment Study (ESIA) shall be carried out by independent professionals with relevant background in parallel with the technical study. The work of the technical/ economic feasibility study- and the ESIA studies shall be done in close interaction so that:

a) due consideration can be taken of environmental and social issues when selecting technical solutions, and
b) technical solutions are communicated early enough to the ESIA team so that the required investigations can be arranged.

The feasibility Study is envisaged to be divided into three phases as follows:

1. Inception Phase
2. Investigation Phase
3. Design and Analysis Phase

3.2 Inception Phase

In the inception Phase, the Consultant should at least undertake the following tasks:

- Conduct initial meetings with the Client in Myanmar to familiarize himself with this project's specific challenges and the Client's requirements.

- Initially review the preliminary conclusions and recommendations drawn in the pre-feasibility report "Bawgata Hydropower Project, Pre-Feasibility Study, May 2017" prepared by Norconsult, both in terms of the cascade option recommended and in terms of the most favourable single project and its configuration.

- In light of the PFS review and the initial meetings with the Client, review these Terms of Reference and the Consultant's Proposal, and propose any alterations of the study program if deemed necessary for the project's success, taking account of seasonal access constraints.

- Prepare a detailed field investigation program including:

    - hydrological surveys including reviewing and upgrading the existing gauging station in Bawgata to incorporate an automatic water level recorder
    - topographical mapping and detailed survey
    - geological mapping

- erosion and sediment transport measurements
- seismic refraction measurements
- sounding and core drillings

- Prepare an updated detailed schedule for the remaining Feasibility Study works

The Inception phase should be summarized and concluded in an Inception Report that should be accepted by the Client before the Consultant can proceed with the Feasibility Study.

3.3 Investigation Phase

3.3.1 Data Collection

At the beginning of the studies, the Consultant shall collect available information such as, maps, aerial photos, hydrological data, geological/seismic maps and data, transmission grid plans including planned expansions, etc.

The Consultant shall collect unit prices for civil work activities for projects carried out in Myanmar and the region and prepare a costs database for the capital expenditure (CAPEX) estimate and financial model.

The Consultant shall analyse and assess all data of any other nature that can contain valuable information for the design and evaluation of the Project. If more information is needed, the Consultant shall advise the Client in advance to obtain their approval for the necessary acquisition.

3.3.2 Topographic Survey and Mapping

The work will consist of at least of the following survey and mapping works which will be carried out under a separate contract by survey and mapping specialists:

a. Prepare contour map in 1:5,000 scale with 2 m contour interval of the whole project area, including upstream villages. All land and terrain features must be shown in the contour map.
b. Prepare separate orthophoto contour map at 1:5,000 scale with 2 m contour interval.
c. Prepare map in 1:1,000 scale with 1 m contour interval of sites for all main projects structures like dam, powerhouse area, adits, tunnel/penstock alignment.
d. Detailed profiles near dam site and powerhouse site as basis for preparing rating curves.
e. Prepare access route map in scale 1:5000 with 5 m contour interval and cross-sections of locations of bridges/ culverts lying in the road alignment. The profile should be plotted in a scale of V 1:500 and H 1:5000.
f. Transmission Line walk-over survey of around 30 km (to be conducted together with the Feasibility Study Consultant)
g. Establish permanent bench marks tied with the national grid at the dam site, along tunnel and penstock alignment, near adits and at the power station site. Prepare control survey map showing benchmarks.

The topographical map will be prepared by aerial photogrammetry or LIDAR techniques, but elevations and coordinates need to be verified by field survey establishing ground control. The topographical data should be prepared and presented to the Client in a 3D digital terrain model in a recognized format.

The Feasibility Study Consultant shall liaise with the Client in order to ensure the mapping defined in the Survey and Mapping Contract meets the Consultants needs for the project in both areal coverage and delivery date.

3.3.3 Hydrology and Sedimentation

The scope of work will include the collection of all relevant meteorological and hydrological data, preparation of the storage elevation curve, defining the mean, low and high flows, determination of long term monthly flow sequence and duration curves, collection of field sediment data and sedimentation studies.

A permanent gauging station with manually read staff gauge was installed on the Bawgata river a short distance from the proposed lower dam site in December 2016. There is also a gauging station with long-term discharge data in a neighbouring river to Bawgata (Shwegyin), but the analysis in the PFS revealed that there seem to be errors in these data.

The following tasks shall be carried out to cover the above mentioned scope of work.

- Review the data from the gauging station in the Bawgata River, and improve the quality of these data with a programme of supplementary discharge measurements to include measurement at high flows.
- Install an automatic water level recorder at the Bawgata gauging station incorporating a data logger capable of recording water level at 15 minute intervals together with facilities for data retrieval. The water level recorder shall be of the "bubbler" or pressure transducer type and shall be installed in a secure weatherproof housing. The recorder shall be capable of operating unattended for up to 3 months. The recorder shall be provided with all necessary equipment and software to allow downloading of data by the Client (or his appointee) together with battery charger (if required) and spares as necessary for 3 years of operation.
- Review in detail the gauging station in Shwegyin River and the discharge data from this station. Make recommendations as appropriate for improvement of accuracy and reliability of data capture at this gauging station.
- Meteorological, hydrological and sediment studies to upgrade the hydrological database, consistency analysis, flow estimation etc.
- Flood hydrology and sediment studies to derive the required information for design and optimization of the project and the major components.
- Collection of sediment samples in suspension during the rainy season and its analysis in the laboratory to evaluate the volumes and characteristics of material transportation including particle size distribution petrographic analysis to determine hardness of particles, PH acidity and quality of water.

3.3.4 Geology, Geotechnics and Seismicity

The Consultant should prepare and carry out a detailed field program for the geological and geotechnical investigation of the project area including supervising the work of contractors engaged by the Client for specific aspects of the investigations (as indicated below). The geological and geotechnical investigations should at least include the following:

- Regional geology, of the site covering approximately a 500 km² area, presented in maps and sections 1:50,000 scale; Investigate the discrepancies between the later and the older geological maps that was commented in the PFS.
- Detailed geological mapping of the project area including plans and sections through the major structures such as reservoir area, dam site, intake, tunnel, adit/surge tunnel, penstock, powerhouse and tailrace in appropriate scale
- Discontinuity survey including a stereographical air photo study to identify and analyse main rock discontinuities that can affect the proposed project, particularly along the tunnel alignment.

- Test pitting for construction material testing at relevant locations (estimated 50 trial pits to be excavated by others under separate contract)
- Geophysical (seismic refraction) survey of ground in dam site, intake, adit/ surge tunnel, penstock and powerhouse sites (estimated 2000 m)
- Conclude whether the weakness zones within the site area are active
- Determine soil overburden at adits, dam foundations and in areas with low rock cover over the tunnels
- Logged core drillings at dam site and other locations as per the plan proposed by the Consultant. (Estimated 800 m of core drilling)
- Define ground water levels and rock mass permeability by permeability test at various intervals in rock and in overburden/gravel deposits in each drill hole. (observations and tests to be carried out by others)
- Conduct Rock Mass Classification of rock and define weakness zones along tunnel alignment.
- Define any other hazards for the tunnelling works.
- Identification of construction material
- Survey and selection of quarry sites and borrow area for construction materials.
- Conduct laboratory tests of rock and samples from joints/weakness zones fill material to verify relevant mechanical and chemical characteristics (e.g. compressive strength, abrasion, crushing value, swelling, alkali reaction) (by specialist laboratories)
- Laboratory soil testing to verify the soils characteristics and suitability as foundation or construction material. (by specialist laboratories)
- Seismic Risk Assessment Study to determine the seismic exposure of the project and to recommend Peak Ground Acceleration (PGA) and other seismic design parameters for major components of the project.

3.4 Design and Analysis Phase

In the Design and Analysis phase, the Project's features should be defined and analysed informed by the findings from the initial PFS review and the site investigations.

The design of all components should meet or exceed the requirements of Myanmar Hydropower Standards if these have come into effect by the time the study is conducted and be in accordance with good international practice.

3.4.1 Optimization Studies

The Consultant shall propose a preferred project configuration as basis for the optimization Studies.

Based on this configuration and: (i) results of field investigations; (ii) production simulation studies; (iii) cost estimates; and (iv) agreed economic and financial criteria, the Consultant shall perform optimization studies of:

- Reservoir volume with Highest Regulated Water Level and Lowest Regulated Water Level.
- Spillway: Weir or gated, arrangement.
- Water conveyance system: Dimensions, intake, material or lining of canals, headrace tunnel and penstock shaft.
- Sand excluder arrangement
- Installed capacity, number of units and turbine arrangement
- Power house layout
- Other components as per the configuration

3.4.2 Project Design

The scope of work will consist of preparing feasibility study stage design for the optimum plant.

The Consultant shall present a summary of main parameters used for the feasibility design and optimization including monthly river discharge, unit prices for civil work, costs for electro-mechanical and hydraulic steel works and transmission line.

The work will include but may not be limited to preparing feasibility level design for the items listed below.

- Determining location, layout, principle design, main dimensions and preparation of drawings for the following Civil Structures:
    - Reservoir
    - Dam including the spillway, weir and appurtenances
    - Intake structure
    - Desander
    - Headrace tunnel including the intake
    - Surge tunnel including a preliminary transient analysis to determine the size and effect on operation
    - Penstock alignment and foundations
    - Powerhouse
    - Tailrace canal and outlet facilities
    - Switchyard at power house
    - Transmission facilities
    - Temporary structures for construction period like cofferdams and diversion tunnels or canals

- Prepare feasibility study stage design by determining installation type, size and arrangement of the following Hydraulic Steelworks:
    - Flushing and possibly spillway gates in main dam
    - Main intake trash racks
    - Main intake gate
    - Penstock and appurtenances
    - Main inlet valves
    - Draft tube gates

- Prepare feasibility study stage design by determining systems and types and arrangement of equipment of the following Electro-Mechanical installations:
    - Turbines
    - A.C. generators
    - Excitation System
    - Main transformers
    - Protection and Control systems
    - Switchgear and equipment
    - Power cables, cable racks, grounding etc.
    - D.C. supply
    - Lighting and power supply in Powerhouse
    - Station Service Equipment, Emergency Power Sources
    - Cooling and Lubricating System
    - Dewatering System
    - Communications and Control Systems
    - Transmission and Sub-Stations
    - Firefighting systems

- Prepare feasibility study stage design of a transmission line system from BLHP to the national grid. Different options for transmission system from the Bawgata Cascade development (possibly 3 projects) should be assessed. The Consultant should specifically consider whether the BLHP's transmission system should be prepared for the possible future projects upstream, or if it should be planned for BLHP as a stand-alone project.
- Perform a preliminary power system study of the national power grid to simulate the power flow from BLHP and to verify that connection of the plant where planned is compatible with the stability requirements of the grid.
- Prepare feasibility study stage design of a local power distribution system to the villages near to BLHP. Consider the option of having the power supply to this grid from a separate unit near the dam (connected to the environmental flow). Exactly which villages to be electrified will be determined by the Client during the course of the study.
- Prepare feasibility study stage design of the access roads from the road head proposed in the PFS to the project sites (dam, powerhouse, construction adit), including necessary bridges and retaining structures.
- Propose a site plan showing construction facilities like construction camp, rig area, dump area, quarry etc.
- Prepare an overall site plan for construction pits and deposits.
- Prepare an overall site plan for land acquisition, indicating permanent land-use (for permanent structures) and temporary land-use (during construction).

3.4.3 Cost Estimate

The scope of work will consist of:

- Preparing a simplified rate analysis for the unit rates to be applied.
- A complete feasibility level cost estimate of the project prepared on the basis of quantities taken off from the drawings. The estimate should include civil works, hydraulic steelworks, mechanical and electrical equipment, transmission line, roads and camps, environmental and social mitigation costs, construction supervision, engineering services etc.

Physical contingencies shall be included as appropriate. Engineering, supervision during construction and owners administration shall be included as a percentage of the base costs.

The cost estimate for mechanical and electrical equipment should be based on using established current international prices.

The cost estimate should be split in local currency and foreign currency components.

A cash disbursement schedule corresponding to the construction schedule and total cost estimate should be prepared.

3.4.4 Energy Computation

The energy to be produced from the project should be calculated based on the best available hydrological data and should include the following:

- Mean annual production, and a monthly breakdown of these
- Calculation of firm energy. Firm energy to be defined together with the Client.
- Indication of the expected variation span by calculating energy production in the driest year and wettest year recorded

- Consider power outages due to operation and maintenance and grid disturbances

3.4.5 Construction Planning and Schedule

The Consultant shall prepare an implementation schedule for the various alternatives, including the further planning and design phases and construction phases.

The relevant implementation scenarios for financing of the projects shall be discussed with the Client and used as a basis for the implementation schedule.

Various options for the construction approach and methods should be analysed. Similarly, options for contracting modalities (e.g. EPC or BoQ) and breakdown in contracting packages should be analysed.

In addition to the schedule, an estimate of the needed labour force throughout the construction period should be prepared.

3.4.6 *Economic and Financial Analysis*

The Consultant shall conduct a market study to analyse different options for selling the electricity from the project and to determine realistic rates for the power to be sold. The market modality and price estimates proposed in the feasibility study should be duly discussed with the Client before the analysis is presented.

The Consultant shall calculate the average annual revenue from power sales based on the energy calculation and the price estimates. The revenue estimates should be presented with monthly breakdown and indication of revenue generated in driest year and wettest year.

Other parameters to be applied by economic and financial analyses of the project and adopted for project evaluation should be duly discussed with the Client and clearly mentioned in the project documentation. These includes among others:

- Base year for the financial and economic analysis
- Currency exchange rates
- Relevant taxes, royalties etc.
- Price escalations
- Discount rate
- Debt-equity ratio
- Interest of loans
- Operation, management and replacement costs
- Power Market
- Price Assumptions
- Tax and Royalty etc.

The economic and financial analyses shall include all components of the projects, including assessment of environmental and social impacts and potential mitigation strategies and compensation costs, for potentially affected and recently displaced communities in the project area.

The Consultant shall perform a financial analysis of the different project options and express the findings as Financial internal Rate of Return (FIRR), net present value (NPV), Benefit/cost ratio and levelized unit cost (per kWh).

The Consultant shall perform an economic analysis of the different project options and express the findings as Economic Rate of Return (EIRR), Economic NPV and Economic levelized unit cost (per kWh). The economic analysis will show the viability of the project for the whole economy, and possible project benefits like multipurpose use, flood protection and value of reduced carbon emissions should be monetized and included if relevant.

With basis in the financial analysis, the Consultant should conduct a Sensitivity analysis. As a minimum, the following cases should be analysed:

- Increase and decrease of capital cost, stepwise to +/-20%
- Increase and decrease of annual production, stepwise to +/- 20 % and the driest and wettest year
- Varied discount rates, stepwise to +/- 3% from base rate
- Delay in commissioning, stepwise to 3 yrs.
- Cumulative effect of cost and time over-run.

3.4.6 Risk analysis

The project risk analysis from the Pre-feasibility study should be updated with the updated information from the technical study, the financial analysis, and the environmental, social impact assessments. The risks should be quantified and categorized as per a probability/severity matrix with criteria developed for the project. For each identified risk, the Consultant should propose risk mitigation measures and a plan for handling residual risk.

The Consultant should conduct a consultative risk workshop with participation by the Client and possible other stakeholders.

4 TIME SCHEDULE AND REPORTING

The Consultant shall prepare an ***Inception Report*** for the study after 2 months of the commencement of work, in which the Consultant shall review the existing pre-feasibility study, the actual conditions in the project area with those anticipated in the Terms of Reference and the Consultant's Proposal, and propose any alterations of the study program if deemed necessary for the project's success. Further, the Inception Report shall contain a detailed study program for the remaining Feasibility Study.

The Consultant shall present a ***Draft Feasibility Study Report*** to the Client within 12 months of commencement of the study. However, the topographic surveys and site investigations will have to be conducted during the dry season, and the schedule may have to be adjusted accordingly to facilitate this. The Draft Feasibility Study Report shall be in compliance with accepted international standards for projects of this nature and shall comprise the full documentation of the technical characteristics of the project at a Feasibility level of detail, together with the results of the above-mentioned economic and financial assessments and the results of the ESIA. Attached with this ToR is a tentative format for the Feasibility Study. The draft Feasibility Study Report will be disclosed for public hearing and separate workshops will be arranged to get input from potentially affected communities, relevant stakeholders and civil society.

The Consultant shall work in close collaboration with the Client throughout the project, so that the results as presented in the draft report are well known and worked-through by the Client when the draft report is issued. The Consultant shall prepare a ***Final Feasibility Study Report*** after 15 months of the commencement of work, including the results of any comments received on the draft report from the hearing process and the public hearing.

Every quarter after commencement of work, and monthly upon request, the Consultant shall prepare

brief ***Progress Reports*** in order to keep the Client and other relevant parties informed about the progress of the project. The necessary content of these Progress Reports shall be agreed with the Client at the outset of the study, but is envisaged to include project progress and staff inputs during the period, any issues which require attention and measures proposed to ensure the success of the studies.

All reports including appendices, drawings etc., shall be submitted both in paper copy and in electronic copy (editable version – Excel or Word file. Drawings in AutoCad). All reports/documents shall be prepared in English language and delivered to the Client. The Inception Report, Draft and Final Feasibility Study Report will have executive summaries not exceeding 10 A4 pages in length in English, Myanmar and Karen language.

The Inception Report, Draft and Final Feasibility Study Reports shall be submitted in 10 paper copies each. The Draft and Final Feasibility Study Reports shall each be submitted as one Main Volume (A4 format) and with an appropriate number of volumes for appendices, drawings, photographs etc., in A4 or A3 format as appropriate. Any necessary changes to the above schedule shall be raised and agreed in consultation between the Consultant and the Client.

5 RESPONSIBILITIES OF THE CLIENT

The Client will provide area permission for fieldwork upon 6 weeks written notice. The written notice must include the objective of the fieldwork, time schedule, list of involved personnel and their respective title and copy of passports.

The Client will ensure Consultant's reports are circulated to relevant stakeholders (including Local Communities etc.) for input and feedback within the deadlines as described in this report. The Client will collect feedback from stakeholders and if necessary translate input to English and send the information to the Consultant for review

The Client will brief the Consultant of potential safety aspects and measures prior to the field trip to the project site and for public consultations.

The Client are responsible for identifying counterpart staff to work together with the Consultant and cover costs for their participation.

The Client may facilitate logistic support (food, transport and accommodation) at site if the Consultant requests this, but the Consultant at cost must cover the cost of this support.

The Client will appoint a contact person for the assignment who will be the main focal point for the Consultant. The Client will respond within three working days to all requests from the Consultant and indicate when the requested information will be available.

6 PARTICULAR CONDITIONS FOR THIS ASSIGNMENT

The Consultant shall include a local partner to assist them in the consultancy study in order to ensure national adaption, effective logistics and reduced costs for the assignment. The Consultant shall quality assure and be responsible for the deliveries produced by the local consultant. The Client shall approve local consultants before they are included in the consultancy team.

The Project is located in an area which for years has been a conflict area populated with different indigenous ethnic communities. It is important that the Consultant is updated on the conflict situation in the area and seeks input from necessary external experts with detailed insight in the conflict. Respecting human rights and supporting and encouraging the peace-building process between the KNU and the GoM throughout all phases of the project will be of paramount importance.

It is not known that landmines have been placed in the project area. However, both sides of the conflict have presence near to the area, and there have been reports of landmines used in the conflict. The Consultant should be extremely cautious with respect to landmines. Before starting any fieldwork, he should check the issue with different well-informed sources. The Consultant is responsible for informing his field staff about the landmine risk and instruct them how to behave if any signs of landmines are identified. If any signs of landmines are identified, the fieldwork should be stopped and the Client informed immediately.

APPENDIX 1:

Tentative Format for the Feasibility Study Report

VOLUME I - MAIN TECHNICAL REPORT

VOLUME I, PART – I: EXECUTIVE SUMMARY

1. Table with Salient Features of the Project
2. Project Background
3. Project Area
4. Field Investigations
5. Basic Studies
6. Project Layout
7. Optimization
8. Physical Description of Project
9. Environmental Impacts and Mitigation
10. Construction Planning, Schedule and Cost
11. Project Outputs and Benefits
12. Project Evaluation
13. Conclusion and Recommendations.

ATTACHMENTS TO PART 1

i. Location Map

ii. Project Area Map

iii. Drawing Showing General Arrangement of Project

VOLUME I, PART – II: MAIN REPORT

1. INTRODUCTION

1.1 Study Background

1.2 Previous Studies

1.3 Objective and Scope of Work

2. DESCRIPTION OF PROJECT AREA

2.1 Location

2.2 Physical Features

2.3 Accessibility

3. FIELD INVESTIGATION AND DATA COLLECTION

3.1 Topographical Survey and Mapping

- 3.1.1 Available Maps
- 3.1.2 Surveying and Mapping

3.2 Hydrological Investigations

- 3.2.1 Available Meteorological and Hydrological Data

8.2 Conceptual Layout and Dimensioning

8.3 Estimate of Energy Production

8.4 Cost Estimates

8.5 Economic Analysis

8.6 Recommendation of Optimized Parameters

9. PROJECT DESCRIPTION AND DESIGN

9.1 Design Basis

9.2 General Arrangement of Project Components

9.3 Project Civil Structures

9.3.1 Headworks

9.3.2 Water Conveyance

9.3.3 Powerhouse Complex

9.4 Hydraulic Steelworks Structures

9.5 Mechanical Equipment

9.6 Electrical Equipment

9.7 Transmission Line

9.8 Access Roads, construction camp, Rig areas and dump areas.

9.10 Operators Camp

10. POWER MARKET

10.1 Market

10.2 Price Assumptions

10.3 Tax and Royalty etc.

11. ENERGY, REVENUE AND BENEFITS

11.1 Basis for Computation

11.2 Energy Computations

11.3 Revenue Calculation

11.4 Estimate of Other Benefits

12. CONSTRUCTION PLANNING AND SCHEDULE

12.1 Preparatory Works

12.2 Construction Method and Approach

12.3 Access and Transportation

12.4 Diversion Works

12.5 Camping Facilities

12.6 Construction Power

12.7 Implementation Schedule

13. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT [1]

13.1 Conducted Investigations

13.2 Baseline Conditions

13.2.1 Environmental

13.2.2 Social

13.3 Impacts

13.3.1 Environmental

13.3.2 Social

13.4 Impact Mitigation and Management

13.4.1 Environmental

13.4.2 Social

1)*NOTE: This chapter is a summary of the IEE or EIA/ SIA study report prepared separately as per the requirements of MOECAF*

14. SUSTAINABILITY ASSESSMENT (if conducted) [2]

14.1 Basis and Assumptions

14.2 Sustainability Analysis

2)*NOTE: This chapter is a summary of the Sustainability Assessment Report prepared separately as per the requirements of IHA*

15 COST ESTIMATE

15.3.1 Criteria and Assumptions

15.3.2 Capital Cost Items

15.3.3 Civil Works

15.3.4 Electrical and Mechanical Equipment

15.3.5 Transformers, Switchyard and Transmission Lines

15.3.6 Land Acquisition, Access Road, Camp and Construction Power Facilities

15.3.7 Environment Impact Mitigation and Management Cost

15.3 Additional Project Costs

15.3.8 Contingencies

15.3.9 Development Costs

15.3.10 Engineering, Management and Administration Cost

15.4. Disbursement Schedule

16. PROJECT EVALUATION

16.1 Basis and Assumptions

16.2 Financial Analysis

16.3 Economic Analysis

16.4 Sensitivity Analysis

16.5 Risk Analysis

17. CONCLUSION AND RECOMMENDATIONS

17.1 Conclusions

17.2 Recommendations

VOLUME II: DRAWINGS

The drawings volume should contain all relevant maps and drawings of project components. Typically there would be 40-60 drawings in various scales

VOLUME III: APPENDIX:

The Appendix should contain supporting materials like memos and reports, e.g. of the following:

- Topographic Survey and Mapping
- Hydrology and Sedimentation Studies
- Geological and Geo-technical Studies
- Seismic Hazard Assessment Report
- Optimization Studies
- Hydraulic Design
- Access Road and Transmission Line Studies
- Cost Estimate
- Economical and Financial Analysis