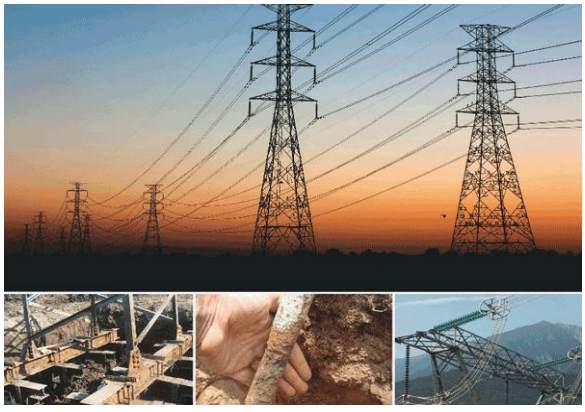
Implementation Monitoring and Evaluation Division
Ministry of Planning
Sher-e-Bangla Nagar, Dhaka-1207

Monitoring & Evaluation (M&E) Guideline for

Industry, Power & Energy



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ABBREVIATION AND ACRONYMS

^{0}C	Degree Celsius
AC	Alternating Current
ADP	Annual Development Program
APP	Annual Procurement Plan
APSCL	Ashuganj Power Station Co. Ltd
BAB	Bangladesh Accreditation Board
BAPEX	Bangladesh Petroleum Exploration and Production Company Limited
BCIC	Bangladesh Chemical Industries Corporation
BCMCL	Barapukuria Coal Mine Company Limited
BCR	Benefit-cost ratio
BIM	Bangladesh Institute of Management
BITAC	Bangladesh Industrial and Technical Assistance Center
BMD	Bangladesh Mineral Development
BNBC	Bangladesh National Building Code
BPC	Bangladesh Petroleum Corporation
BPDB	Bangladesh Power Development Board
BPI	Bangladesh Petroleum Institute
BSCIC	Bangladesh Small and Cottage Industries Corporation
BSEC	Bangladesh Steel and EngineeringCorporation
BSFIC	Bangladesh Sugar and Food Industries Corporation
BSTI	Bangladesh Standards and Testing Institution
CEA	Cost-effectiveness analysis
CEII	Critical Energy Infrastructure Information
CETP	Central Effluent Treatment Plant
CGS	City Gate Station
CMMS	Computerized Maintenance Management System
CO_2	Carbon Dioxide
CONTASA	Convertible Taka Special Account
CPM	Cost Per Thousand
CPTU	Central Procurement Technical Unit
CSOS	Community Service Organization Selection
CQBS	Quality- and Cost-Based Selection
DC	Direct Current
DCDB	DC Distribution Board
DCS	Design Contest Selection
DESCO	Dhaka Electric Supply Company
DG	Director General
DIFE	Department of inspection for Factories and Establishments
DLN	dry-low NO_X
DMP	Demineralization Plant
DN	Diameter Nose
DOSA	Doller Special Account
DP	Development Partner
DPD	Deputy Project Director
DPDC	Dhaka Power Distribution Company
DPDT	Department of Patents, Designs & Trademarks
DPM	Direct Procurement Method
DPP	Development Project Proforma/Proposal
ECNEC	Executive Committee of the National Economic Council

ECR	Environmental Conservation Rules
EIA	Environmental Impact Assessment
EGCB	Electricity Generation Company of Bangladesh Ltd.
EOI	Expression of Interest
EPZ	Export Processing Zone
ETP	Effluent Treatment Plant
EZ	Economic Zone
FAT	Factory Acceptance Testing
FBS	Fixed Budget Selection
FGD	Focus Group Discussion
FY	Fiscal Year
GDP	Gross domestic product
GI	Galvanized Iron
GOB	Government of Bangladesh
GPS	Global Positioning System
GSB	Geological Survey of Bangladesh
GT	Gas Turbine
GTCL	Gas Transmission Company Limited
HCl	Hydrochloric Acid
HDD	Horizontal Directional Drilling
HP	High Pressure
HRD	Human Resource Development
HRM	Human Resource Management
HRSG	Heat recovery steam generator
HV	High Voltage
ICS	Individual Consultant Selection
ICT	Information and Communications Technology
ICT	International CompetitiveTender
ID	Identification
IEEE	Institute of Electrical and Electronics Engineers
IEC	The International Electrotechnical Commission
IEC	Important Environmental Component
IFT	Invitation of Tender
IMED	Implementation Monitoring and Evaluation Division
IRR	Internal Rate of Return
kg	Kilogram
KII	Key Informant Interview
KPI	Key Performance Indicators
KV	Kilovolt
LA	Lightning Arresters
LCS	Least Cost Selection
LD	Liquidated Damage
LOI	Letter of Intent
LP	Low Pressure
LTM	Open Tender Method
M&E	Monitoring and Evaluation
MDAC	Ministerial level Development Action Committee
MDG	Millennium Development Goal
MfDR	Managing for Development Results
MIG	Metal Inert Gas
MoPEMR	Ministry of Power Energy and Mineral Resources

MS	Mild Steel
MTEF	Medium-term Expenditure Framework
MW	Megawatt
NaOH	Sodium hydroxide
NCT	National Competitive Tender
NEC	National Economic Council
NGO	Non-Government Organization
NOA	Notification of Award
NPO	National Productivity Organization
NPV	Net Present Value
NWPGCL	North-West Power Generation Company Limited
OSTETM	One Stage Two Envelope Tendering Method
OTM	Open Tender Method
PAT	Prototype Assembly Test
PCR	Project completion report
PD	Project Director
PDB	Power Development Board
PE	Procuring Entity
PE	Project Engineer
PEC	Project Evaluation Committee
PGCB	Power Grid Company of Bangladesh Ltd.
PIB	Project Implementation Bureau
PIC	Project Implementation Committee
PIG	Pipeline Intelligent Gauge
PLI	Post Landing Inspection
PMIS	Personnel Management Information System
PMO	Prime Minister Office
PMU	Project Management Unit
PO	Purchase Order
POC	Project Opening Committee
PP	Procurement Plan
PPA	Public Procurement Act
PPR	Public Procurement Rules
PPR	Public Procurement Rules
PRS	Poverty Reduction Strategy
PSMP	Power Sector Mega Plan
PSN	Public Services Network
PSTN	Public switched telephone network
PV	Present Value
QBS	Qualifications-Based Selection
QCBS	Quality- and Cost-Based Selection
QRM	Quality and Risk Management
RADP	Revised Annual Development Program
RAP	Resettlement Action Plan
REB	Rural Electrification Board
RFQM	Request for Quotation Method
RMS	Regulating and Metering Station
RO	Reverse Osmosis
RoW	Right of Way
RPA	Reimbursable Project Aid
SAFE	Special Account in Foreign Exchange

SAW	Submerged-arc welding
SCADA	Supervisory control and data acquisition
SDG	Strategic Development Goal
SEE	Static Excitation Equipment
SFC	Static Frequency Converter
SMECI	Strengthening Monitoring and Evaluation Capabilities of IMED
SPT	Standard Penetration Test
SSS	Single Source Selection
ST	Stream Turbine
STP	Sewage Treatment Plant
SWOT	Strengths Weaknesses Opportunities Threats
TBS	Town Board Station
TEC	Technical Evaluation Committee
TFR	Tower footing resistance
TGTDCL	Titas Gas Transmission & Distribution Company Limited
TOC	Taken Over Certificate
TOC	Tender Opening Committee
TOR	Terms of Reference
TPP	Technical Project Proforma/Proposal
TSTM	Two-Stage Tendering Method
VAT	Value Added Tax
WBS	Work Breakdown Structure
WTP	Water Treatment Plant
WZPDCO	West Zone Power Distribution Company

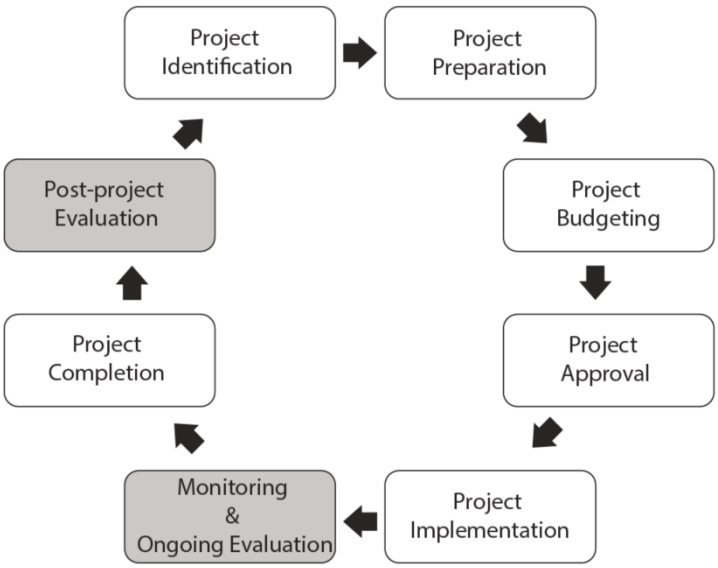
1. INTRODUCTION

1.1 Background

Generally, monitoring and evaluation are looked as synonyms. In reality, both are interdependent, and "Monitoring and Evaluation" together is treated as an important management tools that are necessary to track the progress and facilitate decision making for present and future interventions. In function and usages, there are distinct differences between them. The primary difference between monitoring and evaluation is that while monitoring is a continuous activity, performed at the functional level of project/programme management. Evaluation is a periodic activity, performed at the outcome and impact level of project activities. The detail on Monitoring and Evaluation is being discussed in the following sections.

A project is a set of interrelated activities that are designed to achieve specific objectives, with the available resources and within a specific time frame. The project cycle is a tool for understanding the tasks and functions that must be performed in the lifespan of a project. Commonly/ generally, a project cycle contains stages of design, formulation,implementation monitoring and evaluation.

As background to the work an overview of the existing system of project planning andapproval, monitoring and evaluation in Bangladesh is given in the diagram below that ingeneral illustrates the main steps of the project cycle. Under this study 5th and 7thstageof the project cycle, namely 'Project Monitoring/Ongoing Evaluation and Post-ProjectEvaluation' is covered.



Source: IMEDmonitoring and Evaluation (M&E) manual on construction works (Roads, Bridges and Culverts)

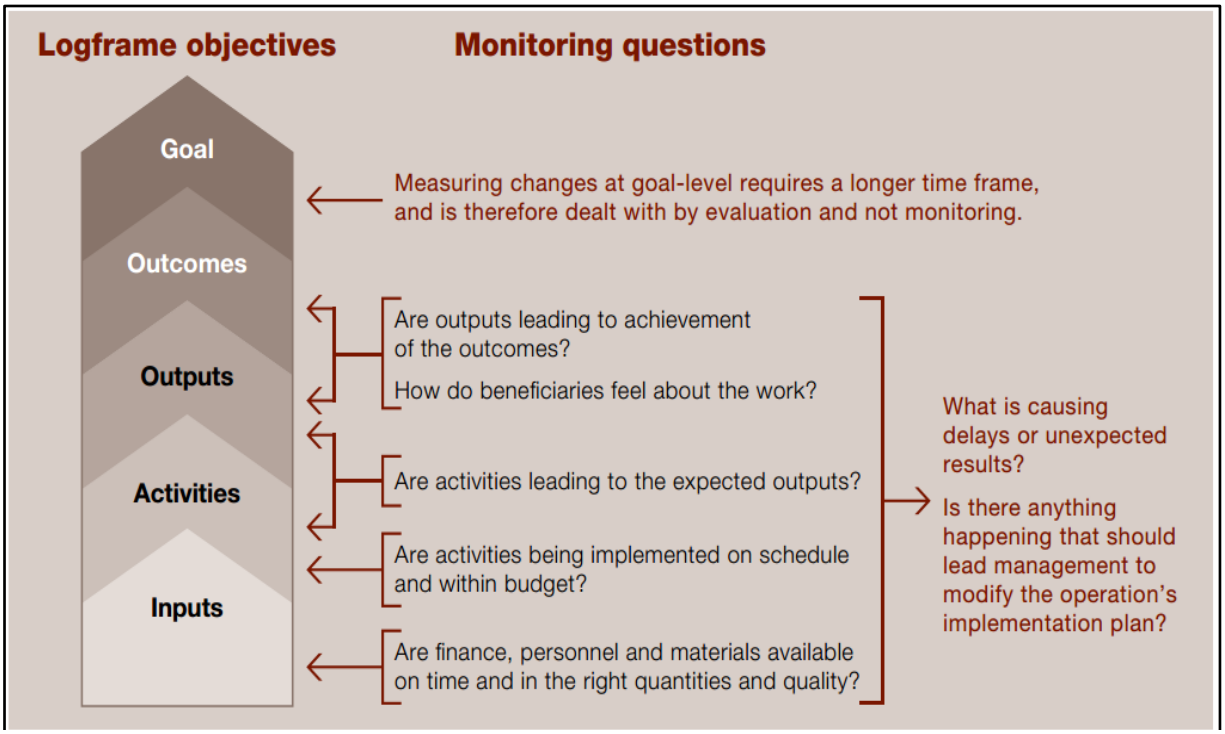
Figure 1: Project Cycle

1.2 Monitoring

Monitoring is the routine collection and analysis of information to track progress against set plans and check compliance to established standards. Monitoring is the process of keeping

track of progress on a continuous and/or periodic basis by management at different levels of an institutional order, or the individual or agency entrusted by the management to examine whether the inputs and resources meant for the implementation of plans, policies, programmes and project are being properly delivered.Moreover, the verification of whether the project activities arebeing implemented and where the intended outputs achieved as per the plan and schedule.

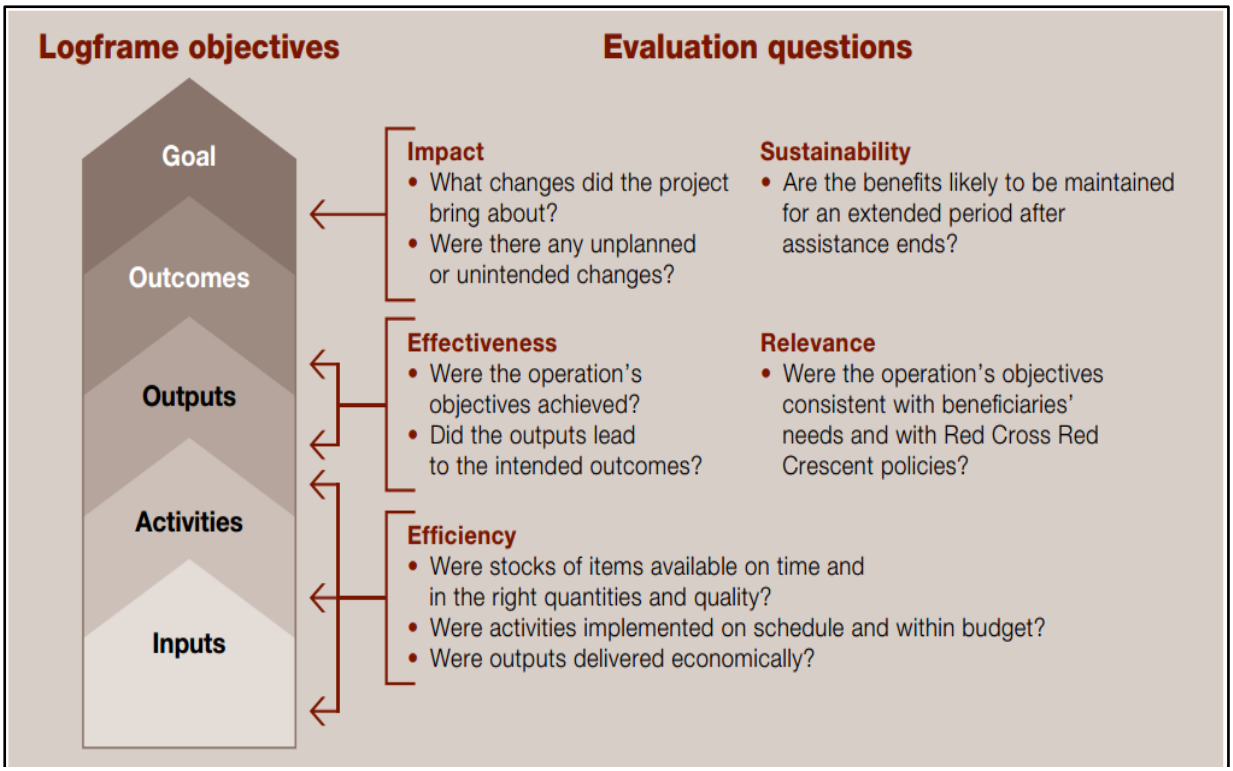
Below diagrams summarizes key monitoring questions as they relate to the log frameobjectives. During monitoring, more emphasis is given on the lower-level objectives–inputs, activities and (to a certain extent) outcomes. This is because the outcomes and goal are usually more challenging changes (typically in knowledge, attitudes and practice/behaviors) to measure, and require a longer period and a more focused assessment provided duringpost project evaluations.



During monitoring, data and information on the above mentioned aspects are collected, processed and reported in a continuous, systematic and time-bound manner. This helps identify problems and initiate corrective measures.

1.3 Evaluation

Evaluation is the systematic and objective assessment of an ongoing or completed project, program or policy, including its design, implementation and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact, and sustainability. The main objective of evaluation is to draw lessons from the strengths and weaknesses experienced in the implementation of plans, policy, programmes and project so as to improve their design and implementation in the future as well as to hold the officials and agencies involved in the process accountable for its implementation and results. It focuses on the changes impacted by devilment interventions and assessed in a few criteria to gather lessons. Therefore, evaluation may be taken as tool for learning lesson.



In addition, along with M&E process, another activity is undertaking, the 'review'. It is quite similar to evaluation, but it looks at the results of an evaluation and decides whether it needs to change. Information from monitoring may also prompt a review based on issues and in a limited form. Review may take place annually, mid-term or at the end of a longer-term project for specific objective.

1.4 Significance of the Study

It is hoped that the findings of this study will enhance the effectiveness and generalefficiency in management of Industry, Power & Energy projects. IMED officers will have a guideto use in monitoring and evaluating the projects. Project Director/Ministry will also have a guide touse in the evaluation of Industry, Power & Energy related projects.

The findings of this research are expected to broaden the understanding of IMED officers and teams on challenges affecting M&E in projects. The community likewiseis bound to benefit as the study highlights the importance of community participation inM&E of projects. This Monitoring and Evaluation Guidelines aim to: ensure responsibility and accountabilityamong the key constituents engaged in service delivery; enable appraisal and measurementofdirect and indirect impacts of development interventions on the lives of people; help ensureresults from development investments; and improve effectiveness and result-orientation in futurepolicies and programmes by obtaining feedback from past experiences.

1.5 Monitoring and Evaluation Practice in Bangladesh

Project Implementation Bureau (PIB) was created in 1975 through an executive order of thegovernment as a central project monitoring organization of the Government of Bangladesh.The PIB, latter upgraded and renamed Implementation Monitoring and

Evaluation Division(IMED), started its journey in 1982 in a modest way. Initially, its monitoring activitieswere mostly limited to financial performance reporting of projects. Although, physicalprogress reporting formats were also in place, IMED's data analysis activities and reportswere limited mostly to observations. The reports based on those observations were made onthe (project) reports received from the Ministries/Agencies.

According to The Rules of Business of the government, allocated functions or activities to theIMED are as follows:

- Monitoring and Evaluation of the implementation of development projectsincluded in the Annual Development Program (ADP).
- Collection and compilation of project-wise data for preparing quarterly, annual and periodical progress reports for information of the President, NEC, ECNEC,Ministries and other concerned.
- Rendering such advisory or consultancy services to Ministries/Agenciesconcerned on implementation of projects as and when necessary.
- Field inspection of projects for on the spot verification of implementation status and such other Co-ordination works as may be necessary for the removal of implementation problems, if any, with the assistance of related Ministries/Agencies.
- Submission of project inspection reports to the President and Ministersconcerned when attentions at such levels are considered necessary.
- Matters relating to Central Procurement Technical Unit (CPTU).
- Matters relating to The Public Procurement Rules (PPR), 2008.
- Such other functions as may be assigned to the Division by the Prime Ministerfrom time to time.

1.6 Monitoring and Evaluation of a Project

Monitoring is a continuous function that uses the systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds.Monitoring gives information on where a policy, program, or project is at any given time (and over time) relative to respective targets and outcomes. It is descriptive in intent.

On the other hand, evaluation gives evidence of why targets and outcomes are or are not being achieved. It seeks to address issues of causality.

Monitoring is defined as collection of data prior to and during the project implementation. These data, when analyzed, pinpoint progress or constraints as early as possible, allowing project managers to adjust project activities as needed. It also provides basis for undertaking evaluation.

The primary objectives of monitoring are to:

- Reveal if there is any impending problem to avoid disaster/delay
- Assess the progress of the project with respect to the proposed timeline
- Make necessary adjustments in resources, if necessary
- Ensure quality of the ongoing work
- Learn weakness and strength of the project management

- Redesign or readjust project implementation strategies or project components to achieve desired objective

Existing Monitoring Management:

A. Implementing Agency

In the project activities, all implementing agencies imply its own monitoring & evaluation steps in the stage of procurement, physical & financial progress and after completion of the project.

1. Procurement Stage:

Factory Acceptance Testing (FAT)

Factory Acceptance Testing conducted at the site at which the product is developed and performed by employees of the supplier organization to determine whether or not a component or system satisfies the requirements mentioned in the specification of contract document, normally including hardware & software as well as functionality.

While there are standard tests (as per guideline of international EEE, IEC others.) that are routinely conducted during a FAT; it can consist of a variety of inspection points and tests per the request of the customer, based on your requirements and unique equipment specifications. In general, the following things are covered during an FAT:

Comprehensive inspection – this is typically customized based on the equipment and the requests of the customer but can include a range of conformity checks and verifications (e.g. does the actual equipment match up to the drawings and name plate data).

Contract audit – this consists of a review of the original agreement to make sure all contractual obligations are met.

FAT can be performed at a very basic level, or a more complete FAT can be conducted where the manufacturer physically builds the whole system in their shop to test it fully. In the latter example, the system is then taken apart, moved to the customer's site, and put back together again.

Factory Acceptance Test helps to:

- Achieve independent proof of functionality, quality and integrity with our comprehensive checking process
- Verify all important documents, such as manuals, instructions, plans, drawings and instrumentation diagrams
- Ensure that your equipment or plant performs as expected under the testable range of likely conditions, including mishandling and error.

Prototype Assembly Test (PAT)

Prototype Assembly Test is performed to add to go along with high-quality fabrication and component procurement services. This includes fast, affordable prototype assembly where products/ equipment/ parts are prepared for the assembly process and comprehensive testing is performed to ensure they meet precise performance requirements. It can serve as a one-stop shop approach that saves time, money and hassles.

Post Landing Inspection (PLI)

After getting clearance for the implementing agency complying the quality in FAT, the material / equipment come into the site. In this stage Post Landing Inspection is conducted by a committee formed by implementing agency.

Post Landing Inspection helps:

- To ensure to get information regularly arrival/landing condition of the cargos.
- To facilitate to know the extent/nature of damage/pilferage/loss of cargo, if any.
- To enable the clients/importers to lodge claim to the shipper/carrier or appropriate authority who is liable for damage/ pilferage/loss, if any.
- To facilitate the importer/client to know the actual quality of cargo arrived.
- To enable the client/importer to lodge claim on quality differences, if any.

Field Level Activity

The inspection of Project Work process collects measures and disseminates performance information, and assesses measures and trends to forecast potential items requiring corrective action. This includes monitoring project risks and ensuring that they are being managed according to the project's risk plans. The project manager or the higher officials often do this through the site visit from concerned line ministry and/or implementing agency.

Scope Control

The Scope Control process ensures that changes to project scope are controlled.Outputs include:

- Updates to the Project Scope Statement and Scope baseline (this includesrequirements)
- Updates to the Work Breakdown Structure (WBS) and the WBS Dictionary
- Requested changes
- Recommended corrective actions
- Updates to organizational process assets
- Updates to the Project Management Plan

Schedule Control

The Schedule Control process monitors and controls changes to the project schedule. Outputs include:

- Updates to the schedule model data and baseline
- Performance measurements
- Requested changes
- Recommended corrective actions
- Updates to organizational process assets
- Activity list and activity attribute updates
- Updates to the Project Management Plan

Cost Control

The Cost Control process monitors and controls costs and changes to the project budget. Outputs include:

- Cost estimate updates
- Cost baseline updates
- Performance measurements
- Forecasted completion
- Requested changes
- Recommended corrective actions
- Updates to organizational process assets
- Updates to the Project Management Plan

Performing Quality Control

The quality control performance process measures specific project results to determine whether the project is meeting quality standards. Outputs include:

- Quality control measurements
- Validated defect repair
- Updates to the quality baseline
- Recommended corrective and preventive actions
- Requested changes
- Recommended defect repair
- Updates to organizational process assets
- Validated deliverables
- Updates to the Project Management Plan

Process Monitoring & Control

Monitoring and controlling Project Work Process involves tracking the actual project performance with the planned project management activities. It can mainly be looked as a Control function that takes place at all stages of a project i.e. from Initiation through Closing. For small projects, monitoring and control project work is comparatively an easy task. However, Project Management is more stringently required for large projects where the project manager requires a formal effort to monitor and control how the processes are going.

Outputs include:

- Recommended corrective actions
- Recommended preventive actions
- Forecasts
- Recommended defect repair
- Requested changes

This process of monitoring and controlling project work is extremely important as it can happen that PMU is able to complete the project on-time, however, have not been able to meet the desired quality levels. Similarly, the project has increased scope, however, have exceeded limits of time and cost. The project manager must balance the requirements of different knowledge areas to control the project through Monitor and Control project work. Project Managers create performance measures or use existing organizational performance measures to identify project performance at regular intervals during the course of the project.

2. Progress (Physical & Financial) Monitoring:

The implementing agency has its own project monitoring mechanism in place to weigh the monthly, quarterly and annual expenditure with the corresponding allocation and thus get a picture of the financial progress of the project. This helps to meet the ADP/ RADP targets for the projects.

Similarly, weights are assigned to the physical work components and upon completion of a component, physical progress of the project is updated. Physical progress is often matched with the financial progress to verify the consistency of the project workflow.

B. Ministry

1. Process Monitoring.
2. Progress Monitoring (Financial & Physical)

1. Process Monitoring

Integrated Change Control

The Integrated Change Control process ensures that changes as a result of project corrective actions and other controlling factors are managed across the project knowledge areas. Integrated change control takes place throughout the project, from project initiation through project closure.

Outputs include:

- Approved change requests
- Rejected change requests
- Updates to the Project Management Plan
- Updates to the Project Scope Statement (and requirements)
- Approved corrective and preventive actions
- Deliverables

Managing the Project Time line and performance

This process tracks team member performance, provides feedback, resolves issues and coordinates changes to maintain and improve project performance.

Coordinating Stakeholders

This process manages stakeholder communications and works with stakeholders to ensure that requirements are satisfied and issues are proactively resolved. Outputs include:

- Resolved issues
- Approved change requests
- Approved corrective actions
- Updates to organizational process assets
- Updates to the Project Management Plan

2. Progress (Physical & Financial) Monitoring

The line ministry has web based monitoring system for the projects of its subordinate organizations. The implementing agencies are required to input the monthly progress data into the system and the progress is reviewed at specific intervals. The line ministry also collects status reports from the implementing agencies as per real time demand. It also

coordinates monitoring functions originating from outside of its own like Planning Commission, PMO etc.

Project Completion Report (PCR)

Project completion report is a formal document of closing of a project. It consists of the following:

- Project description
- Implementation position
- Financial and physical programme
- Achievement of objectives of the project
- Benefit analysis
- Monitoring and auditing
- Descriptive report

It also contains remarks and recommendations of the project director, comments of agency head and remarks/comments of the officer-in-charge of the Ministry/Division.

C. IMED

Performance Monitoring & Evaluation

The Performance Reporting process collects and distributes performance information—including status reports, progress reports and forecasts. Outputs include:

- Performance reports
- Forecasts
- Requested changes
- Recommended corrective actions
- Updates to organizational process assets

Progress (Physical & Financial) Monitoring

The IMED has its own format designed for all sector projects to collect and review the monthly and quarterly progress of the projects.

1.7 Causes of Increasing Project Cost, Time and Scope of Development Project

Delay, Cost overrun and changes of scope are inherent part of most project despite the much-acquired knowledge in project management. Although some may argue that, this is negligible. It is important to note that physical and economic scale of projects today is such that it is driven under the platform of profit to the parent organization and of national interest by the degree of success defined within the cost, time and scope. Therefore,it is much appreciated to look at some reasons of delays and cost overrun in project.

Causes of increasing the project time-period	Causes of increasing the project cost	Project scope & external factors
Improper project design	Time over run leads to cost increase	External factors such as new vendors, technologies or methodologies
Inadequate assessment of	Delays lead to cost increase	Changes organizational

Causes of increasing the project time-period	Causes of increasing the project cost	Project scope & external factors
available technology, resources, manpower, methods, planning for implementation	for inflation-need revision-time to approve revised DPP-vicious cycle	structure or restructuring
Lack of skilled, resourceful, contractors, deficient contract management	Sources of raw materials and transportation cost of the project site	Change of priority of project
Change project scope/design midway	Faulty transportation system	Condition imposed on source of goods/service
The complexity of project HRM and capacity building	Lack of skilled labor and availability of labor	Lack of Stakeholder engagement and change in stakeholder requirements
Lack of project management during execution	Sudden increase of prices of goods and services	Lack of clarity of the specification
Shortage of reliable data base on similar previous	Increase VAT and TAX	Project resourcing pattern changes (supply and demand)
Delayed decision making	Deficient institutional structure	Technology advances, this can be considered in procurement contracts
Natural and anthropogenic disaster	Lack of Coordination/ Contingency plan	Requirements are not aligned with project scope

1.8 Weaknesses and Limitation of Monitoring and Evaluation System

In spite of the aforementioned contributions of the present monitoring system, the following weaknesses may be recognized which affect its operational efficiency;

- The need and importance of efficient monitoring and evaluation (M&E) activities is yet to be fully understood by the officials;
- The lack of proper and prompt response from top managers on monitoring reports
- Implementing officers often apprehend the problems reported may be considered as personal failures and thus instead of seeking help in solving these, try to hide them.
- Quality control of progress reports is absent or neglected at the project, agency and ministry/division levels;
- There is inadequate of manpower in the central monitoring organization to manage the monitoring of large number of projects efficiently;
- There is a lack of updated knowledge and technologies for efficient monitoring and evaluation both at the Center as well as in the ministry/agency levels;
- Monthly project review meetings in some ministries are not held regularly;
- Submission of project completion reports after a project is declared complete by the ministries/divisions has not yet been developed as a regular practice;
- Large projects do not have always full time PDs.

- Sustainable monitoring lacks proper attention at all levels making investment ineffective;

Weaknesses of current M&E format of IMED is given below:

- Existing IMED formats (Form 1 and 2, Monthly Implementation Progress Report, Form 3, Progress of Procurement Report, Form 4 a-b, Quarterly Financial and Physical Progress Report, Form 4 c-d, Implementation Problems and Suggested Measures and Contract Implementation Reports are formulated in generic form. It is required to be sector specific and addition to general M&E report.
- The formats focus more on inputs and activities than on outputs and outcomes. Also the indicators are not defined as SMART (Specific, Measurable, Achievable and Time bound)
- The nature and demand of various sectors are different, so components should be detail to the needs of the relevant sector;
- Like time over run caused mainly the organizational weakness, structure and human resources. Lack of committed and capable human resources often constrains time over run and cost overrun;
- People who received training on the specific development issues/areas are frequently transferred to the other sector/department where he is not able to utilize the gathered knowledge and skills;
- Incentives/dis-incentives structure is poor that does not prevail effectively;
- Reward and recognition system is poor;

1.9 Planning of Formulating Report

For planning of formulating the report Survey questionnaire, FGD questionnaire, Key informant questionnaire, etc. will be developed as well as different checklist will be used to collect various project related information/activities. Checklist/Format will be used for measuring progress of physical and financial activities. Stakeholders' interview is a major part for making a good monitoring & evaluation report. Format/checklist/questionnaire will be developed for stakeholder interview and the findings of the stakeholders interview will be identified appropriate requirements for preparing an effective M&E guidelines and understanding existing weaknesses and limitations in the M&E process. IMEDOfficers/Consultant's shouldmeet with key persons of relevant Ministries, Agencies and Projects to identify areas of interest and/or concern with respect to M&E of Industry, Power& Energy under their domain.

1.10 Emphasis on Field/ Site Inspection

Field inspection is one of the important tools of monitoring and evaluation, and that is beingcarried out by the IMED in Bangladesh with the available resources. It is necessary that M&E function be carried out continuously from the identification ofprogrammes and projects through their formative, pre-completion and completion phases. Necessary reforms and modifications should be initiated, taking into account the findings,suggestions, and recommendations obtained from M&E at different stages as feedback. Emphasis given on the field inspection by the IMED can be understood by the fact that everyofficer of the

organization is required to visit for ongoingprojects/completing projects/impact evaluation and submit itsinspection reports to the government for necessary action.

1.11 Site Inspection of Industry, Power & Energy Related Project

Field inspection gives an on the spot impression of project performance in itsimplementation phase. Since most of the investment projects have civil construction/ physical work component, the overall physical progress of work of any project can only be assessed properly through site visits. Site visits gives an opportunity to see whether the works are being carried out as per the approved work plananddesignstandards/specifications or there are deviations from the approved DPP. Besides, the rate of progress of work vis-a-vis the utilization of funds can also be assessed as to whether there are possibilities of time and cost overruns. Through project inspection early forecast of the likely impending problems/hazards in the implementation phase can be made in advance and the remedial/corrective measures can be suggested.

Inspection and quality assurance of project implementation is the ultimate responsibility of the Respective Agency, though it is contractor's responsibility to guarantee quality of works as per terms of the contract. However, in order to have an impartial/unbiased view of the project performance inspection by an independent and higher body like IMED becomes pertinent.

1.12 Inspection Coverage and Attitude/ Approach of the Inspector

Site inspectors provide an independent assessment of the works. They are likely to keep a site diary, attend construction progress meetings and to produce regular written reports. The amount of detail to be covered depends on the scope of the inspection and the time available. The inspection coverage should be as follows:

a. Progress and quality of work
b. Materials and quality control
    1. Project sampling and testing program
    2. Project special provisions
    3. Computation and use of quality levels analysis
    4. Product acceptance
    5. Innovative materials
c. Workmanship
d. Construction operations and features
    1. Adequacy of provisions for safety
    2. Innovative processes and procedures
e. Project records
    1. Field checks by project personnel and others
    2. Quantity and quality of materials delivered, usedand rejected
    3. Construction work performed
    4. Methods and frequencies of checks on scales and other measuring devices
    5. Adequacy of field notes, diaries and records supporting pay quantities
    6. Subcontracting
    7. Labor compliance, Equal Employment Opportunity, and on-the-job training
f. Changes and extra work including time extensions
g. Compliance with environmental acts

h. Staffing, inspector qualifications, facilities, and project control
i. Claims and potential claims
j. Compliance with contract requirements with respect to physical measurements

Achievement of project's target is attributed to a team effort and not to an individual;therefore, a Project Director (PD) alone should not be put in the dock for failure to achieve the target of project. A Project Director does not live in isolation. He does not have absolute control on the entire risk and assumptions of the project activities.An inspector should encourage PD to speak freely about the impediments, project is encountering in its implementation.

1.13 Monitoring and Evaluation Framework for Industry, Power & Energy Sub-Sector Projects

Manyindustry, power &energy projects are faced with the challenge of developing reliable, cost effective and credible means of measuring their effectiveness. Effectiveness measures the extent to which a development project is achieving the specific objectives set for it. Availability of monitoring data and statistics on the performance of the project output would help improve respective sector efficiency and effective operational performance. The project team to determine whether they are meeting the set objectives within the planned time and cost should continuously monitor projects. All this can be enhanced if there is an M&E framework/manual in place. It is important that during project planning, the broad framework of the M&E is established.

The need for M&E information on respective projects is important to stakeholders such as GoB, management and development partners, who would want to know how resources are being utilized and whether works are carried out as originally planned. This information on the performance of each projects can be made available if there is a robust M&E framework. The goal of the M&E framework is to establish a well-coordinated, harmonized M&E system. The lack of an evaluation framework has a negative effect on the project success. Project managers are required to undertake more rigorous monitoring and evaluation of the projects and develop frameworks and guidelines for measuring impact. Projects funded by the development partners usually require a comprehensive M&E plan that includes an M&E framework.

Monitoring and Evaluation frameworks and guides are already in existence. Even if M&E frameworks already exist, it is important for various project types to have specific M&E frameworks. Common accountability frameworks have several benefits but must be adaptable to different contexts. This is because different projects even if they are similar, have unique outputs and indicators, which are different. The continued implementation of capital projects such as power sector projects without a well-formulated and strategic M&E framework could not yield the desired results.

This M&E framework/ manual is a reference document that provides-step-by-step guidance on how to perform a specific task. It contains many sets of instructions containing DOs and DON'Ts. The Guideline will be instrumental in making overall monitoring functioneasier and more comprehensive by establishing unified, user-friendly, and explicit monitoring and

evaluation procedures. This Guideline will be prepared based on suggestions and inputs from all relevant ministries through a series of discussions and interactions.

This M&E manual includes specific steps/instructions to be followed by the inspecting/investigating officials of the IMED.

The purpose of the manual is as follows:

- To provide an operational framework for achieving the IMED's M&E goals.
- To explain its working procedures
- To provide clear and fair inspection/investigation guidance for the IMED's officials
- To establish standard internal reporting system
- To improve quality of project monitoring and evaluation
- To ensure consistency in M&E within the sectors/sub-sectors
- To enhance inspection skill of the IMED's official
- To improve quality of reporting.

This manual will require periodic updating for keeping pace with the development strategy of the government as well as the monitoring and evaluation policy of the IMED.

1.14 Preparation for project inspection by using M&E Manual:

The inspection and review process involves several steps: advance preparation, data gathering, conducting the physical review itself, evaluating and communicating the findings, writing and presenting the report, and distributing and archiving the report and related documentation. Before embarking on project inspection a number of preparatory works are necessary to be taken to make it more effective and meaningful. In brief, these steps are:

- Having knowledge of the stages of construction of a building will be helpful in understanding the project activities and its efficient management.
- Holding a pre-inspection meeting with the Project Director/Project Management, preferably in the IMED, to get an overall impression of the project progress and the impediments centering round the project implementation.
- Preparing inspection schedule in consultation with the project officials, so that inspection is completed within a reasonable time period.
- Studying procurement plan provided in the DPP in the light of PPA-2006 and PPR-2008
- Studying Development Project Proposal (DPP)
- Studying yearly, quarterly and monthly reports (IMED's 01/2003, 02/2003, 03/2003, 04/2003 and 05/2003 formats or newly developed two formats, 2015) of the project received in the IMED and filling in part of the inspection report with static data/information before going to the field or by using online PMIS.

2. POWER SUB-SECTOR

2.1 Power Sector in Bangladesh

The Power Sub-sector of Bangladesh is operating under Power Division of the Ministry of Power, Energy and Mineral Resources. Like any other country,theoperational activities of Bangladesh Power System are divided into three majorcategories: Generation, Transmission and Distribution.

Ministry of Power, Energy and Mineral Resources (MoPEMR)

MoPEMR is the main Ministry to deal with primary energy and electrical power policy and administration in Bangladesh. As of January 2019, the Prime Minister holds the post of the Minister of MoPEMR (another post, "State Minister in Charge" exists). Under MoPEMR, Energy Division (Energy and Mineral Resources Division) and Power Division exist.

Power Division

Power Division is responsible for all activities related to power generation, transmission and distribution. Its scope also covers the coordination with other Divisions and Ministries to promote public-private partnership, private investment, rural electrification and renewable energy, and energy efficiency and conservation. Power Division also monitors the performance of public-owned power utilities with key performance indicators (KPIs). If a utility performs below the pre-determined/agreed KPI, then the utility needs to pay the penalty.

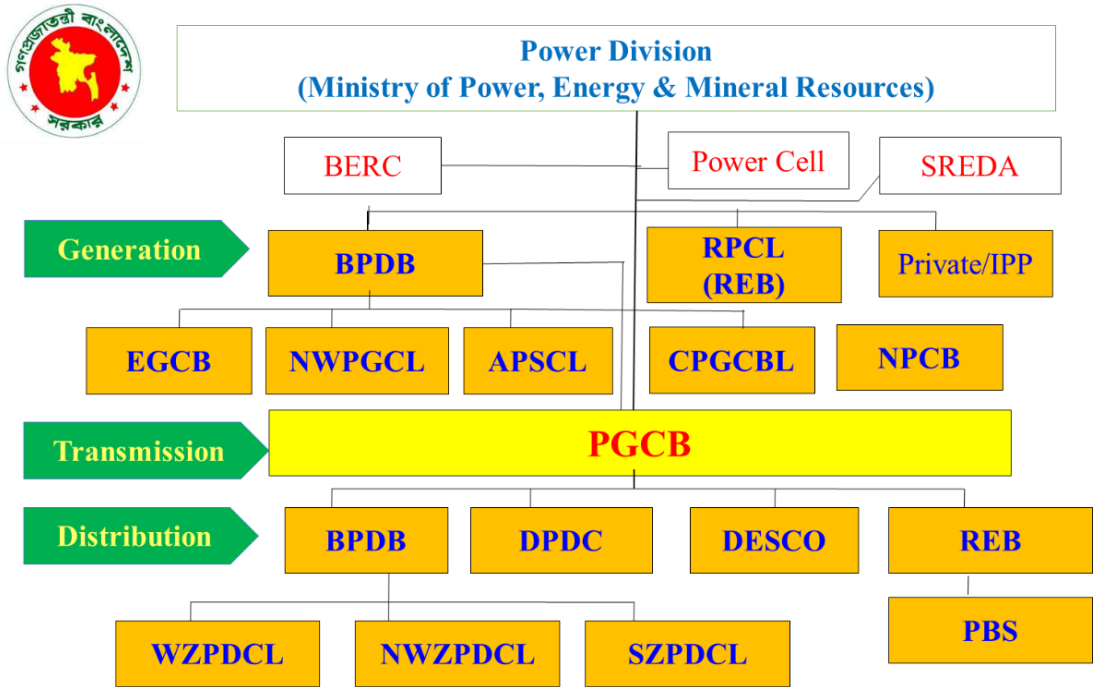


Figure 2: Structure of Bangladesh Power Sector

2.2 Present Status of Power Sub-Sector

Electricity is one of the driving forces of economic development of a country.Industrialization progress of the country depends on power generation according to demand and proper distribution/use of it. Presently the number of total power plant is 127

and total power generation capacity is 11623MW (with Captive). Almost 92% of people of the country are getting electricity now and targets have been set to cover 100% people under electricity facility by 2021 according to the Vision 2021. Install capacity of power generation has been set 23,000 MW by 2020; 24,000 MW by 2021; 40,000 MW by 2030 according to Power Sector Mega Plan (PSMP, 2016).

Table 1: Present Status of Power Sector in Bangladesh

Subject	Status
Generation	
No. of Power Plant	127
Total Electricity Generation Capacity (MW)	21282 MW (including Captive and Renewable Energy)
Maximum Electricity Generation Capacity	12,067 MW (25 April, 2019)
Total Electricity Customer	33.0 Million
Access to Electricity	93%
System Loss	11.87% (June 2018)
Transmission Line	
Total Transmission Line	11,493 Ckt. km
Distribution Line	
Total Distribution Line	5,10,000 km
Distribution Loss	9.60% (June 2018)
Substation	
Grid Sub-station Capacity (MVA)	39,976MVA

Source: Power Cell

2.3 Glossary of Power Sub-Sector related Terminologies

Activities: Activities are the set of various actions executed by project personnel to convertresources to the specific outputs as defined by a programme or project.

Business Plan: The business plan is a sectoral plan which has been prepared based on the assignedduties or responsibilities of the concerned public agencies; goals and objectives of the periodicplans; and the principles and tools of Managing for Development Results (MfDR) so as to achieveoptimum outputs from the available resources.

Evaluation: Evaluation is a systematic and purposeful undertaking carried out by internal orexternal evaluators to appraise relevance, effectiveness, efficiency, impacts as well assustainabilitygenerated by the policies, plans, programmes, and projects under/after implementation.

Ex-ante Evaluation: The act of carrying out appraisal before making investment in a projector programme to ensure its relevance and need.

On-going Evaluation: An assessment undertaken during the implementation phase of aprogramme/project to analyze the continued relevance, effectiveness, efficiency,

impactand sustainability of the programme/project so as to improve or reorient its design andimplementation if necessary.

Terminal Evaluation: A study conducted at the end of an intervention (or at the end of aphase of that intervention) to analyze and determine its efficiency, impact and sustainabilityto obtain inputs or suggestions for future courses of action.

Impact Evaluation: A type of outcome evaluation carried out a few years after thecompletionof a programme or project to analyze and evaluate its impacts and sustainability toobtain feedback for the formulation of similar programme or project in future.

Impact: The actual or intended changes brought about in the life and wellbeing of targeted beneficiaries by the outputs of a plan, policy, programme, or project.

Investment: The input of funds, materials, human resources, services, technologies, and otherresources which are used to carry out programme and project activities so as to achieve theirobjectives.

Logical Framework (Log Frame): Log Frame is a planning and management tool that summarizesgoals, objectives, outputs, and activities of a programme or project along with their causal linkages.Also included are indicators of performance and means for their veri fi cation in a single matrix.

Medium-term Expenditure Framework (MTEF): MTEF is the schema for prioritizingdevelopment programmes with a view to improve the process of programme/project formulationand implementation; to improve the effectiveness of development programmes; and to ensureclear budgets for the programmes and projects that are critical to the achievement of goals andobjectives of periodic plans.

Monitoring: Monitoring is the process of keeping track by management at different levels ofhierarchy or the individual or agency entrusted by the management, on a continuous orperiodicbasis, of the inputs and resources meant for the implementation of plans, policies, programmes,and projects are being properly delivered; and the verification of whether the project activities arebeing implemented and where the intended outputs achieved as per the plan and schedule.

Results-based Management: A management strategy that focuses on the processes, products and services contributing to the achievement of development results.

Affected utility: Affected utilities are those whose systems cause, contribute to or would experience an impact from a reliability issue.

Alignment: Marking off points on the ground in correct line of direction for setting out aroad, railway, transmission line, gas pipeline etc.

Angle: Used to measure the synchronism between different alternating quantities, such as voltage or current. It is often an important performance measure; it is measured in degrees.

Back Fill or Back Filling: Earth, cinder, rubbish or stone chips used to fill thefoundation trench after the foundation have been laid.

Baseload: A baseload power plant is an electric generation plant that is expected to operate in most hours of the year.

Blackout: A total loss of power over an area; usually caused by the failure of electrical equipment on the power system.

Boiler: A plant for steam generation.

Breaker-and-a-half: A substation design that offers advantages such as ensuring that the failure of any one circuit breaker will not interrupt power for more than a brief time. The designs also allow parts of the substation to be de-energized for maintenance and repairs without causing a power interruption.

Brownout: Abnormally low voltage that causes voltage-sensitive equipment such as computers, motors and certain types of lighting to have degraded or interrupted performance.

Bus: Also referred to as a "node" or a "station" or a "substation." A common connection point for two or more electrical components, such as a transformer, a generator.

Cable: A collection of ropes or conductors, insulated and protected where needed.

Capability: The capacity of a piece of equipment to perform its intended function, such as carrying current for a conductor or transformer, or interrupting current for a switch or breaker, or supplying power for a generator. Certain pieces of equipment can have different capabilities based on certain factors, such as ambient conditions (temperature, wind) and the amount of time the equipment is expected to perform the intended function. Typically, a Normal rating or capability is nearly continuous, and an Emergency capability is a higher capability utilized during infrequent events for a short duration, typically twelve hours or less.

Capacitor: A device that stores an electrical charge and is typically used to address low voltage issues on a power system.

Conveyor: An equipment with a moving flat belt used for transportation of coal, ore,sand, etc. continuously over a short distance. This is chiefly used in industries.

Conductor: Part of a transmission or distribution line that actually carries the electricity; in other words, the wire itself. The wire or conductor is just one part of a transmission line; other parts include the poles and the insulators from which the conductor is hung. A conductor must have enough capacity to carry the highest demand that it will experience, or it could overheat and fail.

Contingency: An unplanned event creating an outage of a critical system component such as a transmission line, transformer, or generator.

Converge: Power flow programs use an iterative mathematical process to solve for, or converge to, the solution of unknown system parameters, such as Voltage and Angle. When the mathematics do not result in a solution, the iterative process has "failed to solve" or "failed to converge" to a solution. This result is an indication of voltage collapse or loss of load.

Critical Energy Infrastructure Information (CEII): Specific engineering, vulnerability, or detailed design information about proposed or existing infrastructure (physical or virtual) that: (1) relates details about the production, generation, transmission, or distribution of energy; (2) could be useful to a person planning an attack on critical infrastructure; (3) is exempt from mandatory disclosure under the Freedom of Information Act; and (4)gives strategic information beyond the location of the critical infrastructure.

Demand: The amount of electricity being used at any given moment by a single customer, or by a group of customers. The total demand on a given system is the sum of all of the individual demands on that system occurring at the same moment. The peak demand is the highest demand occurring within a given span of time, usually a season or a year. The peak demand that a transmission or distribution system must carry sets the minimum requirement for its capacity (see also the definition for energy).

Demand-side management (DSM): A set of measures utilized to reduce energy consumption. Energy conservation is one kind of DSM.

Discharge: The quantum of fluid following through a pipe or channel per unit time. It isusually denoted by 'Q'.

Dispatch: As a verb: turning on or off, or setting the value or output of a generator, a capacitor bank, reactor or transformer setting. As a noun: the state or status of these devices.

Distribution: Distribution lines and distribution substations operate at lower voltage than the transmission systems that feed them. They carry electricity from the transmission system to local customers. When compared to transmission, distribution lines generally use shorter poles, have shorter wire spans between poles and are usually found alongside streets and roads, or buried beneath them. A typical distribution voltage would be 13.8-kV.

Distribution utility: A utility in the state of Vermont that is responsible for owning, operating, and maintain the distribution part of the electric system within an area.

Dredger: A vessel fitted with a bucket ladder or grab machinery for mining operation orunder-water excavation.

Earth Work: Digging earth or raising the ground with soil.

Easement: A right to use another's land for a specific purpose, such as to cross the land with transmission lines.

Elevation: Normally it is the front view of an object. However it may be a rear elevationor end elevation. This is required to show the object in orthographic view.

Embankment: A mound of earth, rock or composite material forming a trapezoidalsection used for a roadway or railway. This is also built along a banks of a river orstream to protect the surrounding areas from flood due to high water level in theriver/stream.

Enclosure: A space covered by walls or fence.

Erection: Placement, positioning and fixing of precast concrete frames or fabricatedsteel frames.

Fault: The failure of a line, transformer, or other electrical component. Once such a component has failed (due to overheating, short-circuiting, physical breakage, or other trauma) it is automatically taken out of operation by a circuit breaker that quickly turns the component off. Once it has been "tripped off" it no longer poses a threat to human safety, but its loss may present a difficult burden to the remaining system (see also the definition of redundant below).

Foundation: The sub-structure or the part of a structure built underground for transferof load to soil and to hold the structure.

Friction: A force that oppose a motion.

Geological Map: A map showing the geological formation and underground strata of anarea on earth.

Geophysical Survey: The survey conducted for search of mineral deposits. Maps areprepared with variations of elastic properties of earth, gravitational field, magnetic field,radio activity, etc.

Generation or generator: A device that converts mechanical power from an engine, a water wheel, a windmill, or other source, into electrical power.

Inductor: See reactor.

Kilowatt-hour (kWh): One thousand watt-hours. A watt-hour is a measure of the amount of electric energy generated or consumed in a given period.

Kilovolt (kV): One thousand volts. Volts and kilovolts are measures of voltage. Lead distribution utility -A utility selected by the affected utilities to facilitate decision-making and to lead the effort to conduct the NTA analysis.

Layout: A general concept or arrangement for a proposed construction or installation.

Lead distribution utility: A utility selected by the affected utilities to facilitate decision-making and to lead the effort to conduct NTA analysis.

Link: One hundredth of an engineer's chain or Gunter's chain.

Load Test: This test often carried out to determine the bearing capacity and settlementcharacteristics of a soil at site by applying and increasing loads in stages and nothingthe stress-strain and consolidation or settlement.

Location Plan: A site plan which shows the dimensions of the location of the proposedconstruction site.

Load shedding: Intentionally turning off power to a customer or group of customers, usually for reliability reasons such as to avoid a blackout or equipment damage.

Loss of load: See blackout.

Megawatt (MW): One million watts. Watts and megawatts are measures of power. To put this in perspective, the peak power demand for the Bangladesh region is approaching 11,623 MW or 11,623,000,000 watts.

Mixer: A mixing machine for making mortar or concrete or a puddling machine for clay.

N-0 or N-1 or N-1-1: The term N minus zero (or one or two) refers to the failure of important equipment. Although these terms sound complex, they are actually quite simple. "N" is the total number of components that the system relies on to operate properly. The number subtracted from N is the number of components that fail in a given scenario. Therefore, N-0 means that no components have failed and the system is in a normal condition. N-1 means that only one component has failed. N-1-1 means that two components have failed, which is generally worse than having only one fail (see also the definition of contingency above).

Non-transmission alternative (NTA): The use of a non-transmission solution such as local generation or energy efficiency to solve a transmission reliability deficiency.

Open Cut: An excavation in the open.

Out of angle: See phase shifter.

per unit (pu): The ratio of an actual or measured quantity to the base or reference value of the same quantity. For example, a 0.9 pu voltage on a 100 kV system represents a 90 kV measurement of the voltage.

Phase shifter: Also referred to as a "phase shifting transformer" (PST) or "phase angle regulator" (PAR). A transformer that adjusts the angle between two buses in order to change the amount of power flowing between these buses. Some of these transformers are also able to adjust voltage. These transformers have an angle capacity, which states the extent to which the transformer can adjust the angle between two buses. When the angle capacity is reached before the desired flow can be achieved, it is stated that the transformer ran out of angle or that the angle capacity of the transformer is not sufficiently large.

Power: The amount of electricity that is consumed (demand) or supplied at any given time.

Power factor: A measure of the amount of reactive power (by-product of alternating current, i.e., AC) in relation to the real power (component of power that can heat).

Reactive reinforcement: Also referred to as "reactive compensation." The act of adding a capacitor bank or shunt reactor to increase or reduce voltage.

Reactor: A device that stores energy in the form of a magnetic field, and then uses this energy to induce current. Typically used to address high voltage issues on a power system.

Reliability deficiency: An existing or projected future violation, before or after a contingency, of the applicable planning, design and/or operating criteria, with consideration given to the reliability and availability of the individual system elements.

Renewable power source: Any power source that does not run on a finite fuel which will eventually run out, such as coal, oil, or natural gas. Renewable power sources include solar, wind and hydro generators, because sunlight, wind and running water will not run out. Generators that burn replaceable fuels also commonly qualify as renewable power sources. Examples include bio-diesel generators that run on crop-derived fuels and wood-burning generators.

Right of way (ROW): The long strip of property on which a transmission line is built. It may be owned by the utility or it may be an easement.

Ring bus: See breaker-and-a-half, busand substation.

Sensitivity studies: A technique of analysis whereby different values of certain key variables such as the permanent loss of a generation or transmission resource are tested to see how sensitive study results are to possible change in assumptions.

Safety Belt: A belt to be worn by a worker for his safety while working at a height morethan one meter.

Sewage: Foul water carrying human excreta and filthy matters.

Shoulder load: A load level that is within some bandwidth over and above 80% of the peak load level.

Steady state: Refers to the period of time after all momentary network disturbances and automatic equipment adjustments have ended.

Substation: A substation is a fenced-in area where several generators, transmission and/or distribution lines come together and are connected by various other equipment for purposes of switching, metering, or adjusting voltage by using transformers.

Sub transmission: Sub transmission lines are power lines that typically operate at a voltage of 34,000 to 70,000 volts and are generally below 100 kV.

Testing Machine: There are a number of testing machines to determine the variousproperties of engineering materials. In a universal testing machine, quite a number oftests can be carried out. These tests are for tension, compression, torque, impact andfatigue.

Thermal: Refers to the heating effects of current flow. Often used in conjunction with capability, affect, analysis.

Top Soil: The soil layer of 6" to 12" thickness at the ground surface that supportsvegetation. This soil is usually composed of silt and humus.

Transformer: A device that typically adjusts high-voltage to a lower voltage. Different voltages are used because higher voltages are better for moving power over a long distance, but lower voltages are better for using electricity in machinery and appliances. The two (or more) voltages commonly describe transformers that they connect, such as "115/13.8-kV," signifying a connection between 115-kV and 13.8-kV equipment or lines.

Transmission: Transmission lines and transmission substations operate at high voltage and carry large amounts of electricity from centralized generation plants to lower voltage distribution lines and substations that supply local areas. Transmission lines use poles or structures, have long wire spans between poles and usually traverse straight paths across large distances. Typical transmission voltages include 345-kV and 115 kV and generally, all are above 100 kV.

Transmission system reinforcements: Transmission line or substation equipment added to existing transmission infrastructure.

Turbine: A prime mover by gas, steam under high pressure or falling water.

Voltage: Voltage is much like water pressure in a system of pipes. If the pressure is too low, the pipes cannot carry enough water to satisfy the needs of those connected to them. If the voltage is too low, the electric system cannot carry enough electricity to satisfy the needs of those connected to it.

Voltage collapse: A phenomenon whereby a series of events ultimately results in a blackout after a certain amount of time ranging from seconds to minutes.

Voltage instability: A phenomenon whereby system operators cannot maintain acceptable system voltage given the tools at their disposal for a specific combination of load, generation and transmission. Voltage collapse may ensue

2.4 Major Construction Equipment for Civil Works

1. Excavator

Excavators (hydraulic) are heavy construction equipment consisting of a boom, dipper (or stick), bucket and cab on a rotating platform known as the "house". The house sits atop an undercarriage with tracks or wheels. They are a natural progression from the steam shovels and often mistakenly called power shovels. All movement and functions of a hydraulic excavator are accomplished through the use of hydraulic fluid, with hydraulic cylinders and hydraulic motors.

Excavators are used in many ways:

- Digging of trenches, holes, foundations
- Material handling
- Brush cutting with hydraulic saw and mower attachments
- Construction
- Demolition with hydraulic claw, cutter and breaker attachments
- General grading/landscaping
- Mining, especially, but notonly open-pit mining
- Driving piles, in conjunction with a pile driver
- Drilling shafts for footingsand rock blasting, by use of an auger or hydraulic drill attachment
- Snowremoval with snowplow and snow blower attachments

Figure 3: Excavator

2. Dozer

A dozer is a crawler (continuous tracked tractor) equipped with a substantial metal plate (known as a blade) used to push large quantities of soil, sand, rubble, or other such material during construction or conversion work and typically equipped at the rear with a claw-like device (known as a ripper) to loosen densely compacted materials.

Figure 4: Dozer

3. Roller Compactor

A roller-compactoris a compactor type engineering vehicle used to compact soil, gravel, concrete, or asphalt in the construction of access roads and foundations. Similar rollers are used also at landfills. Rollers are still known colloquially as steamrollers, regardless of their method of propulsion. This typically only applies to the largest examples (used for road making).

Figure 5: Roller Compactor

4. Tractors Trailors

A tractor is an engineering vehicle specifically designed to deliver a high tractive effort (or torque) at slow speeds, for the purposes of hauling a trailer or machinery used construction. Most commonly, the term is used to describe a vehicle that provides the power and traction to mechanize construction tasks, especially (and originally) tillage, butnowadays a great variety of tasks.

Figure 6: Tractors Trailors

5. Drum truck

A dump truck, known also as a dumper truck or tipper truck is used for transporting loose material (such as sand, gravel or demolition waste) for construction. A typical dump truck is equipped with an open-box bed, which is hinged at the rear and equipped with hydraulic rams to lift the front, allowing the material in the bed to be deposited ("dumped") on the ground behind the truck at the site of delivery.

Figure 7: Drum Truck

6. Pile Driver

A pile driver is a device used to drive piles (poles) into soil to provide foundation support for buildings or other structures. The term is also used in reference to members of the construction crew that work with pile-driving rigs.

One type of pile driver uses a weight placed between guides so that it can slide vertically. It is placed above a pile (pole). The weight is raised, which may involve the use of hydraulics, steam, diesel, or manual labour. When the weight reaches its highest point it is released, and hits the pile,

Figure 8: Pile Driver

driving it into the ground.

7. Transit Mixers

Transit mixer is a piece of equipment that is used for transporting concrete/ mortar or ready mix material from a concrete batching plant directly to the site where it is to be utilized. Transit mixer is loaded with dry material and water. The interior of the transit drum is fitted with a spiral blade. Spiral blade is able to move in two directions. During clockwise movement drum is charged with concrete and in counterclockwise direction concrete discharge out from the transit drum. Concrete mixing drum ensures the liquid state of materials through rotation of the drum about its own axis.

Figure 9: Transit Mixer

8. Concrete Placers

Concrete placers are differentiated as those that are used in the construction of concrete pavements for roads and airports, concrete foundations, floors for industrial buildings, and so forth and those that are used in the manufacture of precast reinforced-concrete components. Widely utilized in road building are concrete placers that move along "rail-forms" (rail tracks that simultaneously serve as forms for the concrete that is being placed). Concrete placers used on construction sites (usually automotive track-laying vehicles) are furnished with attachments to receive the concrete mix from the concrete-mixer trucks. Rotating belt conveyors are used to supply the concrete mix and distribute it within the forms.

Figure 10: Concrete Placers

9. Crane

A crane is a type of machine, generally equipped with a hoist rope, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. The device uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a human. Cranes are

Figure 11: Crane

commonly employed in the transport industry for the loading and unloading of freight, in the construction industry for the movement of materials, and in the manufacturing industry for the assembling of heavy equipment.

10. Forklift

Figure 12: Forklift

Operate powered industrial trucks to load and unload materials and deliveries and move them to and from storage areas, machines and loading docks, into railroad cars or trucks or storage facilities.

Essential duties and responsibilities:

- Obtains copy of production schedule or shipping order and transports material or equipment to and from designated areas in the facility
- Loading and unloading goods from vehicles such as trucks or aircraft
- Moving goods packed on pallets or in crates around the storage facility
- Stacking goods in the correct storage bays, following inventory control instructions
- Checking loads are secure
- Stacking empty pallets
- Performing daily equipment checks such as recharging the truck's battery and lubricating equipment
- Removing machine attachments and waste material from machines
- Examining products to verify conformance to quality standards
- Dumping materials into machine hoppers

11. Submerged-arc welding

Figure 13: Submerged-arc welding

The submerged-arc welding (SAW) process is similar to MIG where the arc is formed between a continuously-fed wire electrode and the work piece, and the weld is formed by the arc melting the work piece and the wire. However, in SAW a shielding gas is not required as the layer of flux generates the gases and slag to protect the weld pool and hot weld metal from contamination. Flux plays an additional role in adding alloying elements to the weld pool.

12. Water truck

The water truck is a Carrier Truck having Water Cistern over his frame. The main task of a Water truck can be either dust control, cleaning or fire extinguishing (Fire Truck) The Water Truck is often used for Municipal duties. Water trucks are GPS equipped and dispatched. This allows for effective fleet management with quicker response times, assists in accurate billing and provides up to the minute information to our customers.

Figure 14: Water Truck

2.5 Stages ofConstruction of Power Plant and Plant Machineries

1. Land Acquisition

Before Land acquisition site have to be selected as per feasibility study. During site selection, following things to be consider for Power Plant such as, Water availability, Fuel supply, Waste disposal, Power Evacuation and Material & Equipment transportation etc.

Figure 15: Land for Power Plant

Acquisition of private land by the government for public purposes is a common practice in Bangladesh. Land acquisition for various development projects has become a critical issue in Bangladesh. The country's large population and small geographical size have put land at the center of any policy implication. The compensation should give to the affected persons as per government policy & guideline.

2. Land Development

Development of Land is a very important part of every projects. Clearing, terracing or land levelling work done as per detail design and drawing as well as topographic survey report.Site preparation will involve mowing the site if required and marking out the site, erecting the security fence, construct approach road, fuel-unloading jetty etc.

Figure 16: Land Development Work

3. Layout Plan

The General Layout will be composed of main block area and auxiliary area. The main block of the Plant will consist of dual fuel gas turbine(GT), steam turbine (ST), Heat recovery steam generator (HRSG) andbypass and exhaust stacks. Black start and

emergency dieselgenerators will beprovided to provide black start and safe shutdown capabilities. The auxiliary area will be composed of Boiler make-up water treatment plant, wastewater, sanitary wastewater treatment plant and intake firefighting water basin.

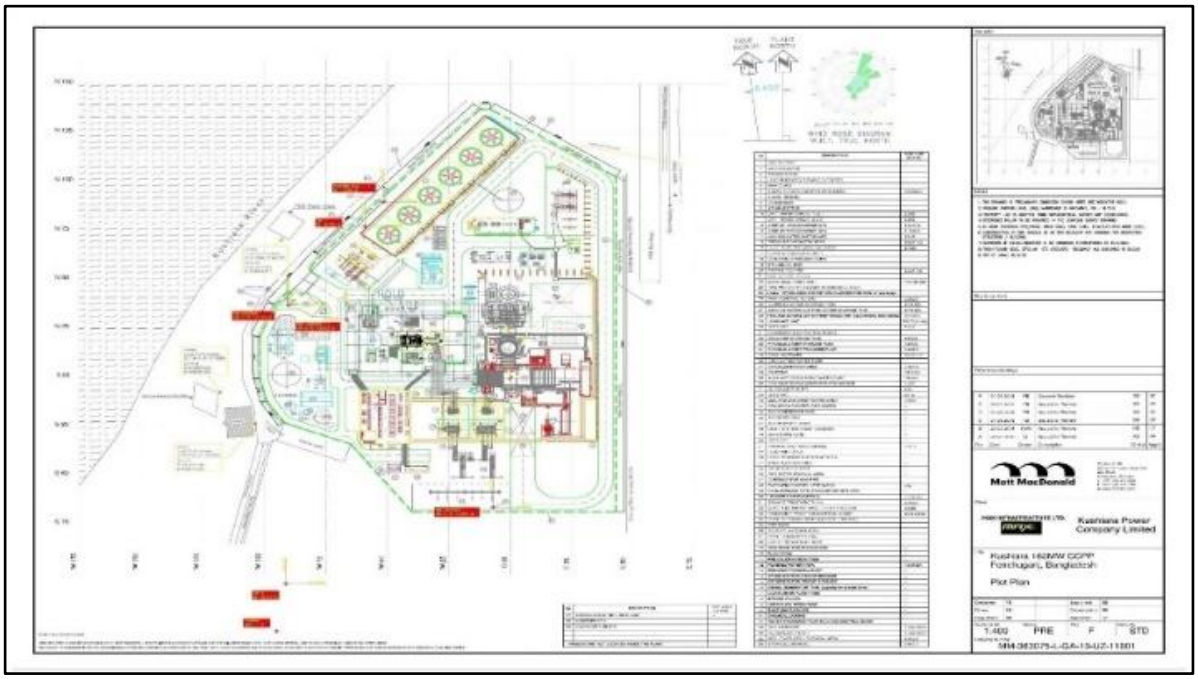


Figure 17: Layout Plan

4. Process Flow

The gas turbinecompresses air and mixes it with fuel that is heated to a very high temperature. The hot air-fuel mixture moves through the gas turbine blades,making them spin.The fast-spinning turbine drives a generator that converts a portion of the spinning energy into electricity.A Heat Recovery SteamGenerator (HRSG) captures exhaust heat from the gas turbine that wouldotherwise escape through the exhaust stack.The HRSG creates steam from the gas turbine exhaust heat and delivers it to the steam turbine.The steam turbine sends its energy to the generator drive shaft, where it is converted into additional electricity.

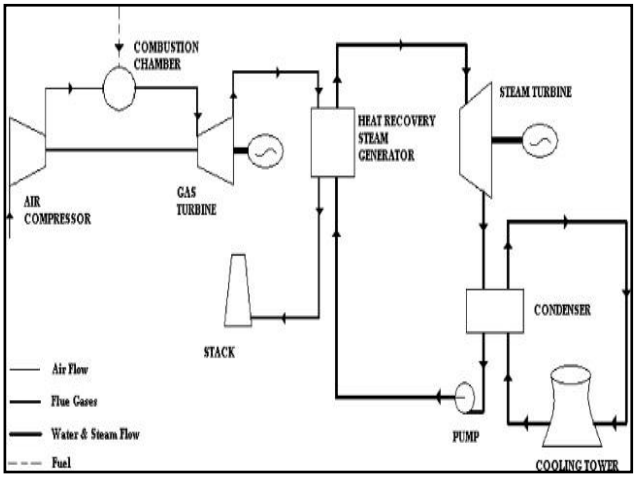


Figure 18: Flow Diagram

5. Mobilization of Material & Construction Equipment

Mobilized material & construction equipment required such as Excavator, Pay loader, Mobile Crane, Batching machine, Boring machine, Forklift, Dump truck etc. Material such as rod, brick, cement, sand, stone etc. The competent authority should check quality of the material. Material or equipment that is purchased from outside of the country should be arrange pre-shipment inspection or post landing inspection.

Figure 19: Batching Machine

6. Pilling Works

Bored piling is a method that involves boring a circular hole into the ground, installing steel reinforcement and filling the borehole with concrete to form a pile.

Figure 20: Boring Work for Piling

Foundations provide supportfor structures, transferring their load to layers of soil or rock that havesufficient bearing capacity and suitable settlement characteristics to support them. In broad sense, foundations are divided into two categories: Shallow Foundations and Deep Foundations.The word Shallow and Deep refer to the depth of the soil in which foundation is made. Shallow and Deep foundations are made as per requirement of the conditions of the soil (soil test report) and the type of structure to be built.

7. Civil Works

Civil works is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works such as residences, boundary wall, institutional/ administrative buildings, roads, canals, dams, sewerage systems, pipelines etc.

Figure 21: Foundation

8. Procure & Shipment / Transport of Major Equipment & Material

Procure & shipment/ transport of major equipment & material such as Steam Turbine, Gas Turbine, Generator, HRSG, Transformer, Switchgear, Pump, motor, Steel Structure, Pipe, Valves, Vassal, Compressor etc. All equipment may be bringing at site by means of road transport, watercraft or railcar.

Figure 22: Shipment by watercraft

9. Switchyard Construction (Power Evacuation & Back Power Arrangement)

A Switchyard or Substation, consisting of large breakers and towers, is usually located in an area close to the plant. The substation is used as the distribution center where: electrical power is supplied to the plant from the outside, and electrical power is supplied to the outside from the plant.

Figure 23: Switchyard

Substations may be owned and operated by an electrical utility, or may be owned by a large industrial or commercial customer. Generally, substations are unattended, relying on SCADA for remote supervision and control.

A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. Between the generating station and consumer, electric power may flow through several substations at different voltage levels. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

The equipment installed at the Switchyard includes, security fence, steel structures, circuit breakers, transformers, Isolators, lighting arrestor, capacitor banks and control buildings (measuring, monitoring, protection system). After the equipment is installed, a finish layer of crushed stone (typically 6 inches deep) is installed over the station. For power, evacuation & Back power feeding construct 230 / 132/ 33 KV and 11 / 6.6 KV switchyard.

10. Fuel Station Construction

Construction of Fuel station for power plant maybe Gas or Diesel or both i.e. Duel fuel.

In case of gas fuel, station is known as RMS (Regulating and Metering Station). It is consist of Condensation separator, gas-heating system, pressure control system, metering system, filter and booster compressor etc.

In case of liquid fuel (diesel), station is known as pumping station. It is consist of storage tank, service tank, transfer pump, low-pressure pump, high-pressure pump, filter, control system etc.

Figure 24: Regulating and Metering Station (RMS)

11. Gas Booster Compressor

A compressor is a specific type of gas compressor. Compressors are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe. A fuel gas boosting compressor is the "Important" for gas turbine power plants because if the fuel gas compressor fails, the gas turbine power plant stops entirely. As a result, compressors are critically important for reliable gas turbine power plant operation. At the same time, the demands on compressors have been increasing because gas turbines require higher fuel gas pressures to achieve increased performance efficiency and because pipeline pressures fluctuate due to increased overall and peak demand requirements. Therefore, selecting the correct type of fuel gas compressor is one of the most important factors in achieving successful plant operation.

Figure 25: Gas Booster Compressor

12. Construction of Compressor Station

A centralized compressed air system is needed to provide clean dry air for pneumatic instrumentation and compressed air for pneumatic tools and maintenance purposes. Compressed air shall be supplied in particular to the following buildings for maintenance and operation purposes:

- workshop and store
- water treatment plant
- turbine hall

Figure 26: Compressor Station

The instrument air receiver is designed to have adequate storage capacity capable of supplying required quantity for the whole of facility requirement and shall have at least 5 minutes holding time. Compressor may be

screw or reciprocating type.

13. GT/STGenerator

The generator shall be of the closed-circuit air-cooled or hydrogen-cooled type depending on the size and the standard model available from the manufacturer. It is consist of Stator, Rotor and Exciting system. The cooling of the generator may be by closed air or hydrogen circulation with re-cooling by auxiliary cooling water. Capacity of Generator is depend on the ST/GT capacity. Its accessories are:

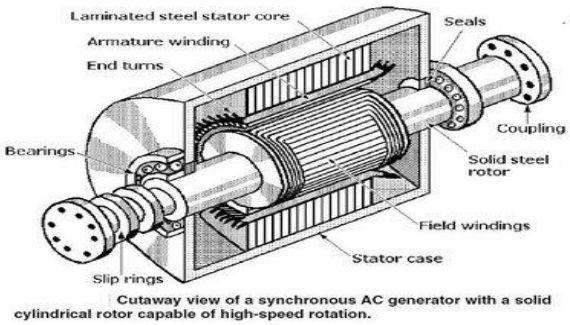


Figure 27: GT/ST Generator

- DC Power System.
- Power Control Center and Generator Protection Center.
- Starting Frequency Converter, Including SFC Transformer.
- Excitation System, Including SEE Transformer.
- Synchronization Unit.

14. Gas Turbine

For redundancy and emergency reasons, high efficiency gas turbine (GT) shall be designed for dual fuel firing, with natural gas as main fuel and High Speed Diesel as back-up fuel. The GT shall be equipped with dry-low NO_X (DLN) burners in order to meet the NO_X emission requirements without steam or water injection when firing fuel gas. For operation with back-up fuel, water shall be injected into the combustion chambers to reduce the NO_X concentration in the exhaust gas. Generally, the gas turbine unit including generator and auxiliaries shall be based on the manufacturer's standard design to secure the advantages of a standardized packaged product. Depending on the type of GT, the electrical starting system for the GT is either a static frequency converter (SFC) or an electric motor.

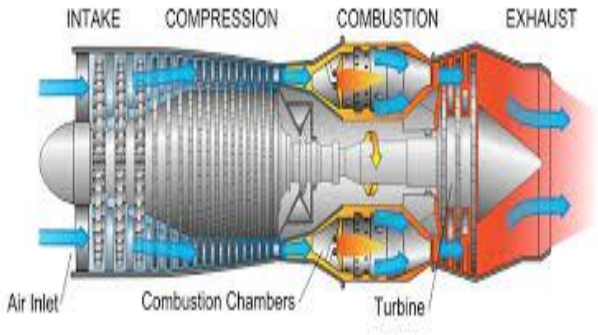


Figure 28: Gas Turbine

- Gas Turbine along with Combustors.
- Air Intake.
- Exhaust Gas System.
- Dual Fuel Module.
- Lube Oil System and Control Oil System.

15. Stream Turbine

Figure 29: Steam Turbine

The steam turbine (ST) shall be condensing type, Single Casing, Downward Exhausts Flow for HP and LP steam. The generator shall be connected to the HP end of the turbine shaft. During normal operation, the turbine receives HP and LP steam from common steam header of the HRSG. After expansion in the LP turbine, the remaining steam heat content at the turbine outlet is given up directly in a water-cooled surface condenser.
In emergencies and during start-up, the steam produced by the HRSG shall be supplied directly to the turbine condenser through the by-pass reducing and de-superheating station. The LP common steam header supplied by LP steam from the HRSG supplies the feed water tank with the necessary heating steam for deaerating and heating of the condensate collected there. The steam turbine shall be operated at sliding inlet pressure to accommodate the load changes of the gas turbine and HRSG.

- Gland Steam System.
- Condenser vacuum system.
- Close cooling water system.
- Lube oil System.
- Control oil system.
- Jacking oil system.

16. Stack Erection

Figure 30: 60 Meter Height Main & Bypass Stack

The boiler stacks have an adequate height (60 meter) so that pollutants are dispersed uniformly in the atmosphere and meet environmental requirements. Bypass stack is 60 meter height foreseen as a part of the base design.

- Diverter Damper.
- Guillotine.
- Sealing fan.
- Instrument & Control.
- Insulation.

Aviation warning lights is provided to each stack of HRSG.
For Coal based Power Plant,
500 MW or above=275 meter
200 to 500 MW=200 meter
Below 200 MW=$14(Q)^{0.3}$
Q=Quantity of deplete SO_2 (kg/hr)

17. HRSG Erection

Figure 31: Vertical type HRSG

HRSG consists of duel pressure boiler with HP and LP drum, economizer, evaporator, super-heaters, along with down comers and connecting piping. The HRSG shall be connected to the exhaust of the gas turbine via the exhaust duct. The HRSG comprise a two-pressure system without supplementary firing. They shall generate the required steam for the downstream steam turbine. The heat from the gas turbine exhaust shall be transferred to the water-steam cycle of the HRSG, where the feed water is then evaporated and the produced steam is transferred to the steam turbine by way of the common steam header. The HRSG will be designed either horizontal or vertical model.

18. Construction of Water Intake Station

Source of water maybe from River orunderground water.

Figure 32: Water Intake Station at River

19. Water Treatment Plant Construction

The water demineralization plant is set to receive treated raw waterfrom raw water tank and produce dematerialized water for HRSG, NOx control water, water washing skid and closed cooling water system in power plant.

Water demineralization can be produced by any of the two following methods:

1. Reverse Osmosis (RO) process
2. Ion exchange process.

Figure 33: Water Treatment Plant

Reverse Osmosis Process:

In this process the demineralization is done in two process steps

a) Reverse Osmosis (RO)

b) Treatment in a Mixed Bed Ion Exchanger

Reverse Osmosis Plant:

One block water requirement will be 50 cubic meter per hours. This will meet by RO plant consists of two trains, each of 50% capacity for the demand of one block. During natural gas firing one stream meets the requirement, whenever liquid fuel firing happens both blocks will be operating to meet the additional De NOx water injection requirement.

During cleaning of the membranes, only one train shall be in operation (it will be planned only when plant is operating on gas fuel). Any shortfalls in water shall be taken from the permeate storage tank. The RO plant will be sized to meet the requirements of the demineralization plant. Initial cleaning of the dealkalized raw water is provided by filtration through pre-filters before supplying it to the reverse osmosis membrane by means of a feed pump. Both trains are equipped with all necessary dosing and storage systems for chemicals, and membrane-cleaning equipment is provided for use by both. One permeate storage tank is provided for a 24 hour supply of one blocks.

Demineralization Plant (DMP):

The DMP consists of two mixed bed exchangers with strong acid cation and strong base anion resins, DM water tank and regeneration system. The regeneration system comprises the storage tanks and dosing pumps for NaOH and HCl. Two 100% streams are provided, with one working and one on standby. All common items, such as pumps, pipes, valves and controllers shall be designed accordingly. The DMP shall be of sufficient capacity to meet the requirements for NO_X abatement of the gas turbine exhausts during fuel oil operation and to replenish losses in the condensate system. The plant shall have a service run of at least 10 hours between each regeneration process.

20. Cooling Tower Construction

Figure 34: Mechanical Draft Cooling Tower

Surface Water or industrial water sources include surface waters such as lakes and rivers as well as groundwater and seawater. Finding the best water source and designing a successful project takes specialized investigation and engineering expertise.

The decision about the type and location of source water includes many factors. Technical and environmental factors such as the source water quality amount of sediment; effect of the intake and construction on aquatic life ability to maintain minimum flows and levels in the source water; proximity to neighborhoods; even political considerations must be included in the analysis of every project. Plenty of due diligence is required before design can be started.

21. Fire Fighting / Hydrant Construction

Figure 35: Firefighting station & Hydrant

A hydrant and hose station system will be located at various positions in the proposed plant, outdoor and indoor. The outdoor hydrants shall be connected to underground fire water supply piping. The distance between two adjacent outdoor hydrants around Steam turbine and generator building and transformer area shall not exceed 60 m and other areas not exceed 120 m.

The fire hydrant will be of coupling type of relevant standards. Outdoor locations shall be protected by pillar hydrants, each with two DN65 mm bib-nosed landing valve outlets and a main operating hand wheel. Underground pipe will be of 250 mm nominal bore.

The plant's indoor locations will be protected by DN65 mm gunmetal bib-nosed landing

valves. All landing valves will be made to standard. These will be of either open or recessed type as appropriate to the location.
The firefighting water will be drawn from cooling tower basin and fire water pumps will be installed in cooling water pump house. Zone valves will be installed in the system to facilitate maintenance of individual section without interrupting the whole system. Portable fire extinguishers of suitable types will be provided throughout the Plant as required. The major equipment's will be,

- A.C Motor Driven pump
- Diesel Engine Driven Pump
- Motor Driven Pump
- Jockey Pump to maintain Constant Pressure of Fire Hydrant Header
- Air Compressor,
- Pressure Vessel.

Further firefighting, protection and detection systems comprise:

- Spray water systems, such as for oil-filled transformers, lube oil facilities, etc.
- CO2 systems for electrical facilities, if applicable according to the requirements
- mobile fire protection equipment
- firefighting control system
- Fire alarm and detection system (with a main panel in the central control room).

22. Testing and Commissioning

Testing and Commissioning of allequipment simultaneously as per contract such as 100 hours continuous operation.
Commissioning is a verification process used to confirm that a facility has been designed, procured, fabricated, installed, tested, and prepared for operation in accordance with design drawings and specifications that all systems and components of plant are operated and maintained according to the operational requirements of the owner or final client. Testing and Commissioning of all equipment simultaneously as per contract such as 100 or 72 hours continuous operation before commercial operation as per DPP. Following steps are consider for testing & commission:

Figure 36: Testing Performance of Equipment

- Reliability and Performance Tests of equipment
- Cold Commissioning
- Hot Commissioning
- Trial run
- Commercial operation

23. Power Evacuation

Power evacuation is a critical function that allows generated power to be immediately evacuated from the Power Generation station to the grid for distribution. Power Evacuation is a generic term associated with plans for evacuating power generated from a generating source to a load centre by means of Sub-Station.

The system starts with generation, by which electrical energy is produced in the power plant and then transformed in the power station to high-voltage electrical energy that is more suitable for efficient long-distance transportation.

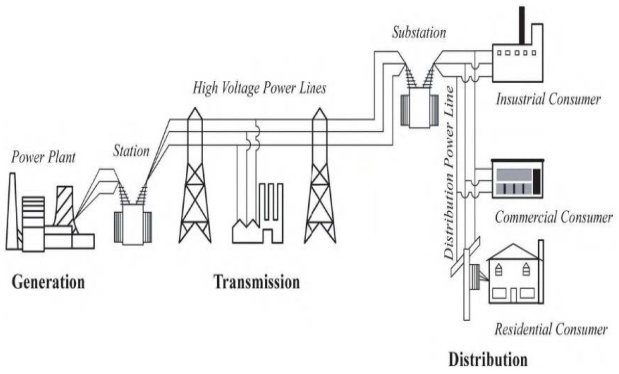


Figure 37: Power Evacuation

High-voltage (HV) power lines in the transmission portion of the electric power system efficiently transport electrical energy over long distances to the consumption locations. Finally,substations transform this HV electrical energy into lower-voltage energy that is transmitted over distribution power lines that are more suitable for the distribution of electrical energy to its destination, where it is again transformed for residential, commercial, and industrial consumption.

2.6 Stages ofConstruction Work of Transmission Line and Machineries

Power Grid Company of Bangladesh Ltd. (PGCB) was formed under the restructuring process of Power Sector in Bangladesh with the objective of bringing about commercial environment including increase in efficiency, establishment of accountability and dynamism in accomplishing its objectives.

A transmission line comprised of a system of interconnected elements, each individually designed to satisfy its respective requirements, both in technical and statutory aspects. The most robust component of a transmission line is the steel tower. The steel tower act as a support to the conductors, which are clamped to the tips of the tower crossarms by suspension or tension joints. Transmission line structures are unique compared to other structures, primarily because no human occupancy is involved and performance requirements are different from other structure types.

1. Route Reconnaissance Survey & Survey for Design

Route Surveys for Overhead Electrical Transmission Lines is done on those principles are listed as follows:

1. Select the shortest possible route.
2. Follow the highways and roads as much as possible.
3. Follow the farmer's property or section lines.
4. Route in the direction of possible future loads.
5. Avoid going over hills, ridges, swamps and bottomlands.

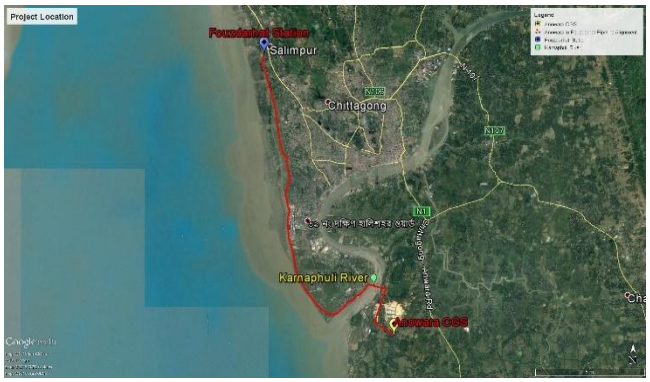


Figure 38: Route Reconnaissance Survey

6. Avoid disrupting the environment.

During the reconnaissance phase, need to study all available maps of the area to gain a general understanding of the landscape.

Look for any existing utilities that may already exist in the area. If there are existing utilities, then look for existing utilities maps. Visit the area to examine the terrain and look for any natural or man-made features that may hinder or help the construction. In short, gather all information that the engineer will need to select one or more general routes for the power line. With the tentative route or routes selected, the agency can start to conduct a preliminary survey from which a map is prepared showing the country over which the line will pass. Since the final location is not known, a wide strip of land needs to be mapped.

2. Survey for Construction / Check Survey

The contractor shall carryout check survey. After the approved profiles are received, the contractor must fix up locations based on the approved spans indicated in the profile / tower schedule and only conspicuous variations in the chainage and physical features as indicated in the profile and as actually noticed during check-survey must be brought to the notice of the utility's Engineer for taking remedial action. If the site of a tower location is not suitable for locating a tower, the location will have to be shifted suitably keeping in view the limitation of span and this will be decided by the concern Engineer.

Figure 39: Survey for Construction/ Check Survey

3. Soil Test

The field work was comprised of drilling boreholes and performing Standard Penetration Test (SPT) to satisfactory depths. The field program was performed by the technical team for Services and Design Company involved in drilling the boreholes and performing the SPT. The laboratory testing shall carry out by the technical staff of the soil mechanics laboratory in an approved institution. The field and laboratory tests were carried out to provide the subsoil profile and the soil physical and chemical properties required for calculations of the foundation soil bearing capacity and help in foundation design.

Figure 40: Soil Test

4. Right of Way (RoW)

Figure 41: Fig: Right of Way (RoW)

An electric transmission line right-of-way (ROW) is a strip of land used by Electrical utilities to construct, operate, maintain and repair the transmission line facilities.
The width of a right-of-way depends on the voltage of the line and the height of the structures. The right-of-way generally must be clear of unauthorized structures that could interfere with a power line.
The ROW or transmission Line ROW distance of different voltage level are

132kV	27 Meters
230kV	35 Meters
400kV	46-52 Meters

5. Foundation

Pile

The load on the tower depends on the type of tower.
The load on the foundation is arrived at, based on the structural analysis of the tower. Normally the foundation is designed to resist the following types of forces.

a. Uplift
b. Down thrust
c. Lateral load
d. Overturning moment

Figure 42: Pile

For a four-lagged lattice tower the foundation is to he designed for the forces uplift« down thrust and lateral load. However, the critical design force is generally the uplift.

Pile Cap

A pile cap is a thick concrete mat that rests on concrete or timber piles that have been driven into soft or unstable ground to provide a suitable stable foundation. It usually forms part of the foundation of a building, typically a multi-story building, structure or support base for heavy equipment.
They are typically used for large structures, and in situations where soil is not suitable to prevent excessive settlement. Piles can be used individually, or they can be grouped together and linked by a reinforced concrete cap.

Figure 43: Pile Cap

Earthing

Tower footing resistance (TFR) of each tower after it has been erected and before the stringing of the earth wire shall be measured during dry weather. Each tower shall be earthed and the tower footing resistance shall not exceed 10 ohms.

The provision of holes on stubs shall be made as per approved earthingdrawings. The earthing will vary depending on soil resistivity.

Figure 44: Earthing

6. Tower Erection

In the case of tower erection the method is most commonly used in Bangladesh for the erection of 132 kV, 230 kV and 400 kV transmission line towers due to the following advantages:

Tower materials can be supplied to site in knocked down condition which facilitates easier and cheaper transportation.

Tower erection activity can be done in any kind of terrain and mostly throughout the year. Because of availability of workmen at cheap rates.

This method consists of erecting the towers, member by member. The tower members h are kept on ground serially according to erection sequence to avoid search or time loss. The erection progresses from the bottom upwards. The four main corner leg members of the first section of the tower are first erected and guard off. Sometimes more than one contiguous leg sections of each corner leg are bolted together at the ground and erected.

Figure 45: Tower Erection

7. Insulator Fitting

Suspension insulators shall be used on all tangent type towers in the line and tension insulators on all angle type towers.

For ensuring insulation co-ordination, the suspension or tension strings on approach and terminal towers near the substation ends up to a length of 1.5 kilometers shall be provided with adjustable arcing horns on tower side and fixed arcing horns on line side, keeping the arcing gap as may be stipulated by the Engineer at site.

Figure 46: Insulator Fitting

8. Stringing of Conductor

The tension method means that the conductor is pulled into position under tension. ... The reel of conductor is staged behind the bull wheel tensioner. A steel cable or synthetic rope, called a pulling line/pilot wire, is strung from the puller through each stringing block between the puller and bull wheel tensioner.

Figure 47: Stringing of Conductor

9. Transmission Line Testing

Correct line parameters are crucial for reliable and selective operation of your distance protection device. It also allows an accurate fault location after an event on the line by evaluating the fault recorder. The set of parameters contains the positive sequence impedance, the zero sequence impedance and the k-factor. For double or multi-circuit lines, the mutual coupling impedance is required in addition.

Figure 48: Transmission Line Testing

2.7 Stages ofConstruction Work of Substation

A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. Between the generating station and consumer, electric power may flow through several substations at different voltage levels. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

Substations are the points for controlling supply of power on different routes by means of various equipment such as transformers, compensating equipment, circuit breakers, isolators etc. The various circuits are joined together through these components to bus-bar systems at the substations.

1. Land acquisition

Before land acquisition site have to be selected. During site selection, following things to be consider for Substation such as, Nearest Power Plant and Transmission, Water availability, Power Evacuation and Material & Equipment transportation etc. The compensation should give to the affected persons as per government policy& guideline.

Figure 49: Land Acquisition

2. Land Development

Site planning and development are crucial first steps towards transforming the land into a valuable resource with practical, compliant, and cost-effective solutions.
Site development begins with the clearing of vegetation at the site. Temporary environmental controls, such as silt fence, are also installed at this time. The area is then leveled by cutting and filling as necessary to bring the site up to subgrade. Sand and aggregate fill materials may be brought in to make a level site for construction.

Figure 50: Land Development

The substation site development also includes the installation of any required environmental controls such as plunge pools, retention ponds, or rip-rap slopes. The final grading and seeding of the areas outside of the substation fence will be installed during this phase.

3. Foundation

After site development is completed, the equipment foundations will be installed. The foundations are reinforced concrete and may be drilled pier or spread footing foundations depending on the size and weight of the equipment. Main scope for foundation work

- Excavate and install support
- Construct underpinning
- Concreting for foundation work including, install formwork, reinforcement and concrete
- Install piling including, driven piles, cast-in piles, groutcrete piles, compressed piles and bored cast-

Figure 51: Foundation

in-place piles
- Dewater site including, sump and permanent dewatering systems

4. Grounding System

M.S.Flat or Copper cable shall be used for earthing. The earth mat shall be as per the drawing and extend over the entire switchyard. The earth mat shall be formed with the steel flats buried in the ground at a certain depth on edge. Wherever necessary, these shall have to be buried at larger depths to restrict potentials within permissible values. G.I. wire or Copper shall be used to connect the overhead ground wires to the ground mat, along the structures at all the locations.

Figure 52: Grounding System

5. Control Building

A control room's purpose is production control, and serves as a central space where a large physical facility or physically dispersed service can be monitored and controlled. The control building the control and protection equipment. Most substations have permanent technical staff for system operation as well as maintenance service.

Figure 53: Control Building

6. Battery System

DC distribution is needed in substation to provide power supply to control &protection equipment situated in substation in case of outages/faults.
Generally DC power is used for this purpose instead of AC, since the reaction time of the protective device is less, operating on DC supply.
Also, as mentioned by Anuj Gupta, system of DC Distribution Board (DCDB), Battery Chargers and Battery Bank are used for this purpose. Further, the Battery charger is supplied through a different power supply/transformer (AC), to provide redundancy.

Figure 54: Battery System

7. Gantry Structure

Substation gantry structure foundations must be such that it safely sustains and transmits to the ground the combined dead load, imposed load, and wind load in such a manner as not to cause any settlement or movement which would impair the stability of the structure or cause damage.

Figure 55: Gantry Structure

8. Equipment Installation

Following installation of the foundations, the substation equipment is delivered and installed at the station. The equipment installed at the stations includes, but is not limited to, substation security fence, steel structures, circuit breakers, transformers, capacitor banks, and control buildings.

After the equipment is installed, a finish layer of crushed stone is installed over the entire station up to the base of the structure foundations.

Figure 56: Equipment Installation

Lightning Arresters (LA) is used for the protection of the equipment at the substations against travelling waves, such type of device is called lightning arrester or surge diverter. In other words, lightning arrester diverts the abnormal high voltage to the ground without affecting the continuity of supply. It is connected between the line and earth, i.e., in parallel with the equipment to be protected at the substation.

Figure 57: Lightning Arresters

Voltage transformers lower the voltage so protection and control units can measure it. Voltage is the difference in electrical level (or potential) between two points. It's expressed in volts (V). A 735-kV line is thus at a very high voltage—many thousands of volts. Potential transformers are generally located where lines enter and exit the substation.

Figure 58: Voltage Transformers

Current transformers lower the amount of current so that protection and control units can measure it. Current is comparable to flow. It is alternating or direct and expressed in amperes or amps (A).

Figure 59: Current Transformers

Disconnect switches are found in several locations at a substation. They play a vital role in ensuring worker safety since they electrically isolate circuits or units undergoing maintenance and make this isolation visible. To visualize how a disconnect switch works, just imagine a section of railway track that can be freely lifted and turned to prevent energy from traveling along a path. A disconnect switch is used once a breaker has opened a circuit and no charge is present.

Figure 60: Disconnect switches

Circuit breakers are used to open and close circuits. Circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit. Its basic function is to interrupt current flow after a fault is detected. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

Figure 61: Circuit Breakers

Busbar assemblies are large, generally rigid aluminum conductors that link circuits together. They can be compared to the distribution panel in a home, where electric current arrives. The distribution panel is used to parcel out current among the various circuits to be supplied. The main difference is that busbars carry and distribute very large currents.

Figure 62: Busbar Assemblies

Transformers is the major part of a substation and almost all equipment and sub systems are slaves of the master equipment. Power transformers are at the heart of the substation.
Transformers are used for increasing or decreasing the alternating voltages in electric power applications, and for coupling the stages of signal processing circuits.

Figure 63: Transformers

9. Commissioning, testing, energizing

When required by the local authority, commissioning tests and checking must be successfully completed to get the authorization to energize a new installation.
All Equipment, switches, wiring, relays, controls, grounding systems, batteries, generators, buildings and associated systems, and all other devices shall be tested and verified by Contractor to meet the manufacturer's recommendations and Industry Standards and to be fully functional. In addition, the specific testing and commissioning criteria as stated in this document must be completed by Contractor. Testing is to be complete and as extensive as necessary to ensure the proper operation and functionality of the entire Project.

Figure 64: Commissioning

The following tests and checking are generally mandatory and applicable to the whole installation:

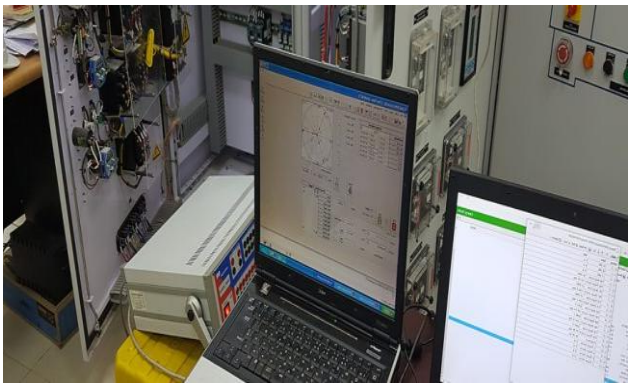


Figure 65: Testing

- Verification that the main substation complies with all the requirements expressed by the utility measurement of earth-electrodes resistances
- Electrical continuity of all equipotential and bonding conductors
- Inspection and functional testing of all equipment and system.
- Exclusive test of switchgears and transformers
- Inspection and testing of the LV parts of the installation
- Mechanical and electrical interlocks checking Protective-relays checking
- Other additional tests and checking mat be required.

2.8 Stages of Construction Work of ElectricityDistribution Line

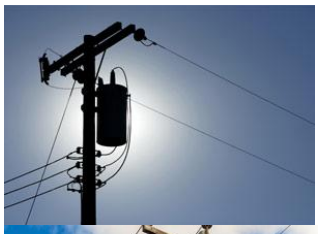
BPDB is responsible for distribution of electricity in most of urban areas in Bangladesh except Dhaka Metropolitan City and its adjoining areas under DPDC and DESCO areas under West Zone Power Distribution Company Limited (WZPDCL), Northern Electricity Supply Company Ltd (NESCO) and some of the rural areas under Rural Electrification Board (REB).

The distribution network comprises of 33 KV, 11 kV and 0.415 KV lines. Total distribution line in the country is more than 3,03,000 km .The per capita consumption of electricity is 464 kwh in 2018. Electricity coverage reach to 92 %. Total consumer 3 cores 3 lac.

To meet the target to develop the distribution network 3,03,000 km by 2018. 14,014 km by 2019, 15,527 km by 2020, 17,304 km by 2021, 18,838 km by 2022, 20,443 km by 2023. Many more project work in implementation and planned. The major activities or Steps in construction of distribution are similar to construction of transmission line.

Pole is mainly used instead of Latice tower. Size of transformer is small. All fitting are adjustable to low voltage.

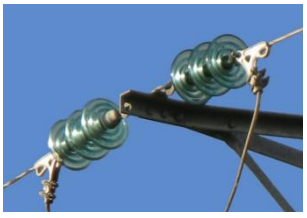
Pole & Pole mounted single phase transformer



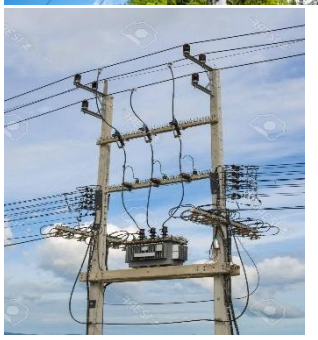
Pin Insulator

Pole & Pole mounted 3 nos. of single phase transformer

Shackle Insulator

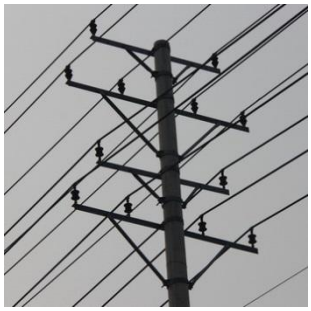


Pole & Pole mounted 3 phase transformer



Transformer (11/0.4 kV)

Pole & distribution lines



Transformer (33/11 kV)

Distribution Project

For the development of distribution system in the urban areas, BPDB takes different Town Distribution Projects. Before taking any Town Distribution Project, a study is conducted to asses different types of works required for the development. Similarly Rural Electrification Board develops distribution system in the rural areas through different Rural Electrification Program. Dhaka Metropolitan City and its adjoining areas under DPDC and DESCO, areas under West Zone Power Distribution Company Limited (WZPDCL) and Northern Electricity Supply Company Ltd (NESCO) also takes different projects to develop distribution system in the urban and rural areas.

The most important considerations for short term planning are:

- Minimizing the cost of laterals, feeders, sub-transmission systems, substations, and equipment required for control and protection and cost of losses while respecting the limits set by permissible voltage values, voltage dips and flicker.
- Maintaining service continuity, reliability and security of the system.
- Taking into account factors like transformer impedance, insulation levels, availability of spare transformers and mobile substations, dispatch of generation and rates that are charged to customers.

Figure 66: Distribution lines through a countryside of Bangladesh

Distribution Planning

The objective of distribution planning is to assure that the growing demand for electricity in terms of increasing growth rate and high load density, can be satisfied in an optimum way.

Distribution planning starts at customer level. The demand, type, load factor and customer load characteristics dictate the type of distribution system required.

For long term planning, the factors that are to be considered are:

- The timing, location and type of energy demand
- The duration and frequency of outage of equipment
- Labour and money
- Increasing fuel costs
- Increasing or decreasing prices of alternative energy sources
- Changing socio-economic conditions
- Regulations of Federal and State governments

Distribution planning involves various activities like load forecasting (type, location and amount), electrical and mechanical design, economic and other considerations in planning. Automation has also become important in distribution planning.

2.9 Maintenance of Power Plant

Power plant maintenance can be divided into two general categories:

a) Running maintenance and
b) Preventive maintenance

a) Running Maintenance

Running maintenance includes the hourly, daily and weekly maintenance requirements recommended in the manufacturer's literature. Some running maintenance and routine checks include the following:

- Check Bring oil level.
- Check free movement of ventilation louvers.
- Check Drain water and sediment from strainers and filters.
- Maintain level of coolant.
- Check radiator and coolant hoses for leaks.
- Check battery electrolyte level.
- Check all switches for proper operation.
- Drain water from fuel tank.
- Fill fuel tank as required with appropriate diesel fuel.
- Check fuel tank for leaks.
- Log all running maintenance events in the operations logbook when it is completed.

b) Preventive Maintenance

Preventive maintenance includes the monthly, quarterly and annual maintenance checks recommended in the manufacturer's literature. The maintenance supervisor is responsible for establishing a maintenance schedule to ensure the preventive maintenance is performed. A maintenance logbook should be established for each equipment of the plant and all maintenance checks recorded. The operation log book should be reviewed periodically to ensure that all preventive maintenance recommended by engine operating hours is scheduled; for example, the schedule of engine lube oil and filter replacement is normally based on hours of operation.

2.10 Maintenance of Power Transmission Line and Substation

The transmission lines play a very important role in transmitting the huge quantum of electrical power generated at various generating stations to the whole area of the country from one end to other end over a distance of several hundreds of kilometers. By such transmission it is possible to distribute the power to the various types of customers through very complex High Voltage Substations, at lowest possible line losses with highest level of reliability.

For uninterrupted power supply, it is essential to maintain the transmission lines and Substations in trim and healthy condition. Transmission lines under Power Grid generally go through the following types of maintenance procedures:

a) Schedule Maintenance

- Monthly routine maintenance
- Annual maintenance
- Preventive and predictive maintenance

b) Unscheduled Maintenance

- Emergency/ breakdown maintenance
- Development work related maintenance

3. ENERGY SUB-SECTOR

The Energy and Mineral Resources Division deals with the Import, Distribution, Exploration, Extraction, Pricing and other policy related details of the primary fuels. It has separate entities for Oil, Gas and Coal.

The main entities that look into these issues are Bangladesh Oil, Gas and Mineral Corporation (Petrobangla), and Bangladesh Petroleum Corporation (BPC). Bangladesh Petroleum Exploration and Production Company Limited (BAPEX) is looking after exploration and extraction. The three main distribution companies for Petroleum are Padma, Meghna and Jamuna.

A company under Petrobangla, Bangladesh Gas Fields Limited, looks after the operation of government controlled gas fields. The Gas Transmission Company Limited (GTCL) and Titas Gas Transmission & Distribution Company Limited (TGTDCL) are the gas transmission and distribution entities respectively.

In the coal sector, the premier entity is the Barapukuria Coal Mine Company Limited (BCMCL), which looks after the only operational coalmine in the country.

3.1 Glossary of Energy Sub-Sector related Terminologies

Adverse impact: An impact that is considered undesirable.

Ambient air: Surroundingair**.**

Aquatic: Growing or living in or near water

Bangla: Bengali language.

Backfilling the trench: Once the pipeline is in place in the trench, the trench is carefully backfilled so as not to damage the pipe coating.

Back Pressure: Pressure against which a fluid is flowing. May be composed of friction in pipes, restrictions in pipes, valves, pressure in vessels to which fluid is flowing, hydrostatic head, or other resistance to fluid flow.

Baseline (or Existing) Conditions: The 'baseline'essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e. the 'No-development Option'.

Bazar: Market.

Beel:A "back swamp" or depression. Can be either perennial or seasonal.

Beneficial impacts:*Impacts*, which are considered to be desirable and useful.

Biological diversity: The variety of life forms, the different plants, animals and micro Organisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity

Booster: A compressor used to raise pressure in a gas or oil pipeline.

Booster Station: A facility containing equipment which increases pressure on oil or gas in a pipeline.

Calibrate: To ascertain, usually by comparison with a standard, the locations at which scale or chart graduations should be placed to correspond to a series of values of the quantity which the instrument is to measure, receive or transmit. Also, to adjust the output of a device, to bring it to a desired value, within a specified tolerance for a particular value of the input. Also, to ascertain the error in the output of a device by checking it against a standard.

Cathodic Protection: A technique to prevent the corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

Cushion Gas: Non-working volume of gas in a cavern.

Density: The weight of a unit of volume, usually expressed as pounds per cubic foot.

Depletion: As applied to natural gas producing land and land rights, means the loss in value incurred in connection with the exhaustion of a natural resource.

D&P: Drilling & Production

Easement: A right-of-way agreement between the pipeline company and the property owner giving a pipeline company a right to use a right-of-way for the construction, operation, and maintenance of a pipeline. It may also include temporary permits, licences, and other agreements allowing the use of one's property. The easement holder typically has the right to access and inspect the property contained within the easement and to place certain restrictions on how the property can be changed, maintained or used, while all other rights remain with the landowner.

Ecosystem: A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit.

Emission: The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.

Endangered species: Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.

Environmental effects: The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.

Environmental Impact: An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.

Environmental management: Managing the productive use of natural resources without reducing their productivity and quality.

EPC: Engineering, Procurement and Construction

Erosion: Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field.

Evaluation: The process of looking back at what has been really done or accomplished.

Fauna: A collective term denoting the animals occurring in a particular region or period.

Field Reconnaissance: A field activity that confirms the information gathered through secondary sources. This field study is essentially a rapid appraisal.

Flora: All of the plants found in a given area.

GDP: Gross Domestic Product. Market value of all final goods and services produced within a country in a given period.

Habitat: The natural home or environment for a plant or animal.

Important Environmental Component (IEC): These are environmental components of biophysical or socio-economic importance to one or more interested parties. The use of important environmental components helps to focus the environmental assessment.

Initial Environmental Assessment/ Evaluation: Preliminary analysis undertaken to ascertain whether there are sufficient likely significant adverse impacts to warrant a "full" EIA. In some countries, use of initial assessment forms a meaning of "screening" proposed projects.

Khal: Small Channel, Canal

Land use: Types include agriculture, horticulture, settlement, pisciculture and industries.

Mauza: A Bangla word for the smallest government administrative area corresponding to a village revenue unit.

Mitigation: An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.

Negative Impact: negative change from the existing situation due to the project.

Permanent Right-of-Way: Usually a narrower strip to enable access for inspection, maintenance, repair and protection of the pipeline. The pipeline company shall have the right to access the strip at any time.

PIG (Pipeline Intelligent Gauge): A generic term to describe a device that travels inside the pipeline. "Pigs" can be used for a number of purposes including cleaning, gauging and measuring the condition within the pipeline.

Pipe Coating: A corrosion resistant material (such as asphalt or tar), sometimes with an outer wrapping, used to protect pipe.

Pipeline: All parts of those physical facilities through which gas is moved in transportation, including pipe, valves, and other appurtenances attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

Pigging: The process of cleaning or measuring internally the pipeline whereby a "pig" is sent though the line to clean/ measure the inside of the pipeline.

Pipe Yard: The area used for the temporary storage of pipe prior to spread.

Pressure: When expressed with reference to pipe, the force per unit area exerted by the medium in the pipe.

Pressure Regulating Station: Equipment installed for the purpose of automatically reducing and regulating the pressure in the downstream pipeline or main to which it is connected. Included are piping auxiliary devices such as valves, control instruments, control lines, the enclosures, and ventilating equipment.

Stakeholders: Those who may be potentially affected by a proposal e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or take an interest in it.

QRM: Quality and Risk Management. Identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events.

ROW (Right-of-Way): A narrow, un-obstructed strip or corridor of land of a specific width directly above the pipeline and around the supporting facilities, where some of the property owner's legal rights have been granted to a pipeline company. A right-of-way agreement between the pipeline company and the property owner is also called an easement. Rights-of-ways and easements provide a permanent, limited interest in the land that enables the pipeline company to operate, test, inspect, repair, maintain, replace, and protect one or more pipelines on property owned by others.

SCADA: System, Control and Data Acquisition. Industrial control system: a computer system monitoring and controlling a process. The process can be industrial, infrastructure or facility-based.

Temporary Right-of-Way: A strip normally 20 feet wide to enable the construction of the pipeline. Additional space is usually required at road or river crossings or when required by terrain or soil.

Taka: Unit of Bangladeshi currency

Terrestrial: Living on land

Thana: Sub-district level of government administration, comprising several unionsunder a district.

Union: Smallest unit of local self government comprising several villages

Upazila: Sub-district name. Upazila introduced in 1982

Valve: A mechanical device for controlling the flow of fluids and gases; types such as gate, ball, globe, needle, and plug valves are used.

Zila: Bengali word of district.

3.2 Stages of Construction Work of Gas Transmission Pipeline

1. Route Selection

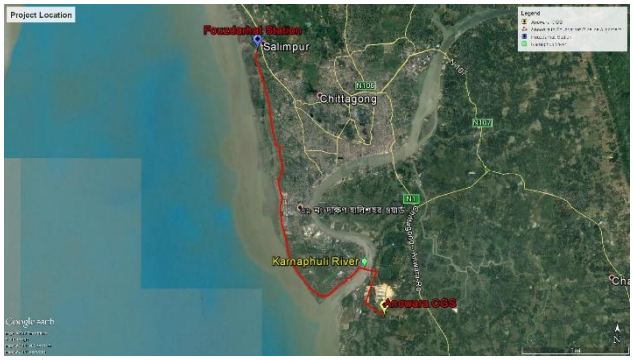


Figure 67: Route Selection for Gas Pipeline

To minimize the adverse impact on the environment, identification of a suitable corridor for pipeline is very important. The actual distance may vary or increase significantly from the aerial distance and will depend on alternative options for selecting a particular route. Which ever is the pipeline route, it will pass through numerous agricultural lands, vegetation, private land and river and drainage canal. Three options have been considered in selecting the proposed Gas Transmission pipeline right-of-way (ROW). Factors those were taken into account include:

- Length of the Route
- Minimal Highway Crossing;
- Avoid Railway tracks crossing as much as possible
- Avoid Rivers crossing as much as possible
- Minimal obstruction to habitation;
- Avoid large trees and tree plantations as much as possible;
- Avoid water bodies and/ swampy areas as much as possible;
- Avoid homestead, schools, grave yard, mosque, church/ temple, cremation yards etc. and
- Avoid environmental sensitive areas, historic and archaeological sites as much as possible.
- Minimum cost and least level of absolute environmental and social impacts.

2. Manpower Engagement

Figure 68: Manpower Engagement

Pipeline construction work will be conducted using both mechanized equipment and manual labor where necessary. The major activities include ROW clearing, pipe stringing, welding, trenching and testing. For this purpose, a number of skilled, semi-skilled and unskilled workers will be employed. Overall supervision of the construction activities will be made by the professionals from Petrobangla/GTCL. Pipeline supervisors and inspectors will permanently be involved with the project along with other personnel. They will monitor and report on construction activities to the head office regularly. Project Director, Engineers, and Financial/Economic Analyst will be involved for the project. In addition, some more staffs will be engaged during implementation of the project.

3. Pipeline Route and Working Areas

The width of the pipeline trench for this project is approximately 1.0 meter, but about 8 meters right-of-way (ROW) will be permanently acquired in addition to 15 meter strip under temporary requisition along the pipeline ROW for the smooth works. In some cases, the width of the ROW may vary up to 3+/-meters depending upon the accessibility into the location. For construction in the Private land and in the highway a reduced ROW width will be utilized wherever possible.

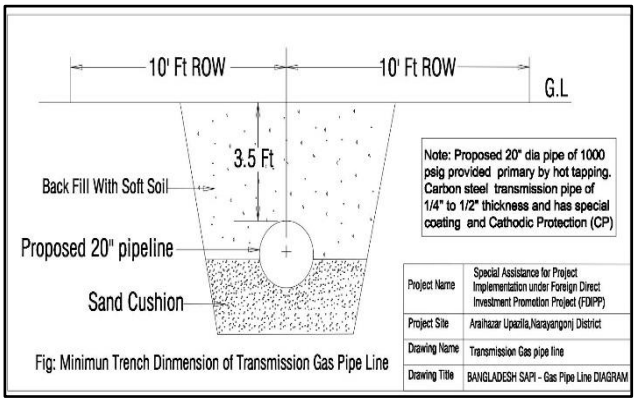


Figure 69: Pipeline Width

In general, the Contractor shall clear and grade the ROW by removal of crop and vegetation. Trees, gardens etc. will be avoided whenever possible. Debris shall be removed to the extreme edge of the right-of-way so that these are not mixed with trench backfill material.

4. Grading

The purpose of grading is to provide adequate right-of-way access and ditch-line preparation to complete construction. In order to achieve this goal, a detailed survey shall be conducted using proper supervision and inspection practices. Attempts should be made to lay the pipeline in areas, which will minimize grading.

Figure 70: Land Grading

5. Trenching and Trenching Diameter

The pipeline will have casing whenever it crosses a highway or rail track. The minimum depth of cover shall be measured from the top of the pipe to the surface of the working grade. Crown materials along the surface of the ground level will not be considered as a part of the depth of cover. The specified depth of trench can be varied as suggested by the engineer or his representatives considering the site condition. The trench shall be carefully cut so that the pipe is evenly bedded throughout its length with sufficient joint holes and trial holes made where necessary. The minimum base width of the trench shall be specified in supplemental/ standard drawings.

Figure 71: Trenching

6. Pipe Diameter

The larger the diameter of pipe, the greater right-of-way width is required. Large diameter pipe will require very accurate bends. The amounts of tough bends are usually kept to a minimum. Increasing the number of bends increases the amount of grading, coupled with the fact that specialized heavy equipment is necessary.

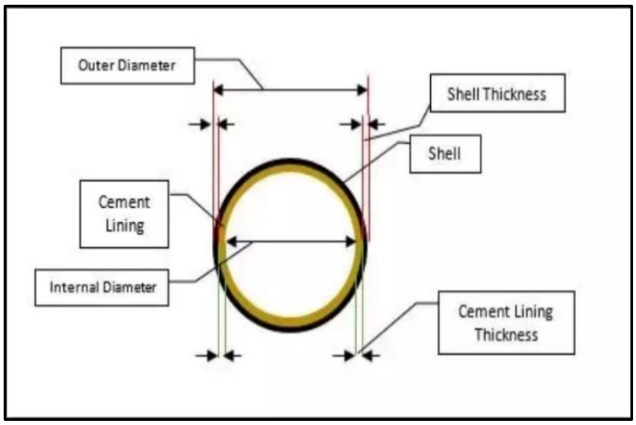


Figure 72: Pipe Diameter

7. Ditch Depth Factor

The amount of soil excavated from the ditch to meet construction specifications is the main factor in determining the width of right-of-way with respect to ditch depth. Ditch depth will vary depending on the use of the pipeline (the top of the pipeline will always be a minimum of 36 inches from the surface), soil characteristics and applicable codes and regulations.

Figure 73: Ditch Depth Factor

8. River Crossing

All care should be taken to see that Horizontal Directional Drilling (HDD) is performed to cross the river at proper alignment and depth below the river bed. The banks of the rivers should be properly re-instated and protected from subsequent erosion. The pipeline crossing section should be properly hydro-tested before tie-in.

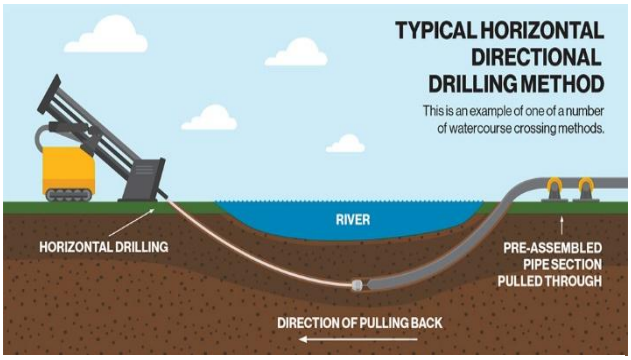


Figure 74: River Crossing

9. Stringing

Pipes should be strung only on the right-of-way which has been cleared and where grading has been completed. The Contractor shall ensure that the pipe is strung for proper placement of the pipe size. Pipes shall be raised on sandbags.

Figure 75: Stringing

10. Coating of Pipe

The pipeline will be coated using 3 layer polyethylenes (3 LPE). Buried pipes and fittings shall be protected against corrosion by means of external coating and wrapping. Holiday detectors shall be used to detect any holiday and shall be repaired.

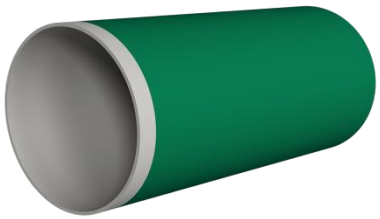


Figure 76: Coating of Pipe

11. Lowering-in and Tie-In

Lowering-In

Commencement of the lowering-in shall take place as soon as possible after the trench has been excavated.

Tie-In

Separate welded joint sections of the pipeline shall be tied into a continuous system in such a manner that no stress will be induced into the pipe as a consequence of the tie-in operation.

Figure 77: Lowering-In

Figure 78: Tie-In

12. Cathodic Protection

Cathodic protection test points shall be installed and connected to temporary cathodic protection facilities in accordance with the specification as the final operation of lowering or tie-in is in progress. The installation shall require inspection before back-fill is placed.

Figure 79: Catrhodic Protection

13. Back filling

Before any back filing is performed, the pipeline will be evenly bedded upon the bottom of the trench throughout its length and will be correctly positioned. Holiday detector shall be used to detect holiday if any and shall be repaired before backfilling. Compaction of back filling material shall be performed by an approved method to prevent any subsequent settlement.

Figure 80: Back Filling

14. Route Marker and Aerial Marker

Reinforced concrete route markers shall be installed along the pipeline route on both sides of roads, rail, and river crossings with a maximum of 0.2 km separation distance between the markers.
Aerial markers shall be installed at every horizontal bend and at intervals along the pipeline route with a maximum separation distance of 1.6 km between the aerial markers.

Figure 81: Route Marker and Aerial Marker

15. Commissioning

Figure 82: Commissioning

The pipeline shall be commissioned following hydrostatic testing, pigging and dewatering. All installation facilities shall be purged with Nitrogen prior to commissioning and provision shall also be made for Nitrogen to be used in the pipeline commissioning phase. Upon completion of the commissioning and appropriate reinstatement and clean up of the ROW including installation of cathodic protection test points, ROW markers and aerial markers etc. in accordance with the programme and procedures, to the satisfaction of the engineer, the pipeline system will be taken over for operation by the company.

3.3 Maintenance of Gas Transmission Line

The gas transmission lines play a very important role in transmitting the huge quantum of gas generated at various generating gas well to the whole area of the country from one end to other end over a distance of several hundreds of kilometers. By such transmission, it is possible to distribute the gas to the various types of customers at lowest possible line losses with highest level of reliability.

For uninterrupted gas supply, it is essential to maintain the gas transmission lines and TBS/CGS/Valve Station in trim and healthy condition. Transmission lines under GTCL generally go through the following types of maintenance procedures:

a) Schedule Maintenance
- Monthly routine maintenance
- Annual maintenance
- Preventive and predictive maintenance

b) Unscheduled Maintenance
- Emergency/ breakdown maintenance
- Development work related maintenance

4. INDUSTRY SUB-ECTOR

The contribution of Industry Sector to GDP is progressively increasing in Bangladesh. According to BBS, the contribution of the broad industry sector to GDP has been estimated at 33.66 percent in FY2017-18 which was 32.42 percent in FY2016-17. Among the broad industry sectors the contribution of the manufacturing sector is the highest. According to the GDP of FY2017-18 the contribution of the manufacturing sector in real GDP is 22.85 percent which was 21.74 percent in FY2016-17. In fact the Government is persistently taking comprehensive measures for developing and flourishing of all industrial sectors of the country such as manufacturing industry and fuel industry for energy security, agriculture and forestry, mineral extraction and processing industry, tourism and service industry, construction industry and ICT based industry. In order to accelerate the pace of industrialization of the country the government announced the 'National Industrial Policy-2016'. The importance and underlying objectives of the Industrial Policy 2016 include sustainable and inclusive industrial growth through generation of productive employment to create new entrepreneurs, mainstreaming women in the industrialization process and international market linkage. The government is continuing its efforts to achieve this goal by providing loans and other ancillary supports through banks and other financial institutions. As a result, the volume of both distribution and recovery of industrial loan are on the increase. The EPZs are playing special role in the process of promoting rapid industrialization and attracting foreign direct investment.

4.1 Glossary of Industry Sub-Sector related Terminologies

Ammonia: The term ammonia shall mean agricultural anhydrousammonia (NH3) fertilizer.

Analysis: The percentage composition as found by chemical measurement, expressed in those termsthat laws require or permit.

Asset turnover: a measure of how efficiently assets are used to produce sales. The ratio shows how many dollars of sales were generated by each dollar of assets. Calculate by dividing net sales by average total assets.

Bottleneck: Any point at which movement is slowed because demand placed on a resource is greater than capacity.

Bulk: Qualification given to a fertilizer or soil conditioner not packed in a container

Centrifugal: A perforated basket which spins inside a casing to separate sugar crystals from molasses

Color: Attenuation index, determined by absorption of light under defined conditions.

Crystallization: The process of "growing" crystals by boiling them with syrup in a vessel (under vacuum). Nucleation and growth of crystals

Cross-training: Skill-development practices that require or encourage production workers and other employees to master multiple job skills, thus enhancing workforce flexibility.

Fertilizer: In the simplest terminology, a material, the main function of which is to provideplant nutrients.

Filter mud: In clarifying cane juice, the insoluble matter extracted from the juice forms a mud which is removed from the clarifiers, filtered and washed to recover the sugar it contains. The solids consist of mainly field soil, fiber, calcium phosphate, denatured protein and a small amount of sugar.

Final molasses: The black syrup, commonly known as molasses or 'C' syrup, remainingafter the sugar syrup has been boiled and passed through the centrifugal for the last time ina mill or refinery. The sugar it contains cannot be removed economically.

Juice: Cane juice consists of water with sugar and other substances dissolved in it and a proportion of insoluble particles suspended in it.

Manufacturing cost: Includes quality-related costs, direct and indirect labor, equipment repair and maintenance, other manufacturing support and overhead, and other costs directly associated with manufacturing operations. It does not include purchased-materials costs or costs related to sales and other non-production functions.

Manufacturing cycle time: The time of actual production from when a customer order is released to the plant floor for a particular product through to the completion of all manufacturing, assembly, and testing for that specific product. (Does not include front-end order-entry time or engineering time spent on customized configuration of nonstandard items, or time in finished goods inventory.)

Phosphate: An element found in many phosphate minerals, which can be processed toinorganic phosphate products for use as fertilizer and industrial applications.

Powder: A solid substance in the form of very fine particles. Powder is also referred to as"no granular fertilizer" and is sometimes defined as a fertilizer containing fine particles,usually with some upper limit such as 3 mm nut no lower limit.

Preventive maintenance -- Maintenance activities, often performed by machine operators at regularly scheduled intervals, to keep equipment in good working condition.The manufacture of products such as chemicals, gasoline, beverages, and food products that typically are produced in "batch" quantities rather than discrete units. Many process operations require inputs such as heat, pressure, and time (for thermal or chemical conversion).

Raw sugar: Brown sugar produced in a raw sugar mill generally destined for further processing to white sugar in a refinery.

Refining: The purification of sugar through chemical and physical methods, generally including some or all of clarification, filtration, decolourization and recrystallization.

Saturation: A sugar solution at saturation will not dissolve any more crystals at the temperature of the solution

Soil Conditioner: Material added to soils, the main function of which is to improve theirphysical and/ or chemical properties and/ or their biological activity.

Sugar: Term for the disaccharide sucrose and products of the sugar industry, essentially composed of sucrose.

Sugar cane: Sugar cane belongs to the vast family of grasses which include other crops such as barley, wheat, rice and maize.

Syrup: The concentrated juice from the evaporators.

Tons: short tons – unit of mass equal to 2000 pounds (907kg), as opposed to metric tons which is equal to 2204.62 pounds (1000kg). In this document, all references to tons are short tons.

Urea: a solid nitrogen-containing product produced by reacting ammonia and carbon dioxide, under pressure. Used for fertilizer and numerous industrial uses. It contains 46% nitrogen.

4.2 Stages ofConstruction Work of Fertilizer Industry

1. Raw Material

1. Ammonia - NH_3
2. Carbon dioxide - CO_2

Ammonia can be manufactured by Haber process. CO_2 is prepared by decomposition of limestone ($CaCO_3$).

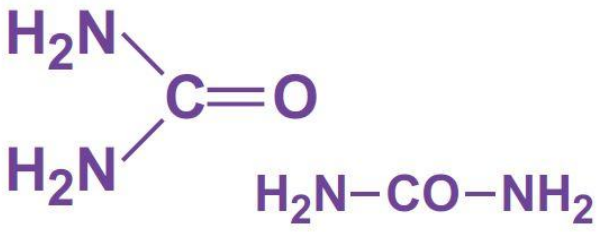


Figure 83: Urea Reaction

2. Manufacturing Process

Liquid ammonia is allowed to react with liquid carbon dioxide in a reactor at high temperature and pressure. The conditions employed are 130-150^{0}C and a pressure of 35 atm. urea is formed in two-step reactions.

$$NH_{3(g)} + CO_{2(g)} \leftrightharpoons NH_2COONH_{4(s)}$$
$$NH_2COONH_{4(s)} \leftrightharpoons CO(NH_2)_{2(aq)} + H_2O_{(l)}$$

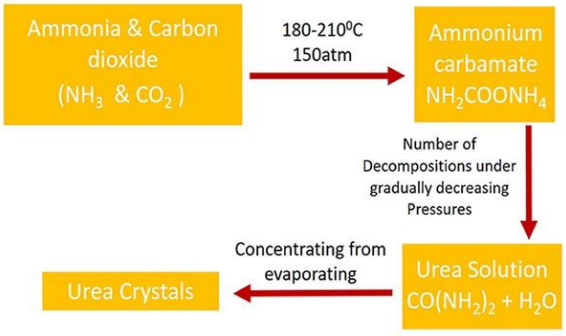


Figure 84: Process flow

Synthesis

A mixture of compressed CO_2 and ammonia at 240 barg is reacted to form ammonium carbamate. This is an exothermic reaction, and heat is recovered by a boiler which produces steam. The first reactor achieves 78% conversion of the carbon dioxide to urea and the liquid is then purified. The second reactor receives the gas from the first reactor and recycle solution.

From the decomposition and concentration sections. Conversion of carbon dioxide to urea is approximately 60% at a pressure of 50 barg. The solution is then purified in the same process as was used for the liquid from the first reactor.

Purification

The major impurities in the mixture at this stage are water from the urea production reaction and unconsumed reactants (ammonia, carbon dioxide and ammonium carbamate). The unconsumed reactants are removed in three stages. Firstly, the pressure is reduced from 240 to 17 barg and the solution is heated, which causes the ammonium carbamate to decompose to ammonia and carbon dioxide:

$NH_2COONH_4 = 2NH_3 + CO_2$

At the same time, some of the ammonia and carbon dioxide flash off. The pressure is then reduced to 2.0 barg and finally to -0.35 barg, with more ammonia and carbon dioxide being lost at each stage. By the time the mixture is at -0.35 barg a solution of urea dissolved in water and free of other impurities remains.

At each stage, the unconsumed reactants are absorbed into a water solution which is recycled to the secondary reactor. The excess ammonia is purified and used as feedstock to the primary reactor.

Concentration

75% of the urea solution is heated under vacuum, which evaporates off some of the water, increasing the urea concentration from 68% w/w to 80% w/w. At this stage some urea crystals also form. The solution is then heated from 80 to 110^0C to redissolve these crystals prior to evaporation. In the evaporation stage molten urea (99% w/w) is produced at 140^0C. The remaining 25% of the 68% w/w urea solution is processed under vacuum at 135^0C in a two series evaporator-separator arrangement.

Granulation

Urea is sold for fertilizer as 2-4 mm diameter granules. These granules are formed by spraying molten urea onto seed granules which are supported on a bed of air. This occurs in a granulator which receives the seed granules at one end and discharges enlarged granules at the other as molten urea is sprayed through nozzles. Dry, cool granules are classified using screens. Oversized granules are crushed and combined with undersized ones for use as seed.

All dust and air from the granulator is removed by a fan into a dust scrubber, which removes the urea with a water solution then discharges the air to the atmosphere. The final product is cooled in air, weighed and conveyed to bulk storage ready for sale.

3. Rotary Drum Granulator

Urea compound fertilizer machine/equipment is composed by two parts: host and assistant. The host adopts a steam heating mode, urea pellet will be accelerated into liquid in the case of no water, thus avoid the shrinkage of the formation of biuret, then can reduce the loss of nitrogen.The assistant can measure belt balance, urine pump, flow meter, valves, meters, pipelines, hoist, nozzles, fans and other components. Spraying System is to increase fertilizer nutrients.

Figure 85: Rotary Drum Granulator

4. Urea Melt Spraying Machine

It takes urea as its main nitrogen source. The melting tank melt the urea and spray the liquid into the granules.

1. for liquid urea spraying granulation
2. anti-corrosion
3. capacity 2.5-3 t/h

Figure 86: Urea Melt Spraying Machine

5. Packing Machine

It is widely suitable for various granular products with good flow ability for urea.

This bagging machine is high speed systems designed for bagging all types of free flowing materials into plastic, paper or polywoven open-mouth bags. The series adopts hopper weighing system.

Figure 87: Packing Machine

6. Environmental Implications

The urea complex is operated in accordance with stringent safety and environmental standards. The Petrochem complex produces effluent in the form of storm water and waste water from the manufacturing process. All effluent is directed to large holding ponds where it is treated and carefully checked as to its composition prior to discharge. The effluent is spray irrigated onto Petrochem's pastures surrounding the complex. Many waste minimization measures are carried out during the process, resulting in the plant having little effect on the environment.

Figure 88: Environmental Protection

4.3 Stages of Construction Work of Sugar Mill

1. Material Handling and Storage

- Storage in cane yards
- Carried from cane yard to feeding area by
  - Hook/chain
  - Cranes
  - Conveyor belt
  - Carry
  - Huge suction truck

Figure 89: Material Handling and Storage

2. Processflow and machineries

Washing: Firstly, sugarcane should wash by washing machine properly.
Cutting of canes: To aid the cane crushing and cane knives to cut cane into small pieces.

Figure 90: Washing Machine

Shredding: To remove leaves and nodes and hammer mill shredder. Cane crushed to break hand structure.

Figure 91: Shredding Machine

Filtration Machine

- Mud from clarifier still contain some residual juice
- Filtered to extract residual juice in rotary vacuum filters

Milling Tandems

- 3 roller mills connected in series
  - Top roller
  - Feed roller
  - Discharge roller
- 5-7 in number

Extract the juice from crushed cane

Figure 92: Milling Tandems

Crystallization

- Carried out in single effect high-vacuum boiling pans
- Brix are increased from $65^0$to $75^0$by boiling at 60^0
- Three stages of crystallization
  - Nucleation
  - Initiation
  - Elongation

Figure 93: Mud Filtration Machine

Figure 94: Crystallizer Machine

Centrifugation

- Separate sugar from molasses
- Centrifuge operates at 10^0-18^00 rpm
- Molasses pass through perforations
- Sugar crystals are washed with 85^0C water
- Raw sugar and molasses

Figure 95: Centrifugal Machine

4.4 Stages ofConstruction Work of Economic Zone

Layout Plan: The off-site facilities as planned by the BEZA to be carried out for Economic Zone are given below:

- Construction of Administration building
- Site Preparation which includes
  - Land filling
  - Construction of walls for all around the boundary
  - Access road
  - Plan for power generation, transmission and distribution
  - Telecommunication plan
  - Gas supply plan
  - Construction of retention pond, retention canal, and pump house
  - Plan for roads in the surrounding area
  - Central Effluent Treatment Plant Drainage channels and a retention pond for controlled drainage discharge

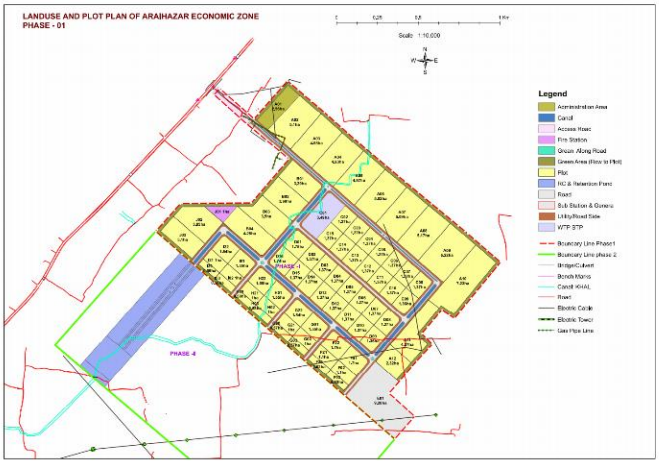


Figure 96: Layout Plan of Economic Zone

1. Land Preparation

The probable high water levels at existing gauge stations of Bangladesh are calculated for each defined return period. Then the high water level of each candidate EZ site was calculated by the weighted average method, based on the calculated probable high water levels of nearby water stations.

Figure 97: Land Grading

2. Access Road

Inside the Economic Zone, a road starting at the gate and passing through the center of EZ will be the internal main road and will have four lanes.

All internal roads in the EZ area have four (4) lanes carriageway, with 2.5m shoulders on their sidewalk sides so that accidents and parking of trucks and other vehicles while waiting will not obstruct traffic.

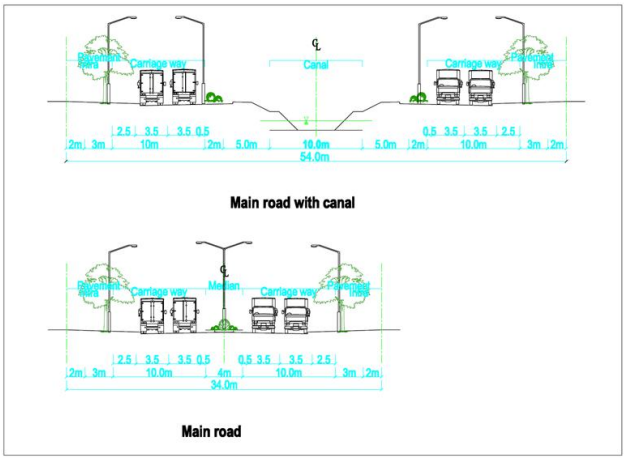


Figure 98: Access Road

3. Retention Pond/Canal

Rainwater drainage ditches will be located on both sides of internal roads and will drain rainwater to the canal located along the main road. A retention pond will be located at the terminal of the canal, and it will have storage functions enabling it to perform the function, preventing the impact of the change of the runoff rate accompanying land preparation, and part of the pump drainage functions during flooding.

Figure 99: Retention Canal

4. Electric Power Distribution Plan

Figure 100: Electric Power Distribution Line

Electric power distribution is the final stage in the delivery of electric power; it carries electricity from the transmission system to individual consumers. Distribution substations connect to the transmission system and lower the transmission voltage to medium voltage ranging between 2 kV and 35 kV with the use of transformers.Distributiontransformers again lower the voltage to the utilization voltage used by lighting, industrial equipment or household appliances.Commercial and residential customers are connected to the secondary distribution lines through service drops.

5. Gas Distribution Plan

Figure 101: Gas Distribution Line

Natural gas produced from a particular well will have to travel a great distance to reach its point of use. The transportation system for natural gas consists of a complex network of pipelines, designed to quickly and efficiently transport natural gas from its origin to areas of high natural gas demand.Moreover, use in the EZ is predicted to be general use rather than industrial use orpower generation use, so gas will be supplied in through distribution pipes.

6. Water Supply Plan

Figure 102: Water Supply Plan

EZ candidate site have to be an uninterrupted water supply facilities, it is necessary to utilize the nearby rivers as wells as water sources. It is important to bear in mind the following points when using these water sources. In the case of river water, there is saltwater intrusion. In the case of groundwater, water intake capacity of underground aquifer and water quality should be confirmed (especially the presence of arsenic) at project site.

7. Telecommunication Line

At EZ, communication services have to be provided by installing wire (optical fiber etc.) feed cables to provide services under contracts completed by each attracted enterprise with local service providers. The wires have to be installed on electric power supply poles or in underground communication line use conduits following consultations with EZ management. In Bangladesh, it is possible to obtain service from the following three kinds of communication companies.

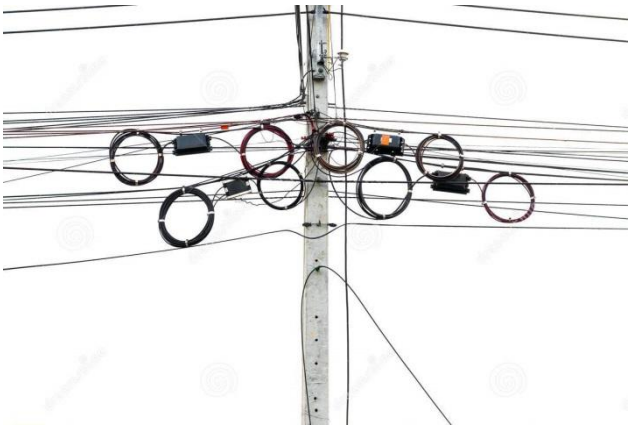


Figure 103: Telecommunication Line

- Public switched telephone network (PSTN)
- Mobile phone operators
- Long distance operators (as per ILDTS Policy 2007)

8. Central Effluent Treatment Plant

Effluent treatment plants need land for construction, capital cost, power and specialized manpower for their operation and maintenance. Because of these constraints, different industries can not afford to have their own effluent treatment facilities and therefore, combined effluent from all industries are to be brought to a centralized place for treatment. This facility is called a Central Effluent Treatment Plant (CETP).The CETP will treat domestic and sewage waste as well as effluent water from each industry. The central ETP should be discharge the treated water to the environment after comply the schedule 10- Standard for waste from industrial unit or project waste of ECR, 1997.

Figure 104: Central Effluent Treatment Plant

4.5 Maintenance of Industries

To avoid costly downtime, everyone needs to monitor the operation of equipment& machineries. Contractor have to observe and troubleshoot equipment at full production speed so issues can be addressed before major mechanical problems arise.

- Computerized Maintenance Management System (CMMS)
- Reliability engineering, e.g. analysis of historical plant data, failure mode and effects analysis
- Predictive Maintenance and Impact on Reliability
- Turnaround Management and Impact of Effective Preventive Maintenance Programs
- Sharing of Maintenance Experiences in Major Rotating Equipment achieving reliable maintenance cycles
- Equipment and Piping Damage Mechanisms in industries
- Optimization of Waste Heat Boilers
- Improvement of laboratories and sampling system
- Maintenance and repair procedure improvement
- Maintenance of material handling

Maintenance schedule:

a) **Schedule Maintenance**
   - Monthly routine maintenance
   - Annual maintenance
   - Preventive and predictive maintenance

b) **Unscheduled Maintenance**
   - Emergency/ breakdown maintenance
   - Development work related maintenance

5. STUDY OF PROCUREMENT DISCIPLINE

Beside other documents, it is advisable to study in depth on the PPA 2006 and the PPR 2008 (Revised/Updated) (See Annexure-7; procurement discipline checklist).Without having comprehensive knowledge of this previously mentioned Acts and Rules with checklists, one may be misguided while visiting the project site. The documents and the checklists will give

officers an insight into the detail of the work awarded to the contractor.

6. STUDY OF INDUSTRY/POWER/ENERGY RELATED TECHNICAL DISCIPLINE

Before investigation of Industry/Power/Energy related projects which purely known as civil works, construction of industries/power plant/transmission line/substation/Gas pipeline, one should remember the basic engineering roles item by item. SeeIndustry/Power/Energy related technical discipline Checklists of Annexure-8.

7. MAINTENANCE OF SITE INSPECTION REGISTER/BOOK

Contractor is also required to maintain a 'site inspection register/book' on the site, and also preserve a copy of the 'Work Order' along with it, so that visiting project officials and other related officials can write their observations/instructions in it regarding progress of work, mobilization of equipment and materials, quality of material as well quality of work performed (workmanship) by the contractor. He is also required to supply construction schedule and keep a copy of it at the site for quick reference and observations. These are considered prerequisite steps for the start of construction work. Therefore, when visiting a site, take a look into this 'book'. That will give first-hand information about the frequency of visits of the senior project officials at site, instructions given to the contractor for compliance and its follow up etc. IMED official should also record his comments/observations in the 'book' regarding his visit and other issues that deem worth mentioning and can desire to be on record for future ready reference.

8. TOOLS FOR COST-EFFECTIVENESS ANALYSIS

Cost-effectiveness analysis (CEA) is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action. Cost-effectiveness analysis is distinct from cost–benefit analysis, which assigns a monetary value to the measure of effect.

Cost-effectiveness evaluation is used during the program's implementation and looks to measure the benefits of the programs against the costs. Doing so generates useful quantitative data that measures the efficiency of the program. This data is like an audit and provides useful information to sponsors and backers who often want to see what benefits their money would bring to beneficiaries.

When:

- At the beginning of a program, to remove potential leakages
- During the operation of a program, to find and remove inefficiencies.

What:

- What Resources are bring spent and where
- How these costs are translating into outcomes.

Why:

- Program managers and funders can justify or streamline costs
- The program can be modified to deliver more results at lower costs

How: A systematic analysis of the program by collecting data on program costs, including capital and man-hours of work. It will also require a survey of program officers and the target population to determine potential areas of waste.

- Where is the program spending its resources?
- What are the resulting outcomes?

Quantitative Tools:

a) Benefit-cost ratio (BCR)
b) Present value (PV) and net present value (NPV)
c) Payback periods
d) Internal Rate of Return (IRR) IRR > Market rate of Interest.

a) Benefit-Cost Ratio (BCR)

A comparative analysis of benefit vs. costs:
Example:

- Project A will charge TK 100,000(cost) and generate TK 150,000 in value (benefit). 150,000 / 100,000 = 1.5
- Project B will charge TK 100,000 (cost) and generate TK 160,000 in value (benefit) 160,000 / 100,000 = 1.6
- Project C will charge TK 100,000 (cost) and generate TK 100,000 in value (benefit) 100,000 / 100,000 = 1

BCR must be >1, So Project **A**Good, Project BBetter, Project **C** Poor.

b) Net Present Value

$$NPV = \sum[P/(1+i)t] - C$$

- NPV = Net Present value of money
- P = Net period cash flow
- i = Discount rate or Rate of return
- t = number of time periods or Payback periods
- C = Initial Investment

Example:

C = Tk. 1000, (considering interest rate 12% and payback period 3 years)

Assuming Cash flow

1st year – Tk. 3000	$3000/(1+ 0.12)^1 = 3000 / 1.12 = 2678.57$
2nd year – Tk. 2000	$2000 / (1+ 0.12)^2 = 2000 / 1.254 = 1594.89$
3rd year – Tk. 1000	$1000 / (1 + 0.12)^3 = 1000 / 1.405 = 711.74$

NPV = 2678.57 + 1594.89 + 711.74 – 1000 = 3982.20

Since NPV > 0, So Project is viable.

IRR=NPV=0

$$FV=PV\ X\ (1+i)^t$$

- PV = Present value of money
- FV = Future value of money
- i = Discount rate or Rate of return
- t = number of time periods or Payback periods
- C = Initial Investment

PV = Tk. 1000, (considering interest rate 12% and payback period 3 years)

FV = $1000\ X\ (1 + 0.12)^3 = 1000\ X\ 1.405 = 1405$

9. GUIDELINE OF IMPLEMENTATION OF MONITORING ONGOING PROJECTS

It is a critical task of project monitoring by IMED. The improvement of risks management, in all forms, is the major objective of this task for strengthening the project implementation process in achieving the results with due capacity and in time. All projects under ADP should be monitored by its risks and the assumptions cited in projects LF in terms of programmatic, political, social, environmental etc., those may be surfaced during the implementation of projects and imped its progress.

An assessment undertaken during the implementation phase of aprogramme/project to analyze the continued relevance, effectiveness, efficiency, impactand sustainability of the programme/project so as to improve its design andimplementation if necessary.

Table 2: Checklist for implementation ofmonitoring ongoing project

1. Ministry/Division		
2. Implementing Agency		
3. Project Completion Time as per DPP		
4. Date of NOA issued		
5. Date of Contract Signing		
6. Date of Commencement		
7. Project Name and ID		
8. Brief Description of project component /Works		
9. Stage of Project work (Tick relevant one)	Less than 1 year ☐ 1 to 1.5 year ☐ 1.5 to 2 year☐ More than 2 years☐	

SL	Aspects (General)	Status
10.	Gantt Chart/ Schedule of the project available (yearly/entire project)	
11.	Land Acquisition	
	a. Date of acquisition b. Public landowner resettle as per RAP maintained c. Progress of acquisition	
12.	Land Development	
	A.Progress of Land development B.Process of Land development followed a. Pre work measurement done (record/document) b. Uses of Proper equipment &procedure (image/any record) c. Layer compaction (images/any record)	

SL	Aspects (General)	Status
	d. Developed the land up to standard level Post work measurement done (record/document)	
13.	Availability of Approved Drawing	
	a. Construction started as per approved drawing (evidence) b. If not available, reasons of unavailability.	
14.	Procurement should be based on quality	
	a. Economic Lifetime and Salvage value of each equipment shall be considered b. For the protection of Investment Qualification of major equipment manufacturer shall be reviewed. c. Any development regarding infrastructure development is related to economic development of the country. Consideration may be not only price base but also quality base.	
15.	Deployment of construction equipment, Safety and field preparation.	
	a. Ensure all construction equipment b. Ensure safety measures c. Complotted field preparation d. If not available, reasons of unavailability?	
16.	Deployment of Manpower	
	a. Manpower of Implementing Agency b. Manpower of Contractor c. Manpower of Consultant (if any) d. If not available, reasons of unavailability?	
17.	Mobilization of construction material at site	
	a. Mobilized construction material are approved by Implanting Agencies (evidence) b. If not available, reasons of unavailability?	
18.	Progress of work	
	a. Construction work is progressing as process flow diagram/project schedule. b. Evidences of quality ensure tools maintained c. Monthly/Quarterly/Yearly of progress of work are beingarranged by the contractor	
19.	Record keeping	
	a. Maintaining site work register book/ document and checked by authorized supervising officers. b. Maintaining and recorded manufacturer's manuals. c. Maintaining all test reports and records, including material tests and collected samples reports. d. Verification of original catalog of major equipment?	
20.	Safety	
	a. Workplace safety as per labor rules 2016?	

SL	Aspects (General)	Status
	b. Labor shade as per national/international rules c. Safety certificate from department of Department of inspection for Factories and Establishments (DIFE)?	
21.	Whether Environmental Impact Assessment (EIA) is done or not?	
	a. Environmental Management Plan is properly followed b. Monthly/Quarterly/Annual Monitoring is done properly as per Environmental Monitoring Plan	
22.	Deviations	
	a. Financial progress is consistence with the physical progress in the field. b. Any major deviation of the scope of project. c. Any major deviation of the contract agreement. d. Any major deviation of the approved DPP.	

Checklist for Power Sector (Generation)

SL	Aspects	Status
23.	Project contribution in Annual Development Program (ADP)	
	a. ……MW (Generation)	
24.	Equipment / Plants at site	
	a. Number / Percent of equipment/plants reached at site as per procurement schedule. b. If not reached, reasons of not reaching? c. Verification of original catalog of major equipment?	
25.	Assessment of the progress of each project component, such as, ➢ Recruitment of consultants and their performance; ➢ Procurement of goods and works (from preparation of detailed designs and bidding documents to contract awards); and ➢ The performance of suppliers, manufacturers, and contractors for goods and works contracts;	
26.	Soil Test	
	a. Whether soil test of the place is conducted by a competent firm b. Whether plant or industry design consultant has taken into cognizance the result of the soil test	
27.	Weather contractor is establishing building and structures according to the site layout plan.	
28.	Power Plant Equipment (GT/ST Generator, Gas/Steam turbine, Boiler, Stake, Cooling tower and Transformer etc.)	
	a. Number / Percent of equipment/plants installed as per work schedule b. If not completed, reasons of not completion?	
29.	Weather contractor is sourcing useless or no required machines	

SL	Aspects	Status
30.	Whether contractor is providing and warning sign, maintaining signs, markings, lights, barricades etc. around construction area	
31.	Are the outputs or components (eg. goods, services, technical cooperation,training and policy conditions/measures) being achieved as planned, interms of quality, schedule and cost?	
32.	Are inputs (eg. disbursements, counterpart funds, project management,project implementation staff, goods and services, etc.) beingdelivered/provided in a timely and cost-effective manner?	
33.	Assessment of progress in implementing the overall project to date in comparison with the original implementation schedule target, (include simple charts such as bar or milestone to illustrate progress, a chart showing actual versus planned expenditure, S-curve graph showing the relationship between physical and financial performance, and actual progress in comparison with the original schedules and budgets);	
34.	Testing & Commissioning	
	a. Number/Percent of equipment/plants tested as per plan. b. Tests are carried out by following approved test procedure and with proper test set c. Tests are carried out by qualified and experienced personnel of contractor and supervised by Implementing Agency d. Is there provision kept in the contract tests to be carried out by qualified and experienced manufacturer'spersonnel. e. Technology transfer ensured during testing and commissioning activities (evidence). f. If not done b, c & d. reasons of not ensuring? g. If commissioning is done, show taken over certificate (TOC)?	

Checklist for Power Sector (Transmission Line)

SL	Aspects	Status
35.	Project contribution in Annual Development Program (ADP)	
	a. ……MVA (Transmission capacity) □ 765 kV □ 400 kV □ 230 kV □ 132 kV b. ……km (Transmission Line) □ 765 kV □ 400 kV □ 230 kV □ 132 kV c. ……KVAR □ 230 kV □ 132 kV	
36.	Weather project authority has selected best transmission route for overhead Electrical transmission line considering shortage distance, avoiding settlement, hill, swamps and ridges as well as avoiding disrupting environment.	

SL	Aspects	Status
37.	Erection of Equipment/plants (Lightning Arrestor, Current Transformer, Power Transformer, Isolator/DS, Circuit Breaker, Battery & Charger and Transformer etc.)	
	a. Number / Percent of equipment/plants installed as per work schedule b. If not completed, reasons of not completion?	
38.	Foundation Work (pile, pile cap & earthing)	
	a. Foundation is progressing as process flow diagram (methods). b. Evidences of quality ensure tools maintained (evidence-checklists). c. Number / Percent of foundation completed as per schedule (evidence). d. If progress not achieved, reasons of not achieving?	
39.	Tower Erection	
	a. Number/Percent of foundation completed as per schedule (evidence). b. If progress not achieved, Clarify reasons of not achieving.	
40.	Stringing of conductor.	
	a. Length of line (km) is completed as per schedule (evidence). b. If progress not achieved, reasons of not achieving?	

Checklist for Power Sector(Distribution Line)

SL	Aspects	Status
41.	Project contribution in Annual Development Program (ADP)	
	a. ……MVA (Distribution capacity) □ 33 kV □ 11 kV □ 0.4 kV b. ……km (Distribution Line) □ 33 kV □ 11 kV □ 0.4 kV c. ……KVAR □ 33 kV □ 11 kV □ 0.4 kV	
42.	Weather project authority has selected best distribution route for overhead Electrical distribution line considering shortage distance, avoiding settlement, hill, swamps and ridges as well as avoiding disrupting environment.	
43.	Equipment/plants (Pole & Pole mounted single phase transformer, Pin Insulator, Shackle Insulator, Transformer etc.)	
	a. Number / Percent of equipment/plants installed as per work schedule b. If not completed, reasons of not completion?	
44.	Whether distribution planning involves various activities like load forecasting (type, location and amount), electrical and	

SL	Aspects	Status
	mechanical design, economic and other considerations in planning.	
45.	Is the distance between two electric poles set up accordingly?	
46.	Assessment of the progress of each project component, such as, ➢ Enrollment of manpower and their performance; ➢ Procurement of goods and works (from preparation of detailed designs and bidding documents to contract awards); and ➢ The performance of suppliers, manufacturers, and contractors for goods and works contracts;	

Checklist for Energy Sector (GasTransmission Pipeline)

SL	Aspects	Status
47.	Project contribution in Annual Development Program (ADP)	
	a. Construction..…… inch Diameter ×…….Km × ……psig	
48.	Whether the pipeline design is prepared on the basis of international codes and practices and in compliance with Natural Gas Safety Rule-1991 amended 2003.	
49.	Land Requisition/Hiring/Purchase (if required) and land Development completed as per DPP	
50.	Weather the Total Procurement Plan for Development Project/Programme (Goods, Works & Services) is done as per DPP	
51.	The diameter of Ball Valves (Actuator Operated/Gear Operated) and Scrapper Traps (Launcher/Receiver) is procure as per DPP	
52.	Weather contractor is following the approximate dimensions of the trench (e.g., depth, width).	
53.	Is the construction of pipeline work done as per DPP	
54.	Whether back filling work is done as per design and specifications.	
55.	Analyzing, monitoring and reviewing with the cause of the problems inimplementation of the project as delay of financing, delay in the procurement of goods;	

Checklist for Energy Sector (Drilling Well)

SL	Aspects	Status
56.	Land Requisition/Hiring/Purchase (if required) and land Development completed as per DPP	
57.	Procurement of Drilling materials, Shipment of machinery & equipment completed as per DPP	
58.	Hiring of drilling and hiring 3rd party completed as per DPP	

59.	Year wise Financial and Physical Target Plan is maintain as per DPP	
60.	Workover of well site is completed as per DPP tentative Implementation Programme.	
61.	Is Mud Chemicals dispose at designated pond area	
62.	Indicate methods for disposal of drilling wastes.	
63.	Monthly progress reports to Petrobangla/IMED	

Checklist for Energy Sector (2D/3D seismic Survey)

SL	Aspects	Status
64.	Reviewing and monitoring whether the conventional laws and order (PPR, Guideline of Development Associate etc.) has been observed in the procurement of goods, activities and services completed/running under the project;	
65.	Mobilization and site establishment including establishment of worker camps andequipment storage areas is done as per DPP	
66.	On-ground survey operations done as per DPP & Time frame: • Surveying of geodetic benchmarks; • Surveying of seismic lines; • Shot hole drilling and placement of seismic charges; • Laying of geophones and cables; and • Charge detonation and data acquisition.	
67.	Ideal Survey Layout • Maintain distance between source lines as per DPP • Maintain distance between source stations as per DPP • Maintain distance between receiving stations (geophones) as per DPP	
68.	Which explosive is used in the seismic charges?	
69.	Is the project is completed as per DPP/Implementation Schedule?	

Checklist for Industry Sector

SL	Aspects	Status
70.	Project contribution in Annual Development Program (ADP)	
	Location…..... Yearly Production…….. Yearly Demand……	
71.	Has 'Bangladesh National Building Code (BNBC)' been followed (earthquake, cyclone, flood level, landslides etc. aretaken care of in design preparation)?	
72.	Whether electrical system of the industry is installed by thecontractor as per approved electrical drawing/design	

SL	Aspects	Status
73.	Has the Water supply arrangement/Sewerage system/Effluent treatment plant been made as perrequirement?	
74.	Whether firefighting equipment installation provision has beenkept in the industrial/plant area	
75.	Has internal and external audits are being carried out by the Lenders/ Contractor /Proponent	
76.	Weather all the legal documents (Land Acquisition/ Trade License/ Industry License/ Boiler License/ Fire License/ Explosive License/ Environmental Clearance Certificate etc.) record is maintained	

…… **Date of Visit**	Signature

Checklist for DPP for ongoing project: See Annexure-5

Checklist for TPP for ongoing project: See Annexure-6

Checklist for Procurement of ConstructionWork for ongoing project: See Annexure-7

10. MID-TERM EVALUATION

The review is almost similar to evaluation, but the utility is different from evaluation. It looks into the fiduciaries and the outcome results of the projects and intends to bring revision, if necessary. It is called for reviewing the needs for project's revisionit that project can be made more effective and efficient. It will better if choose four or more than four years long project for midterm evaluation. The Mid-term evaluation should be funded by project cost. The review shall be undertaken internally with IMED's capacity or by outsourcing (third party), if required, in conjunction with national development priorities and project compliances to make the project effective and efficient towards the causes.

11. GUIDELINE OF TERMINAL EVALUATION

A study conducted at the end of an intervention (or at the end of aphase of thatintervention) to analyze and determine its efficiency, impact and sustainabilityto obtain inputs or suggestions for future courses of action. Terminal Evaluation will be covered all completing project and Information collection will be the main scope of inspector.

Table 3: Checklist for Terminal Evaluation of Completed Project

SL	Aspects (General)	Status
1.	Project Designing	
	a. Done properly b. Good c. Fair	
2.	Project contribution in Annual Development Program (ADP)	
	a. ……MW (Generation) b. ……MVA (Transmission/Distribution capacity) □ 765 kV □ 400 kV □ 230 kV □ 132 kV □ 33 kV □ 11 kV □ 0.4 kV c. ……km (Transmission/Distribution Line) □ 765 kV □ 400 kV □ 230 kV □ 132 kV □ 33 kV □ 11 kV □ 0.4 kV d. ……KVAR □ 230 kV □ 132 kV □ 33 kV □ 11 kV □ 0.4 kV e. ……Production (Industry) f. ……..inch Diameter ×…….Km × ……psig (Gas pipeline)	
3.	Quality of project work	
	a. Excellent b. Good c. Fair	
4.	Quality of Material/Equipment	
	a. Excellent b. Good c. Fair	
5.	Percentage of Deviation	
	a. Financial and physical parameters. b. Deviation of the scope of project. c. Deviation of the contract agreement. d. Deviation of the approved DPP.	
6.	Monitoring and visit statement	
	a. Number of visit the top management by Implementing Agency b. Number of visit Consultant (if any) c. Number of visit of Ministry d. Number of visit IMED	
7.	Meeting	
	a. Number of Progress meeting executed. b. Number of Steering committee meetingexecuted. c. Number of PIC Meeting executed.	
8.	Procurement	
	a. Procurement done smoothly	

SL	Aspects (General)	Status
	b. Procurement done with difficulties (issues) c. Procurement done badly. d. If procurement is not done smoothly, identify issues for future development.	
9.	Project completion and over run	
	a. Project started in time b. Project completed on time c. Project over run time below 6 (six) months d. Project over run time below 1 (one) year e. Project over run time above 1 (one) year	
10.	Reviewing and monitoring whether the conventional laws and order (PPR, Guideline of Development Associate etc.) has been observed in the procurement of goods, activities and services completed/running under the project;	
11.	Analyzing, monitoring and reviewing with the cause of the problems inimplementation of the project as delay of financing, delay in the procurement of goods;	
12.	Analyzing, monitoring and reviewing with the cause of the problems inimplementation of the project as activities and services, inefficiency of management and incensement of period and expenditure of the project etc.;	
13.	Whether contractor is sourcing machines or vehicles such as Computer, Printer, Car, Jeep, Pickup, Motor cycle etc. that included for the goods of Procurement Contract and the same documental proof has been found in the implementation of specification.	

Checklist for Power Sector (Generation)

SL	Aspects	Status
14.	Whether contractor is establishing building and structures according to the site layout plan.	
15.	Whether owner is running the plant according to the process flow diagram.	
16.	Whether specification mentioned machines (Steam turbine, Gas Turbine, Generators, Stack, Gas compressor etc.) was included for the goods of procurement Contract and the same documental proof has been found in the implementation of specification.	
17.	Whether Natural Gas is used as main fuel and Diesel as alternative fuel in the power plant. Is the fuel supply is sufficient as per requirement.	
18.	Whether proponent is using cheap fuel for the power plant.	
19.	Whether stack height for power plant is construct adequately	
20.	Whether public services are of good quality, client-oriented and delivered on time.	
21.	Whether monthly/quarterly/yearly of progress of work are beingarranged by the contractor	

Checklist for Power Sector (Power Transmission/Distribution)

SL	Aspects	Status
22.	Whether equipment/machinery positioned for theconstruction of foundation works and sub-structures areusing methods/ techniques as mentioned in thedrawings/design or as instructed by the engineer.	
23.	Whether regular maintenanceis conduct to enhancethe quality.	
24.	Whether proponent is acquiring the appropriate type, quality, and amount of resources at an appropriate cost	
25.	Whether proponent/contractor is using the optimum amount of resources (staff, equipment and facilities) inproducing or delivering the appropriate quantity and quality of goods or serviceson time;	
26.	Whether the transmission line testing done properly	

Checklist for Energy Sector (Transmission Line)

SL	Aspects	Status
27.	Is there any technical person associated with for running thesystem or for maintenance?	
28.	Whether Project Proponent identify defective tools and tagged and removed from service as part of a regular maintenance program	
29.	Has internal and external audits are being carried out by the Proponent/contractor for the Industry/ Power/ Energy related project.	
30.	Whether all system design documents are maintained?	
31.	Whether all system maintenance log book are maintained?	
32.	Whether the transmission line testing done properly	
33.	Is there any difficulties to flow the gas from one station to another	
34.	Any fire accident/Pipeline leakage occur after completion of Pipeline installation.	

Checklist for Energy Sector (Well Drilling)

SL	Aspects	Status
35.	Indicate the total estimated volume of drilling wastes.	
36.	Description of all proposed and existing environmental monitoring programs	
37.	Is they maintain quality control and professional standards	
38.	Ensure proper security arrangement	
39.	Is recruit sufficient workers to run the operation as per DPP	
40.	Whether daily/monthly/quarterly/annually progress report submitted to ministry/Agency/IMED properly.	

Checklist for Industry Sector

SL	Aspects	Status
41.	Whether proponent is establishing building and structures according to the site layout plan.	
42.	Whether the factory run according to process flow diagram	
43.	Whether contractor has setup laboratory testing facility atsite	
44.	Whether samples of the product have been tested in thelaboratory and have been approved by thecompetent authority	
45.	Whether tested sample's reports are preserved at site for crossreferences	
46.	Whether WTP/STP/ETP/CETP is working properly	
47.	Has internal and external audits are being carried out by the landers as well as proponent for the Industries	
48.	Whether site register or inspection book is maintained	
49.	Whether daily/monthly/quarterly/annually progress report file is at site	
50.	Whether design& drawing record is maintained	
51.	Weather all the legal documents (Land Acquisition/ Trade License/ Industry License/ Boiler License/ Fire License/ Explosive License/ Environmental Clearance Certificate etc.) record is maintained	
52.	Weather all the labor, engineers attendance record is maintained	
53.	Weather all the visitor entrance record is maintained	

12. GUIDELINE OF PROJECT IMPACT/ OUTCOME EVALUATION

A type of outcome evaluation carried out a few years after the completionof a programme or project to analyze and evaluate its impacts and sustainability toobtain feedback for the formulation of similar programme or project in future. The consultant will be evaluated the impact of the completed projects and IMED will play the role of supervision.

Table 4: Checklist for Impact/Outcome Evaluation of Completed Project

	Aspects to be answered/covered	Yes/No	Remarks
1.	Is the projects outcome reflected the project objective?		
2.	What are the main component of the project?		
3.	Source of the fund of the project?		
4.	Weather the component implemented is relevant with project Objective?		
5.	What was the physical progress of the project during projectcompletion?		
6.	Current usage of the implemented project component?		
7.	How sustainability of the project ensured?		
8.	Benefit-cost ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) figures are inconsistent between estimated value and Actual value (for completed profit earning industries).		
9.	The project is contributing to the Annual Development Programme(ADP) and Strategic Development Goal (SDG) as mentioned in the DPP.		
10.	Whether project proponent is running the project according to the process flow diagram.		
11.	How sustainability of the project ensured?		
12.	Is there any technical person associated with for running thesystem or for maintenance?		
13.	Whether Project Proponent identify defective tools and tagged and removed from service as part of a regular maintenance program		
14.	Has internal and external audits are being carried out by the Proponent/contractor for the Industry/ Power/ Energy related project.		
15.	Whether all system design documents are maintained?		
16.	Whether all system maintenance log book are maintained?		
17.	Whether all system maintenance log book are maintained?		
18.	Whether all the test results of material or equipment record is maintained		
19.	Whether all the labor, engineers attendance & visitors record is maintained		
20.	Whether project completion report is done by project proponent;		

1. Benefit Analysis (Annual Out-put)

Items of out-put	Unit	Estimated quantity expected at full capacity	Actual quantity of out-put during the 1st year of operation at full capacity (or during, real production for newly completed project)

2. Cost / Benefit

Item	Estimated	Actual
(1) Benefit cost ratio of the project (i) Financial (ii) Economic		
(2) Internal Rate of Return (i) Financial (ii) Economic		

3. Internal Audit

Period of Audit	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4

4. External Audit

Audit period	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.

5. Main Problems in the project Implementation

a)Project Title……..

b) Ministry.....

c) Division.....

d) Agency.....

e)Description Regarding Problems of the Project

S.N.	Main Problems Observed in the Project Implementation	Causes of the Problems Observed	Efforts Made to Solve problem	Problems Observed to be Presented in Ministerial level Development Action Committee (MDAC)	Suggestions for Solution of Problems

6. Impact Evaluation Template

SL.	Project Impact	Measuring Unit	Benchmark data	Total Project Target	% Achievement	Remarks reason form short fall, Suggestions

7. Impact on the Community/Economy

Result/Impact	Component 1	Component 2	Component 3	Overall remark/suggestion
Economy				
Local Community				
Concerned Sector				
Institutional Sustainability				
Environmental Sustainability				
Likely costrecovery				

13. CONCLUSIONS & RECOMMENDATIONS

13.1 Conclusions

Monitoring and evaluation plays an important role for effective and meaningfulimplementation of plans, policies, programmes and projects. Realizing the need for a systematic, simplified, result-oriented, reliable, and effective monitoring and evaluation system, Implementation Monitoring & Evaluation Department (IMED) has issued this guideline by consolidating various frameworks from past monitoring and evaluation (M&E) initiatives.

The excellenceaccomplishment is not an easy outcome; it is the product of determined effort. The PD/PE is the key person who must play an important part to get the work done true to the standards and provisionsto ensure desired quality of work. Project Director (PD) should establish the annual work plan for contractor. The contractor is obligated under the contract for testing of the quality of work to ensure compliance as stipulated in the specifications. TheExecuting Agency/Sponsoring Ministry has to ensure that the contractor is delivering whatever was specified in the contract document. IMED as an outsider can do little to ensure quality of work from the contractor, but it can certainly helpAgency/Ministry in extracting quality work and better workmanship through regular visits to the project sites. Visual aid like Camera or Video Recorder may be used for recording images of project activities. These images will always be helpful in better understanding the project situation in the field. In many cases, it will complement comments/observations of the officials and confirm reliability of information and data collected from the field.To fulfill the conditions of the contract and facilitate smooth construction activities, a contractor is required to builds a site office nearest to the project location. It is the standard practice for the engineer's site staff to supervise and witness such testing of the works. However, the site engineer should also carry out some testing separately, for the purpose of validation of tests done by the contractor as well as for the auditing purposes. The inspecting officials from the Ministry/Department and the IMED may verify whether the contractual obligations of the contract have been fulfilled with proper documentation of the test results and comments of the site/Project Engineer there on. This must be carefully noted and reported at the decision making level of the government.

13.2 Recommendations

The study team recommends following to enhance monitoring capability of the IMED.

- A technical unit may be formulated/established in IMED that will be supportive for assess needs and provide direction for technical services program including investigating new technology, proper M&E with new dimensions and developments in the field;
- Real time monitoring should start and be strengthened specially for procurement management including tendering process;
- Online monitoring system should be developed and made functional;
- SMARTS and effective M&E template format should be developed and used;
- Time schedule should be maintained in procuring equipment, machineries and

services;

- Capacity building training should be specified for IMED staff;
- Communicate with the steering committee members and updated the project problems and progress;
- Mid-term/in-depth evaluation should be conducted;
- Result based monitoring system should be strengthen and practice in the field by using SMARTS template;
- IMED should recruited adequate and skilled manpower for effective M&E;
- Make sure lab support from 3rd party

14. REFERENCE

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ANNEXURE-1: TERMS OF REFERENCE

1. Background of the Study

I. Implementation Monitoring and Evaluation Division (IMED) is the apex body of the Government of Bangladesh to monitor and evaluate the implementation of the public sector development projects included in the Annual Development program (ADP). The prime function of the IMED is to monitor and evaluate the implementation of development projects in order to enable the Ministries and Executive Agencies to ensure their proper implementation. Through monitoring and evaluation, it points out to the project implementing ministries and other appropriate authorities the progress of implementation and problems encountered, if any, in the field relating to the quality, time, cost etc. for taking remedial measures. For timely and proper management of these activities along with the main functions a comprehensive strengthening program has been gravely felt for long time. Therefore, IMED has undertaken the development project, entitled "Strengthening M&E Capabilities of IMED (SMECI)" funded by the GOB.

II. Beside many other functions that are performed by the IMED, an important function is to carry out regular field monitor of development projects to keep itself abreast with the latest progress of projects in the field. It informs the relevant ministries and agencies with the impending problems as well as current problems affecting the progress of projects, for taking remedial actions at their end, so that project's physical and financial progress are accelerated.

III. For the purpose of carrying out field review a comprehensive guideline is necessary. Therefore, IMED intends to develop a Monitoring & Evaluation Guideline on Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) for the use IMED officers. Since these sectors are spending substantial allocation of the annual development budget, its development activities have attracted greater attention of the government and that demands more focused and intensive quality monitoring by the IMED.

2. Objective of the assignment

The main objective of the assignment is to engage an experienced Consulting Firm for preparing an M & E Guideline covering all important areas of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) sector projects, which will help as tolls of monitor for IMED officials.

The specific objectives of the assignment are the following:

2.1 To review the existing available relevant documents/guidelines on project inspection;

2.2 To review the existing available relevant documents/guidelines of other relevant countries and development partner agencies;

2.3 To analyze objectives of the assignments thoroughly;

2.4 To develop a guideline that can be effectively used by the IMED officers during project monitoring and evaluation;

2.5 To develop an identical M&E template for relevant sector;

2.6 To guide the officers of the IMED in building systematic approach to field visit through use of the Guideline;

2.7 To ensure the project management knowledge areas (such as scope, time, cost, procurement, quality, integration, human resource, stakeholders, communication and risk);

2.8 To help accelerate progress of the development projects.

3. Scope of Services:

Consultancy services shall broadly include

3.1 Prepare a study design to carry out interviews of the stakeholders to know the actual requirement of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) related projects for preparation of the guideline;

3.2 Identify weaknesses and limitations in the monitoring and evaluation process of the related projects;

3.3 Identify key areas of project development activities, and also identify/ select smart indicators for effectively monitoring and evaluating related projects;

3.4 Identify the components of different development projects, and describe the parts of each component for effective monitoring and evaluation;

3.5 Study monitoring and evaluation reports, in-depth study reports and other related reports of the projects of the concerned sector and identify monitoring and evaluation weaknesses etc.;

3.6 Study other relevant documents and M&E procedure of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) projects/ program of in country and other countries that can be helpful in preparing M&E Guidelines;

3.7 Consultant/s will interact with the relevant ministries, agencies, projects and identify areas of interest that can be helpful in carrying out the assignment;

3.8 Consultant will deliver comprehensive M&E guideline and M&E templates for Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) in English and Bangla;

3.9 Any other related works assigned by the client.

4. Qualifications and experience of Firm and Team:

4.1 Firm: The assignment will be undertaken by a firm having similar experience in development of guidelines and having adequate staff with appropriate professional qualifications and suitable experience.

a. Firm registered with the Government of Bangladesh
b. At least 3 years' working experience in conducting similar type of assignments
c. Demonstrated capability in monitoring and evaluation of projects as evidenced by the qualifications and experienced of the professional staff;
d. Excellent understanding and knowledge of project implementation procedures;
e. Proven track record of data/information collection, compilation, analysis and analytical report generation;
f. Advantage will be given for experiences of preparation guideline(s) in public sector;
g. Skills in translation of documents/Guideline in English to Bangla

4.2 Team:

No.	Type of Professionals	Educational Qualifications
1	Team leader	Minimum B.Sc. in Mechanical /Electrical Engineering
2	Industrial Engineer	Minimum B.Sc. Industry & Production Engineering
3	Mechanical Engineer	Minimum B.Sc. in Mechanical Engineering
4	Geologist/Mining Geologist	M.Sc. in Geology/Mining Geology
5	Rural Electrification Engineer	Electrical Engineering and at least 10 years of Experience. With only a Bachelor degree, at least 12 years of relevant experience is required.

5 Duration of assignment:

Duration of assignment shall be 04 (four) months from the date of signing the contract.

6 Consulting Firm Responsibilities

6.1 The Consulting Firm must purpose services of consultants having good academic background and knowledge of the subject (assignment), so that quality M&E Guidelines and templates can be prepared and delivered within the stipulated time frame;

6.2 Consulting firm shall propose an appropriate methodology for the study in the context of objective of the assignment and scope of services;

6.3 Prepare and finalize M&E Guideline based on the study of documents, objective of the assignment and the data/information collected from various internal and external sources. M&E Guideline should cover maximum areas of monitoring activities/components of specific item;

6.4 Arrange a Workshop/Seminar for dissemination of the study findings and finalizing the guideline incorporating comments/observations of the participants.

7 Expected Deliverables/ Reporting:

The following deliverables are expected (from the date of contract signing)

SL.	Deliverables	Number of reports	Delivery timeline (Weeks after signing contract)
1	Inception report (Inclusive of detailed work plan, methodology, sample size, questionnaire and strategy)	10	3
2	Submission and finalizing the data collection instruments after field testing	-	4
3	Information collection from stakeholders and preparation of draft report	-	8
4	Submission of 1st draft report	10	8
5	Submission of 2nd draft report	10	12
6	Workshop with stakeholder for finalization of draft report (Guideline)	50 copies in English	13

SL.	Deliverables	Number of reports	Delivery timeline (Weeks after signing contract)
7	Submission of final report (Guideline) incorporating feedback fromstakeholders.	40 copies in English, 10 copies in Bangla	15

8 Client's Input, Logistics and Support Arrangements:

8.1 Project Director, Strengthening Monitoring and Evaluation Capabilities of IMED (SMECI) will be the client, and will make available all relevant reports, documents, information for consultant and designate counterpart personnel, if available;

8.2 The client will facilitate the consultancy activities like data collection , meeting/similar arrangement and other arrangement related to the proposed assignment;

8.3 The consultant will make own arrangement for necessary equipment (Desktop/Laptop, Printer, Scanner etc.) and facilities (home office space with telephone, fax, internet connectivity etc.) essential for providing the services. The client will arrange temporary necessary working space when required to review the documents a client premises. The consultant will make own arrangement for all sorts of transportation.

9 Contents of Guideline:

The Guideline will be user friendly. Illustrative example/Case study and images might include for better understanding for the users. Page size: A4.

ANNEXURE-2: THE PROCESS OF THE STUDY: THE SCOPE, APPROCH, METHODOLOGY AND PLAN OF THE STUDY

1. Scope of the Services

The scope of study was quite ample as IMED is set to have any guideline for M&E system operation and its strategy as well is emphasizing on enhancing the capacity and accountability of M&E system that goes with the need of a comprehensive guideline. The Government has as will been emphasizing on guideline and strategy based operation of all sectors. However, the specific scopes of the study were:

- Prepare a study design to carry out interviews of the stakeholders to know the actual requirement of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) related projects for preparation of the guideline;
- Identify weaknesses and limitations in the monitoring and evaluation process of the related projects;
- Identify key areas of project development activities, and also identify/ select smart indicators for effectively monitoring and evaluating related projects;
- Identify the components of different development projects, and describe the parts of each component for effective monitoring and evaluation;
- Study monitoring and evaluation reports, in-depth study reports and other related reports of the projects of the concerned sector and identify monitoring and evaluation weaknesses etc.;
- Study other relevant documents and M&E procedure of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) projects/ program of in country and other countries that can be helpful in preparing M&E Guidelines;
- Consultant/s will interact with the relevant ministries, agencies, projects and identify areas of interest that can be helpful in carrying out the assignment;
- Consultant will deliver comprehensive M&E guideline and M&E templates for Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) in English and Bangla;
- Any other related works assigned by the client.

2. Responsibilities of the Consulting Firm

- The Consulting Firm must purpose services of consultants having good academic background and knowledge of the subject (assignment), so that quality M&E Guidelines and templates can be prepared and delivered within the stipulated time frame;
- Consulting firm shall propose an appropriate methodology for the study in the context of objective of the assignment and scope of services;
- Prepare and finalize M&E Guideline based on the study of documents, objective of the assignment and the data/information collected from various internal and external sources. M&E Guideline should cover maximum areas of monitoring activities/components of specific item;
- Arrange a Workshop/Seminar for dissemination of the study findings and finalizing the guideline incorporating comments/observations of the participants.

3. Approach and Methodology

3.1 Approach

General Approach: The Consultants as part of their approach to accomplish the objectives of the study assessed the needs of the M&E guideline for effective and efficient project management, monitoring and evaluation in using the established smart indicators at the project areas as result of project intervention.

Specific Approach: The consultants approach was in line with the main objective of the study that seeks to gather information and provide complete picture on guideline that can be effectively used by the IMED and other stakeholders to guide the officers of the IMED and external stakeholders in building systematic approach through use of the Guideline. In addition, the study carries out SWOT analysis to identify strengths, weaknesses, opportunities and treats including sustainability of the existing IMED M&E Procedures.

3.2 Methodology

The methodology for the present study for preparation of M&E guideline used for system-wide approach, which was both detailed and participatory. This approach wide ranging and sequenced discussion with SMECI professionals and officers related to assess the implementation status of the project and results of the project support and services. The study involved the use of structure interview by means of KII, collection of primary and secondary information, reviewing the available reports by a team of consultants.

3.2.1 Description of different stakeholders to be involved in the proposed activities: IMED officers, project concerns personnel, key officers of the SMECI, planning/M&E related officials of different agencies and guideline makers were involved in study activities.

3.2.2 Coordination with PD/DPD-SMECI: The consultants were coordinated with respective SMECI and IMED relevant officers and MOP officials to get their advice and make good relations, environments and others for smooth survey and information collection. With the help of IMED and suggestions from the PD/DPD-SMECI, the team leader with other experts reached the target stakeholders to collect information, conducting Key Informant Interviews. Moreover, during information collection, concerned IMED staffs were invited to observe the activities of the consultants. In addition to that, the consultants discussed when necessary with the officials of IMED.

3.2.3 The information collection and review process

The study was initiated to develop a guideline in a situation when IMED has no specific guideline for M&E in industry, power & energy sector. The study was therefore had to consult with other countries' experiences in their M&E guideline formulation and adoption, particularly for M&E system management.

The following table shows the categories of documents reviewed and agencies and countries were included in that:

Type of documents	Source Agencies/ Countries
All M&E reporting formats, criteria and guidelines, PMIS policy and scope of IMED for ADP	IMED
All M&E formats, criteria, guidelines and MIS for ADP projects implementing agencies	MPEMR, Power Cell, BPDB, APSCL, PGCB, Petrobanga, BAPEX, GTCL,BEZA, BCIC, BSFIC
M&E Guideline and framework of other countries	Nepal, Thailand, Japan

3.2.4 Case study analysis

EQMS team has considered 10 (Ten) ADP Project for review and selected as case study.

3.2.5 Area to be addressed

1. The description of every sector based related terminologies will be included as glossary in the draft/ final guideline/manual and the evaluation and monitoring policy.
2. Separate monitoring and evaluation templates will be formulated with the indicators in sector based guideline/ manual.
3. The methodology of measuring the quality of physical work will be included in monitoring template along with the financial and real progress.
4. Terms of Reference (ToR)will be included in every inception report, draft/final guideline/manual.
5. 'Literature Review' will be included as separate chapter in inception, draft/final guideline/manual and including the monitoring format of IMED the others documents that are being reviewed have to be mentioned clearly in 'Literature Review' chapter.
6. The tools for measuring cost effectiveness of project/specific components will be mentioned in sector-based guideline/manual.
7. 'Reference' will be included as separate chapter in inception, draft/final guideline/manual and the source of used every information there will provide.
8. For the description of various plant (i.e. power plant) or process (i.e. processing, distribution) in the draft/final guideline/manual, the picture/description of layout plan, flowchart and forward and backward linkage will be included in the report.
9. In the draft/final guideline/manual, recommendations will be provided considering the rationality about the formation of technical unit in IMED.
10. Related checklists for the monitoring and evaluation of purchasing will be included in the appendix chapter of the draft/final guideline/manual.
11. The language of the draft/final guideline/manual and monitoring and evaluation policy has to be simple, lively, understandable and easily readable and there should be a linkage within and between paragraphs, sentence making and spelling of word will be written correctly in the report.

3.2.6 Questionnaire Formulation

1. Questionnaire will be formulated containing logical questions considering respondent so that relevant questions will be included in the questionnaire.
2. Specific questions about the durability of the project will be included in the questionnaire.
3. While asking questions to the respondent, the answers will be open ended as far as possible rather than the answers in 'Yes' or 'No'.
4. Topic list, guideline for in depth interview for Focus Group Discussion will be mentioned in Inception/Final Guideline report.

3.2.7 Sampling Collection

1. For the preservation of the quality of sector based guideline/manual, the projects implemented by the financing of GoB including overestimated expensed projects and projects of identical nature will be considered under the Annual Development Program of last 5 fiscal years including the current year for the selection of project.
2. For project selection and information collection, related technical persons, the personnel of planning cell of ministry and organization will be included.
3. Considering Delta Plan, Perspective Plan of sector specific ministry, projects will be selected for observation.

3.2.8 Major Part Need to be Focus in the Report

1. The tools for monitoring and evaluation of cost effectiveness, production efficiency to the goal, desired profit according to IRR in project deed of constructed plants of Industry, Power and Energy Sector.
2. As far as efficient tools will be included in the guideline to estimate the output-outcome and durability of project.
3. For the description of related plant (i.e. power plant) and process in the guideline/manual, the picture/description of layout plan, flowchart and forward and backward linkage will be included.
4. For constructed plants and equipment in Industry, Power and Energy Sector, the issues of di/tri generations will be included in terminology and description.

3.2.9 Expected Deliverables/ Reporting:

The following deliverables are expected (from the date of contract signing)

SL.	Deliverables	Number of reports	Delivery timeline (Weeks after signing contract)
1	Inception report (Inclusive of detailed work plan, methodology, sample size, questionnaire and strategy)	10	3
2	Submission and finalizing the data collection instruments after field testing	-	4
3	Information collection from stakeholders and preparation of draft report	-	8
4	Submission of 1st draft report	10	8
5	Submission of 2nd draft report	10	12
6	Workshop with stakeholder for finalization of draft report (Guideline)	50 copies in English	13
7	Submission of final report (Guideline) incorporating feedback fromstakeholders.	40 copies in English, 10 copies in Bangla	15

3.2.10 Work Plan

The work plan is primarily aimed at identifying the tasks that will be involved in the proposed study. It will also give an attention to developing a task schedule and an appropriate staffing schedule of professional consultants and supporting staff for conducting the guideline study. The work plan is presented in the following table:

No.	Activities	Months															
		1				2				3				4			
		Weeks															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Kickoff Meeting																
2	Identify the purpose and scope of the M&E system																
3	Submission of Inception Report																
4	Plan for data collection and management																
5	Submission and finalizing the data collection instruments after field testing																
6	Data analysis																
7	Plan for information reporting and utilization																
8	Carry out interviews of the stakeholders																
9	Information collection from stakeholders and preparation of draft report																
10	Submission of 1st draft report																
11	Plan for M&E human resources and capacity building																
12	Prepare the M&E budget																
13	Preparation & Review the M&E Report																
14	Submission of 2nd draft report																
15	Workshop with stakeholder for finalization of draft report																
16	Preparation of final report (guideline) incorporating feedback from																
17	Submision of final report (guideline) incorporating feedback from																

ANNEXURE-3: LITERATURE REVIEW

A good number of literatures have been reviewed for the study. The materials were grouped in a few categories to capture the different essentials and views in relation to develop a diverse project-wide M&E guideline. The categories were classified particularly for:

Understanding present practice and priority of IMED in undertaking M&E activities;

Country priority needs in achieving the particular sectoral national and global goals and targets;

Understanding the modern concept and practice of M&E; and

Understanding the M&E policy/guideline framework of different countries those would be best fit in our country context;

For understanding present practice and priority and involvement of IMED in undertaking M&E activities, the following documents were reviewed:

- Strategic plan 2008-2013, IMED;
- Annual Report of IMED 2017-2018;
- Seven-Year Achievement of IMED;
- Project Inspection Guideline of IMED;
- M&E Data Collection & Reporting formats, 2003, IMED;
- Guidelines for preparing ADP 2018-2019, Planning Commission;
- Project overview/List of project of Annual Development Programme 2018-2019, Planning Commission;
- Methods of Preparation, processing, approval and revision of the projects under ADP, Planning Commission;
- Development Project Proforma/ Proposal Manual, Planning Commission;

IMED initiates monitoring and evaluation activities following a guideline and some set criteria. They maintain particular frequency in data collection and reporting and undertake field inspection as required. Besides, in-depth monitoring/review and impact study are also carried out to understand the negative and positive lessons from particular projects. These in-depth monitoring and impact study needs are usually met by outsourcing.

All those documents have given priority to poverty elimination, growth escalation and inclusion and resilient and sustainable development. Specific timeframe, indicators and criteria for achieving those are well defined and subject to systematic monitoring by IMED.

A good number of documents were included for the study for getting detailed perspective on M&E concept, types, process, methods and application with better focus on and understanding of theory of change, Log-frame and result-based performance monitoring and study.

Industry, Power & Energy sector of Bangladesh is a challenging sector and development of these sectors are dependent on many factors. In this guideline, a brief discussion on Industry, Power & Energy scenario of Bangladesh has demonstrated with recent information and data that got from Monthly, Quarterly & Annual Monitoring & Evaluation report of

different Ministry/Division. A total review of feasibility report of power generation, transmission and distribution, machineries of different industries and their uses being demonstrated and preparation of monitoring & evaluation guideline for IMED officers in Industry, Power & Energy sector has been discussed. Experts were reviewing Monitoring and Evaluation (M&E) manual on Construction Works (Roads, Bridges and Culverts) & Construction Works (Buildings) which already uploaded by IMED at their website for preparation of methodology. So long, on the basis of 'learning by doing', newly posted or recruited officers have been carrying out their responsibilities of monitoring and evaluation. Of course, a small 05 page inspection guideline followed by a 06 page format of Project Inspection Report was prepared in 1995 and was practiced till 2004 when Project Inspection Report format was revised and reduced to a 02 page format and was named as IMED 06/2003. Both these guidelines contain number of instructions to the intending field inspecting officials. These instructions cover almost all aspects of project activities. Wefollow indicator-based monitoring though thisis not enough. It directs only what to be inspected, and not how to be inspected and check quality of construction work. Therefore, everybody including the newcomers in the IMED feels necessity of a comprehensive manual/guideline on monitoring & evaluation. Still IMED officers have no monitoring & evaluation policy. In our existing M&E system, absence of high level political commitment, personal interest,low priority given to M&E in general and 'Evaluation' particular.Lack of trained M&E human resource also a major weakness of IMED. We have no specific M&E training for M&E staff to increase their capability.

To facilitate and enhance skill of the officers and to strengthen the capability of the organization, Monitoring & Evaluation Manual for Industry, Power & Energy need to be prepared. The monitoring & evaluation of investment projects leading to Industry, Power & Energy is the subject of major importance in decision-making. In depth, evaluation is needed to determine reasons for poor performance. This guideline presents a critical review of Bangladeshi Monitoring &Evaluation literature on the investment strategy at the national level and the evaluation of its quality & effectiveness.

ANNEXURE-4: CHECKLIST FOR KEY INFORMANT INTERVIEW (KII) WITH PD/AGENCY/FIELD OFFICERS

General information

1. Name of the Informant:
2. Designation:
3. Name of the Project:
4. Name of implementing agency:
5. Location of the project:

Sl.	Aspects to be answered/covered	Yes/No	Remarks
6.	How many times the project director were changed for this project.		
7.	Do you have any M&E guidelines/manual/template?		
8.	If yes, please share your M&E template/Guidelines		
9.	What is the implementation status of the proposed project for what I come here?		
10.	Did you prepare any M&E plan for this proposed project?		
11.	Preparation & following of Gantt chart of project activity and Procurement Schedule.		
12.	Frequency of updating the Gantt chart of project activity and Procurement Schedule.		
13.	Matches or Deviated the Physical Progress to Financial progress of components as approved in the project document.		
14.	Submission of report in the 02, 03 IMED formats with the information matching the targets consistently by progress of physical components.		
15.	Year wise fund release and expenditure are consistent with the reported figures in the IMED formats.		
16.	Project authority has clearly identified the RPA expenditure items of the project and is making the RPA claims from DOSA, CONTASA, SAFE, Impressed, etc. accounts properly and timely		
17.	Claims of RPA expenditures are being submitted quickly for reimbursement.		
18.	Mitigation programs for environmental impact has been taken in consideration by the project authority as mentioned in the DPP.		
19.	Ensuring proper and adequate safety and security measures		
20.	The project is contributing to the PRS and MDGs as mentioned in the DPP.		

Field Visit Template

SN	Component of the project	Activities	Description of Technical Specification	Image/Picture
1.				
2.				

ANNEXURE-5: CHECKLIST FOR DPP

1. Ministry/Division		
2. Implementing Agency		
3. Project Completion Time		
4. Objectives of the Project:		
5. Project Name and ID		
6. Brief Description of project component /Works		
7. Mode of Finance (Tick relevant one)	**Bank☐ GoB ☐ Self☐**	
8. Area covered in the Project (Division, District, Upazila, Union)		
……. Date of Visit	**Checked by……. Designation…..**	Signature

Sl.	Aspects to be answered/covered	Yes/No	Remarks
9.	Log frame is developedand reviewed by Ministry/Agency & Planning Commission properly;		
9a.	Reflection of ADP allocation in DPP		
9b.	Managing the project, required workers from existing setup, recruited directly or recruited by outsourcing is justified properly.		
9c.	Whether recruitment of personnel has been made following government recruitment rules and regulations?		
9d.	Whether recruited/deputed personnel have requisite the progress of project (monthly/quarterly/half yearly)		
10.	The Manpower is recruited as per DPP? (Yes/No) a) Amount of foreign workers b) Amount of local workers c) Ensure Foreign/Local workers facilities as per DPP?		
11.	Provision of Steering Committee and PIC for reviewing the progress of project (monthly/quarterly/half yearly) is kept in DPP.		
12.	Plan for procurement of goods, works and services as mentioned in the Annex III (a), III (b) and III(c) are being executed following the PPA-2006 and PPR-2008. *Make analysis of the individual contracts in the Checklist for Procurement of Construction (Industry/ Power/ Energy) Work – Annexure-7.		
13.	Physical components as approved in the project document is differed from those being executed in the field.		

Sl.	Aspects to be answered/covered	Yes/No	Remarks
14.	Year wise fund release and expenditure are consistent with the reported figures in the IMED formats.		
15.	Whether mitigation programs for environmental impact hasbeen taken care of by the project authority as mentioned inthe DPP.		
16.	Whether the project is contributing to the SDGs as mentionedin the DPP.		
17.	Whether there is a possibility of time over run and cost overrun		
18.	Whether internal and external audits are being carried out. When last internal and external audit was done.		
19.	The cost involvement as mentioned in the DPP for rehabilitation/resettlement will remain within the approved		
20.	The reason of time extension a) Recruitment of Project Director b) Land Acquisition c) Land Development d) Longer Procurement Process e) Force Measures f) Others (If any)		

ANNEXURE-6: CHECKLIST FOR TPP

1. Project Title:
2. Objectives of the project:
3. Estimated cost of the project total GoB PA (RPA):
4. Mode of Financing:
5. Components of the Project:
6. Project Completion Time:

Sl.	Aspects to be answered/covered	Yes/No	Remarks
7.	Possibility for cost and time overrun.		
8.	PD/NPD is a full time or a part time appointee.		
9.	Financing arrangement has been finalized;		
10.	Loan/credit/grant and other amounts as approved in the TPP is the same.		
11.	TOR of the consultants adequately covers the areas related to the objective of the TPP.		
12.	PPR 2008 has been followed in selecting consultants		
13.	Steps and policy adequately have been taken by the project authority to ensure transfer of technology;		
14.	Consultant's performance is being monitored regularly		
15.	Educational qualifications and experience of the consultants are relevant to the assignments they have been engaged.		
16	The counter-part personnel attached to the consultants have required educational qualifications and experience as mentioned in the approved TPP.		
17.	Letter of agreement with implementing agency and the development partner has been signed		
19.	Project steering committee has been formed to review the progress of work		
22.	Project work is progressing as per approved implementation works schedule provided in the TPP.		
23.	CPM/ BarGantt Chart, for smooth execution of the project, has been prepared.		

ANNEXURE-7: CHECKLIST FOR PROCUREMENT OF CONSTRUCTION WORK

PART-A: GENERAL		
1. Ministry/Division		
2. Agency		
3. Procuring Entity		
4. Description of Procurement		
5. Procurement Type	NCT/ICT	
6. Category of Procurement	Goods/ Works/Services/PSN	
7. Method of Procurement	OTM/ LTM/ OSTETM/ TSTM/ RFQM/ DPM	
	QCBS/ FBS/ LCS/ SSS/ ICS/ CQBS/ CSOS/ DCS/QBS etc.	
8. Object of Procurement		
9. Financing Arrangement of the Procurement	Revenue/Development	

PART B: SCHEDULEOF OF ACTIVITIES

Date of approval of Annual Procurement Plan (APP)

Sl.	Activity (If not applicable indicate N/A)	Planned Date (As per procurement plan/ Flow Chart)	Actual Date	Remarks
1	**Procurement Opportunities**			
1.1	Date of advertisement of IFT/EOI in newspaper (NCT/ICT)			
1.2	Date of advertised in CPTUs website/ dg Market Date of advertised in CPTUswebsite/ dg Market			
1.3	Tenders/Proposals followed PPR, 2008 or e-GPguideline			
1.4	Tenders/Proposals followed DP'sGuidelines			
2	**Tenders/Proposals Submission**			
2.1	No of Sale/Issuance of Tender/Proposal Documents			
2.2	No of Tenderer/Consultant participated (Submission)			
2.3	Days allowed per Rule for Preparation andSubmission			
3	**Formation of TOC/POC and TEC/PEC**			

Sl.	Activity (If not applicable indicate N/A)	Planned Date (As per procurement plan/ Flow Chart)	Actual Date	Remarks
3.1	No of members in TOC/POC			
3.2	No of member in TOC/POC from TEC/PEC			
3.3	Approval date of TOC/POC			
3.4	No of members in TEC/PEC			
3.5	No of external members in TEC/PEC			
3.6	Authority approved TEC/PEC with date			
4.	**Tenders/Proposals Evaluation**			
4.1	Days allowed in tender/proposal documents forpreparation, submission and opening			
4.2	Actual days between opening and completion/submission of evaluation			
4.3	No of responsive tenders/proposals			
4.4	No of non-responsive tenders/proposals withreasons			
4.5	Re-invitation of tenders/proposals recommendedby TEC/PEC			
4.6	Procurement proceedingsannulled/cancelled			
5.	**Approval of Tenders/Proposals**			
5.1	Days actual between submission of evaluation andapproval			
5.2	Approving Authority(AA) as per DoFP			
5.3	Authority approved			
5.4	Evaluation report was sent as per PPR to the AA			
5.5	Date of approval decision received by PE			
5.6	Date of issuance of NOA/PO/LOI			
5.7	Authority other than AA, if any, made additionalreview of the evaluation report			
5.8	Authority higher or lower than AA, if any, approved the Tenders/Proposals			
6.	**Contract Award**			
6.1	Procurement processing lag/lead-time (i.e. Daysactual between opening and issuance ofNOA/PO/LOI)			
6.2	Days actual between IFT/RFP and issuance ofNOA/PO/ LOI contract			

Sl.	Activity (If not applicable indicate N/A)	Planned Date (As per procurement plan/ Flow Chart)	Actual Date	Remarks
	signing			
6.3	Contract award made within the initial tender/proposal validity period			
6.4	Publication of award in CPTUs website/PE'swebsite/others			

PART C: INDIVIDUAL CONTRACT REVIEW

Sl.	Contract Implementation	Planned Date (As per procurement plan/ Flow Chart)	Actual Date	Remarks
1	**Completion of Contract**			
1.1	Days per original contract time specified forSupply/Execution/Perform			
1.2	Days actual forSupply/Execution/Perform			
1.3	Amount of LD imposed (if any)			
2	**Complaints and Appeal**			
2.1	Complaint, if any, lodged and reasons thereof			
2.2	Resolution of complaints per Rules			
2.3	Modifications resulting from resolution of complaints			
2.4	Appeal to Independent Review Panel			
2.5	Review Panel's decision and follow-on			
3.	**Contract Amendment**			
3.1	No of times contract completion period extendedand with no of days			
3.2	Variation/ExtraWork/Repeat/Additional DeliveryOrders/ replacement of Key Personals etc. made			
3.3	No and amount of such orders			
4.	**Contract Disputes unresolved**			
5.	**Fraudulence and Corruption**			
6.	**Procurement Management Capacity**			
6.1	HRD facilities			
6.2	No of Staff trained in procurement			

ANNEXURE-8: MONITORINGFORMAT FOR INSPECTION OF INDUSTRY, POWER & ENERGY

Development Project/ Programme Site Inspection Form
(Form to be filled out by Project Inspector)

1. Name of the Project:
2. Budget Sub-title No.:
3. Ministry:
4. Project Implementing Agency:
5. Project Location:
a) Development Region: b) District: c) Municipality/Upazila:
6. Source of Expenditure/Development Partner:
7. Progress of the Project (Up to last FY)

Last year physical progress (%)	Physical progress up to last FY (%)	Last Year expenditure (%)	Expenditure up to last FY (%)	Causes of less achievement

8. Activities and budget of the Project..... FY (current year)
a) Date of authority and approved annual development programme received:
b) Requesting date for budget release:
c) Date of budget release:
d) Reasons if budget is not released:
9. Project's current year activities and progress description:

S.N.	Main Activities	Expected outputs	Previous Trimester Physical Progress Against (%)				Projects output and outcomes up to this period
			First Trimester	Second Trimester	Third Trimester	Fourth Trimester	
1							
2							

10. Budget Description of Current Fiscal Year

Current FY Budget	Release Amount up to this period	Expenditure up to this period	Remarks

11. Managerial Aspect:

(a) Physical

Number ofphysical tools and equipment	Number ofvehicles	Number ofvehicles actually being utilized	Number of vehiclesin workingcondition	Number and name ofadditional physicaltools needed

(b) Human Resources

No. of sanctioned post	Number of fulfilled posts	Number of vacant posts	Period of vacancy and causes	Sufficiency of sanctioned posts

12. Main problems during implementation of the project (mention according to the level of importance):

S.N.	Problem Type	Problems Observed in Implementation	Methods to resolve the problems	Action taken to resolve the problems	Major Achievements up to this Period
1.	Approval Process				
2.	Procurement				
3.	Management				
4.	Fund Allocation/Release				
5.	Manpower Recruitment				
6.	Others (specify)				

13. Description of the inspection visits in current FY

S.N.	Name, Post, Class of inspection officers	Date of inspection
1		
2		

14. Comments and suggestions of project manager about the project:
15. Project Manager:
(a) Name, Designation, Level:
(b) Period of Involvement in the Project:

16. Main aspects that are observed at a time of field inspection:
a) Activities
b) Output
c) Strengths
d) Weaknesses

17. Procurement Plan Monitoring

SL	Construction Equipment/ Machineries	Unit	Quantity	Procurement Method	Contract Approving Authority	Present Procurement Status	Source of Fund	Signing of Contract/ Completion of Contract	Quality of goods	Checking Quality Certificate	Availability of skilled Human resources	Comments/ Remarks
Package	**Works**											
1										N/A		
2												
3												
	Goods/ Equipment											
1												
2												
3												
	Services											
1										N/A		
2												
3												

18. Procurement of Goods, Works and Consultancy Services

Description of procurement (goods/ works /consultancy) as per bid document	Tender/Bid/ProposalCost (in crore Taka)		Tender/Bid/Proposal		Date of completion ofworks/services and supply of goods	
	As per PP	Contractedvalue	Invitation date	Contractsigning/ L.C opening date	As percontract	Actual

19. Training of Project Personnel (Foreign/Local):

Field of Training /Study tour/ workshop/Seminar etc.	Provision as per PP		Actual		Remarks
	Number of person	Man months	Number of person	Man months	
Foreign					
Local					

20. Procurement of Transport (In Nos.)

Type of transport	Numberas per P.P.	Procuredwith date	Transferred to Transport Pool with date	Transferred to O&M with date	Condemned/damaged with date	Remarks
Car						
Jeep						
Microbus						
Minibus						
Bus						
Pick-up						
Truck						
Motor Cycle						
By-Cycle						
Speed Boat						
Others						

21. Financial & Physical Progress of the Project (Taka in Lac)

Sl. No	Project Component	Estimated Cost GoB PA Self Others	Start-Year Cumulative Progress as per DPP			FY... ADP Allocation	July 20.....-present GoB Fund Release	In current FY progress as per DPP: 20....-20.....				Start-Present Cumulative Progress as per DPP		
			Qtty	Percentage (%)	Financial Progress	lakh Taka	GoB Fund Release(%)	Qtty	Percentage (%)	Financial Progress	Target	Qtty	Percentage (%)	Financial Progress
			Physical Progress					Physical Progress			Target	Physical Progress		

22. Cost/Benefit:

Item	Estimated	Actual
(1) Benefit cost ratio of the project (i) Financial (ii) Economic		
(2) Internal Rate of Return (i) Financial (ii) Economic		

23. Comments/Suggestions of the Inspector:
Description of the Inspector

Name	Post, Class	Signature	Date of inspection	Date of submission of inspection report

ANNEXURE-9: MEETING MINUTES

গণপ্রজাতন্ত্রীবাংলাদেশসরকার
পরিকল্পনামন্ত্রণালয়
বাস্তবায়নপরিবীক্ষণওমূল্যায়নবিভাগ (আইএমইডি)
স্ট্রেংদেনিংমনিটরিংএন্ডইভালুয়েশনক্যাপাবিলিটিজঅবআইএমইডি
(এসএমইসিআই) (২য়সংশোধিত) প্রকল্প
শের-ই-বাংলানগর, ঢাকা।

EQMS Consulting Limited
M&E Preparation on Industry, Power & Energy
২য়স্টিয়ারিংকমিটিসভা (১মড্রাফটরিপোর্ট)

পরামর্শকপ্রতিষ্ঠানএরপ্রতিক্রিয়া

নং	সাধারণনির্দেশাবলী	প্রতিক্রিয়া
১	বিদ্যমানমনিটরিংওইভালুয়েশনফরমেটেরদূর্বলতাএবংপ্রকল্পেরসময়, ব্যয়ওপরিধিবৃদ্ধিরকারণগাইডলাইন/ম্যানুয়েলেউল্লেখকরতেহবে;	অধ্যায়১. ৭ও১.৮ পৃষ্ঠা-৯-১০ পরিশিষ্ট/ সংযোজন-৩ পৃষ্ঠা-১০৩-১০৪
২	গাইডলাইন/ম্যানুয়েলেজেনারেশন, ট্রান্সমিশনওডিস্ট্রিবিউশনপর্যায়েরকাজমনিটরওইভালুয়েটকরারজন্যমনিটরিংওইভালুয়েশনটেমপ্লেটপৃথকভাবেপ্রণয়নকরতেহবে;	অধ্যায়৯, ১০,১১ও১২ পৃষ্ঠা-৭৬-৯০
৩	মনিটরিংটেমপ্লেটে/চেকলিস্টেচলমানপ্রকল্পেরপ্রারম্ভিকপর্যায়, মধ্যবর্তীপর্যায়ওশেষপর্যায়বিবেচনাপূর্বকপৃথকশিরোনামেপ্রশ্নসমূহ/আইটেমসমূহঅন্তর্ভুক্তকরতেহবে;	অধ্যায়৯, ১০ও১১ পৃষ্ঠা-৭৬-৮৭
৪	ইভালুয়েশনটেমপ্লেটেপ্রান্তিকওপ্রভাবমূল্যায়নেরজন্যপৃথকশিরোনামেপ্রশ্নসমূহ/চেকলিস্টঅন্তর্ভুক্তকরতেহবে;	অধ্যায়১১ ও১২ পৃষ্ঠা-৮৪-৯০
৫	প্রকল্পদলিলেউল্লিখিতকর্মপরিকল্পনাঅনুযায়ীপ্রকল্পেরকাজেরঅগ্রগতিহচ্ছেকিনা, প্রকল্পেঅভিজ্ঞওদক্ষজনবলনিয়োজিতআছেকিনা, জনবলনিয়োগসঠিকহয়েছেকিনাএবংপ্রকল্পেরআইটেমওয়ারিকোয়ালিটিব্যয়হচ্ছেকিনাতাপরিবীক্ষণেরজন্যপৃথকছক/চেকলিস্টমনিটরিংটেমপ্লেটে/ চেকলিস্টেউল্লেখকরতেহবে;	পরিশিষ্ট/ সংযোজন-৮ নং-১১ও১৭ পৃষ্ঠা-১১৩-১১৪
৬	প্রত্যেকমনিটরিংওইভালুয়েশনটেমপ্লেটেন্যূনতম৩টিকরেআউটপুটওআউটকামইন্ডিকেটরঅ	অধ্যায়১২

নং	সাধারণনির্দেশাবলী	প্রতিক্রিয়া
	ন্তর্ভুক্তকরতেহবে;	পৃষ্ঠা-৮৯
৭	মনিটরিংটেমপ্লেটেআর্থিকওবাস্তবঅগ্রগতিরসাথেভৌতকাজেরগুণগতমানপরিমাপেরপদ্ধতিঅন্তর্ভুক্তকরতেহবে;	পরিশিষ্ট/সংযোজন-৮ নং-২১ পৃষ্ঠা-১১৬
৮	প্রতিটিখসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলে 'টার্মসঅবরেফারেন্স' অন্তর্ভুক্তকরতেহবেএবংএতেউল্লেখিতকর্মপরিধিঅনুযায়ীগাইডলাইনপ্রণয়নকরতেহবে।টার্মস অবরেফারেন্সঅনুযায়ীকাজহয়েছেকিনাতাসুনির্দিষ্টছকেকাজেরস্কোপওপৃষ্ঠাউল্লেখপূর্বকগাইডলাইন/ম্যানুয়েলেঅন্তর্ভুক্তকরতেহবে;	পরিশিষ্ট/সংযোজন-১ পৃষ্ঠা-৯৪
৯	খসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলে 'লিটারেচাররিভিউ' পৃথকঅধ্যায়হিসেবেঅন্তর্ভুক্তকরতেহবেএবং 'লিটারেচাররিভিউ' অধ্যায়েআইএমইডি'রমনিটরিংফরমেটসহঅন্যান্যকীকীডকুমেন্টরিভিউকরাহচ্ছেতাস্পষ্টভাবে উল্লেখকরতেহবে;	পরিশিষ্ট/সংযোজন-৩ পৃষ্ঠা-১০৩-১০৪
১০	প্রকল্পের/নির্দিষ্টকম্পোনেন্টেরকস্টইফেকটিভনেসপরিমাপকরারটুলসেক্টরভিত্তিকগাইডলাইন/ম্যানুয়েলেঅন্তর্ভুক্তকরতেহবে;	অধ্যায়৮ পৃষ্ঠা-৭৪
১১	খসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলে 'রেফারেন্স' পৃথকঅধ্যায়হিসেবেঅন্তর্ভুক্তকরতেহবেএবংসেখানেব্যবহৃতপ্রত্যেকটিতথ্যেরউৎসপ্রদানকরতেহবে।মনিটরিংওইভালুয়েশনসংক্রান্তরেফারেন্সঅন্তর্ভুক্তকরতেহবে;	অধ্যায়-১৪ পৃষ্ঠা-৯৩
১২	খসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলেআইএমইডিতেযৌক্তিকতাবিবেচনায়টেকনিক্যালইউনিটগঠনেরবিষয়েসুপারিশপ্রদানকরাযেতেপারে;	অধ্যায়-১৩.২ পৃষ্ঠা-৯১
১৩	খসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলেনির্বাহীসার-সংক্ষেপ, মেথডোলজি, সীমাবদ্ধতা, সুপারিশওউপসংহারঅন্তর্ভুক্তকরতেহবে;	পরিশিষ্ট/সংযোজন-২ পৃষ্ঠা-৯৮ অধ্যায়-১৩ পৃষ্ঠা- ৯১
১৪	খসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলেওমনিটরিং-ইভালুয়েশনপলিসিতেভাষাসহজ, প্রাঞ্জল, বোধগম্যওসুখপাঠ্যহতেহবেএবংপ্রতিবেদনেরঅন্তঃওআন্তঃঅনুচ্ছেদের (inter and intra paragraphs) মধ্যেসংযোগ/যোগসূত্রথাকতেহবে; বাক্য গঠন ও শব্দের বানান শুদ্ধভাবে লিখতে হবে;	অন্তর্ভূক্ত করাহয়েছে
১৫	"এসএমইসিআই (২য়সংশোধিত)" প্রকল্পেরঅর্থায়নেগাইডলাইন/ম্যানুয়েলপ্রণীতহয়েছেতাশুধুমাত্রগাইডলাইন/ম্যানুয়েলেরব্যাককাভারেউল্লেখকরতেহবে;	অন্তর্ভূক্ত করাহয়েছে
১৬	ক্রয়সংক্রান্তচেকলিস্টেসাধারণওবিষয়ভিত্তিকপ্রশ্নাবলীপৃথকভাবেউল্লেখকরতেহবে;	পরিশিষ্ট/সংযোজন-৭ পৃষ্ঠা-১০৯
১	গাইডলাইন/ম্যানুয়েলেবিভিন্নগ্রুপেরজন্যপ্রণীতপ্রশ্নমালাঅন্তর্ভুক্তকরতেহবে;	অধ্যায়৯,

নং	সাধারণনির্দেশাবলী	প্রতিক্রিয়া
৭		১০,১১ও১২ পৃষ্ঠা-৭৬-৯০পরিশিষ্ট/সংযোজন-৪,৫,৬,৭,৮ পৃষ্ঠা-১০৫-১১৬
১৮	পরবর্তী স্টিয়ারিং কমিটির সভায় বাংলা প্রতিবেদনের খসড়া প্রদান করতে হবে।	অন্তর্ভূক্ত করাহয়েছে
১৯	Power Plant – এরস্টেপগুলোরবিবরণগাইডলাইনেঅন্তর্ভুক্তকরতেহবে।	অধ্যায়২, ৩ও৪ পৃষ্ঠা-১৫-৭৩

গণপ্রজাতন্ত্রীবাংলাদেশসরকার
পরিকল্পনামন্ত্রণালয়
বাস্তবায়নপরিবীক্ষণওমূল্যায়নবিভাগ (আইএমইডি)
স্ট্রেংদেনিংমনিটরিংএন্ডইভালুয়েশনক্যাপাবিলিটিজঅবআইএমইডি (এসএমইসিআই) (২য়সংশোধিত) প্রকল্প
শের-ই-বাংলানগর, ঢাকা।

EQMS Consulting Limited
M&E Preparation on Industry, Power & Energy
৩য়স্টিয়ারিংকমিটিসভা (২য়ড্রাফটরিপোর্ট)
পরামর্শকপ্রতিষ্ঠানএরপ্রতিক্রিয়া

নং	সাধারণনির্দেশাবলী	প্রতিক্রিয়া
১	মনিটরিংটেমপ্লেটে/চেকলিস্টেচলমানপ্রকল্পেরপ্রারম্ভিকপর্যায়, মধ্যবর্তীপর্যায়ওশেষপর্যায়বিবেচনাপূর্বকপৃথকশিরোনামেপ্রশ্নসমূহ/আইটেমসমূহঅন্তর্ভুক্তকরতেহবে;	অধ্যায়৯, ১০ও১১ পৃষ্ঠা- ৭৬-৮৭
২	ইভালুয়েশনটেমপ্লেটেমধ্যবর্তী, প্রান্তিকওপ্রভাবমূল্যায়নেরজন্যপৃথকশিরোনামেপ্রশ্নসমূহ/চেকলিস্টঅন্তর্ভুক্তকরতেহবে;	অধ্যায়১০, ১১ও১২ পৃষ্ঠা-৮৩-৮৬
৩	প্রকল্পদলিলেউল্লিখিতকর্মপরিকল্পনাঅনুযায়ীপ্রকল্পেরকাজেরঅগ্রগতিহচ্ছেকিনা, প্রকল্পেঅভিজ্ঞওদক্ষজনবলনিয়োজিতআছেকিনা, জনবলনিয়োগসঠিকহয়েছেকিনাএবংপ্রকল্পেরআইটেমওয়ারিকোয়ালিটিব্যয়হচ্ছেকিনাতাপরিবীক্ষণেরজন্যপৃথকছক/চেকলিস্টমনিটরিংটেমপ্লেটে/ চেকলিস্টেউল্লেখকরতেহবে;	পরিশিষ্ট/ সংযোজন-৮ নং-১১ও১৭ পৃষ্ঠা-১১৩-১১৪
৪	প্রকল্পের/নির্দিষ্টকম্পোনেন্টেরকস্টইফেকটিভনেসপরিমাপকরারটুলসেক্টরভিত্তিকগাইডলাইন/ম্যানুয়েলেঅন্তর্ভুক্তকরতেহবে;	অধ্যায়৮ পৃষ্ঠা-৭৪
৫	খসড়া/চূড়ান্তগাইডলাইন/ম্যানুয়েলেনির্বাহীসার-সংক্ষেপ, মেথডোলজি, সীমাবদ্ধতা, সুপারিশওউপসংহারঅন্তর্ভুক্তকরতেহবে;	পরিশিষ্ট/ সংযোজন-২ পৃষ্ঠা-৯৮ অধ্যায়-১৩ পৃষ্ঠা- ৯১
৬	ইনসেপশন১মও২য়খসড়াপ্রতিবেদনেরউপরঅনুষ্ঠিতস্টিয়ারিংকমিটিরসভাসমূহেরসিদ্ধান্তঅনুযায়ীগৃহীতব্যবস্থাবলীপৃথকঅধ্যায়হিসেবেম্যানুয়ালের/গাইডলাইনেসন্নিবেশকরতেহবে	পরিশিষ্ট/ সংযোজন-৯ পৃষ্ঠা-১১৭
৭	পরবর্তী স্টিয়ারিং কমিটির সভায় কর্মশালারমাধ্যমেচূড়ান্তকৃতপ্রতিবেদনেরইংরেজিওবাংলাভার্সনপ্রদান করতে হবে।	অন্তর্ভূক্ত করাহবে
৮	Power Plant – এরস্টেপগুলোরবিবরণগাইডলাইনেঅন্তর্ভুক্তকরতেহবে।	অধ্যায়২,

নং	সাধারণনির্দেশাবলী	প্রতিক্রিয়া
		৩৩৪ পৃষ্ঠা- ১৫-৭৩
৯	মূল্যায়নটেমপ্লেটেসাধারণপ্রশ্নাবলীরসাথেসেক্টরবিষয়কপ্রশ্নসন্নিবেশকরতেহবে	অধ্যায়৯, ১০,১১ও১২ পৃষ্ঠা-৭৬-৯০

EQMS Consulting Limited
M&E Preparation on Industry, Power & Energy
Workshop on 2nd Draft Report

Response from Consultancy Firm

SL	Comments	Response
1.	How much time were changed the PD of the project?	Annexure-4, page-105
2.	Timely release the fund?	Annexure-4, SL-15, page-105
3.	Procure was done time or not?	Annexure-8, SL-17, page-114
4.	Land acquisition was done properly.	Table-2, SL-11, 12 page-76
5.	Whether there is a possibility of time over run and cost over run	Annexure-5, SL-17, page-107
6.	Are all the activities done as per annual work plan	Table-2, SL-10 page-76
7.	Commissioning Certificate should be checked	SL-34(g), Page-79
8.	Original Catalog should be checked at monitoring & evaluation period	SL-19(d)& 24 (c) Page-77 & 78
9.	Availability of Approved Drawing	Table-2, SL-13 page-77
10.	Any case study done for this guideline preparation?	Section 3.2.4, Page-100
11.	Legal Documents for industries should be checked at M&E period	SL-76, Page- 83
12.	Checklist for Well Drilling/2D/3D seismic project should be incorporated	Section: 9,Page- 81 & 82
13.	Update procurement checklist	Annexure- 7,Page-109
14.	Safety standard/work place safety should incorporated in the checklist	SL-20, Page-77
15.	How many people are working as per DPP	SL-16, Page-77
16.	Cost/Benefit analysis should incorporated in the checklist	SL-22, Page- 116
17.	Certification for quality assessment	SL-17, Page-114
18.	Reasons of time extension	Annexure-5 (P-20) Page-107

Report Preparation as Per ToR

Objective of the Assignment

SL	Task	Response
1.	To review the existing available relevant documents/guidelines on project inspection;	Annexure-3 Page-103
2.	To review the existing available relevant documents/guidelines of other relevant countries and development partner agencies;	Section-3.2.3 Page-99
3.	To develop a guideline that can be effectively used by the IMED officers during project monitoring and evaluation;	Section-9,10,11 & 12 Page-76-90 Annexure-4,5,6,7 & 8 Page-105-116
4.	To develop an identical M&E template for relevant sector;	Section-9,10,11 & 12 Page-76-90
5.	To guide the officers of the IMED in building systematic approach to field visit through use of the Guideline;	Section-9,10,11 & 12 Page-76-90 Annexure-4,5,6,7 & 8 Page-105-116
6.	To ensure the project management knowledge areas (such as scope, time, cost, procurement, quality, integration, human resource, stakeholders, communication and risk);	Section-9,10,11 & 12 Page-76-90 Annexure-4,5,6,7 & 8 Page-105-116

Scope of Services:

SL	Task	Response
19.	Prepare a study design to carry out interviews of the stakeholders to know the actual requirement of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) related projects for preparation of the guideline;	Annexture-2 Page-98
20.	Identify weaknesses and limitations in the monitoring and evaluation process of the related projects;	Section-1.7 Page-9-10
21.	Identify key areas of project development activities, and also identify/ select smart indicators for effectively monitoring and evaluating related projects;	Section-9,10,11 & 12 Page-76-90
22.	Identify the components of different development projects, and describe the parts of each component for effective monitoring and evaluation;	Section-9,10,11 & 12

SL	Task	Response
		Page-76-90 Annexure-4,5,6,7 & 8 Page-105-116
23.	Study monitoring and evaluation reports, in-depth study reports and other related reports of the projects of the concerned sector and identify monitoring and evaluation weaknesses etc.;	Section-1.7 Page-9-10 Annexture-3 Page-103
24.	Study other relevant documents and M&E procedure of Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) projects/ program of in country and other countries that can be helpful in preparing M&E Guidelines;	Section-3.2.3 Page-99 Annexture-3 Page-103
25.	Consultant/s will interact with the relevant ministries, agencies, projects and identify areas of interest that can be helpful in carrying out the assignment;	Section-3.2.3 Page-99 Annexture-3 Page-103
26.	Consultant will deliver comprehensive M&E guideline and M&E templates for Industry, Power & Energy (To address Industries, Power, Energy and Mineral Resources sector related projects of Annual Development Program) in English and Bangla;	Section-9,10,11 & 12 Page-76-90 Annexure-4,5,6,7 & 8 Page-105-116
27.	Any other related works assigned by the client.	Annexure-9 Page-117-119

Conducted by

Strengthening Monitoring & Evaluation Capabilities of IMED (SMECI)

Prepared by

EQMS Consulting Limited

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