

Nepal Electricity Authority
Distribution and Consumer Services Directorate
Grid Solar and Energy Efficiency Project (GSEEP)
Terms of Reference
Consultancy Services for
Distribution System Loss Reduction Master Plan
(Contract ID NO. GSEEP/CS/QCBS-02)

1. Background:

The power sector in Nepal is primarily hydro based with installed capacity of about 806 MW. Nepal Electricity Authority (NEA) is the vertically integrated national utility, which owns and operates generation facilities at around 66 percent of the total installed capacity. Independent power producers (IPPs) account for around 26 percent by hydro-capacity in the country. The transmission network in Nepal, owned by NEA, consists of more than 2,129 circuit km of 132 kV, 511 km of 66 kV, and around 4,000 km of 33 kV power lines. Customer services are provided with around 33,000 km of 11 kV distribution lines.

NEA has about 2.9 million customers, which are categorized in commercial, industrial, domestic (or residential), etc. NEA buys electricity from IPPs to supplement its own generation capacity. To stimulate rural distribution, NEA has adopted the concept of community rural electrification program. Rural participation in the program is overwhelming: NEA's invitation for proposals on operating the distribution system by the community themselves has led to 241 agreements already in place. Total numbers of consumers served through the program exceeds 200,000.

To expand access to electricity, various donors are supporting Government of Nepal (GoN) in expanding the medium and low voltage distribution network. This initiative is aimed at connecting rural consumers by NEA. Funds have been supported mainly from the World Bank (WB), Asian Development Bank (ADB), and Japan International Cooperation Agency (JICA) as a combination of grants and loans for transmission and distribution network expansion.

NEA does not have a Distribution System Master Plan (Master plan) though some sporadic works have been done in the past to prepare ad hoc electrification and distribution projects. This has resulted in unplanned and improper electrification using suboptimal technical solutions, and has contributed to high distribution system loss. The Distribution System Master Plan is being prepared by NEA with the financing from ADB..

NEA is also engaged in an ambitious program of improving the situation by both enhancing access and improving the quality of electricity service. A key aspect of this program is to curtail power system losses to acceptable levels. Currently, the system loss of NEA stands to 24.4 percent, which incorporates both technical and non-technical losses. Many activities

have been carried out to reduce the system losses: such as conductor upgrade work for 132kV cross border transmission line (TL), and capacitor banks installation in some substations as initiatives to reduce the system losses. What persist are the non-technical losses, such as leakages, and NEA has been trying hard to address these critical issues through introduction of electricity leakage control act. NEA now wishes to understand more fully the nature and incidence of existing system losses and to develop a focused program to reduce both technical and non-technical losses to acceptable levels over a reasonable period of time.

2. Objective:

NEA intends to prepare a Distribution Loss Reduction Master Plan (DLRMP) for reduction of distribution system loss of the entire country and carry out the investment in loss reduction project based on the recommendation of the DLRMP. A consulting firm will be hired to prepare the DLRMP. The overall objective of the assignment is to identify, through a proven utility operational approach, the least cost and economically viable means to reinforce and upgrade electricity distribution system and to develop DLRMP for distribution system loss reduction both technical and commercial and to design, supervise and monitor the loss reduction project in selected five distribution units of NEA.

3. Scope of Work

3.1 Distribution Loss Reduction Master Plan

The activities to be addressed under the DLRMP will cover (but not be limited to) the following:

As a utility firm, the Consultant shall provide the services covering: (i) Data acquisition, analysis of system losses, and identification of their sources; (ii) Preparation of proposals for the system loss reduction to acceptable levels; (iii) provision of instruments and proven software; (iv) training for distribution system loss identification and reduction planning; and (v) assisting in procurement and implementation of necessary software, computers & hardware, IT tools in compliance with the World Bank Procurement Procedure; (vi) Metering quality and billing procedure management (including inspections, usage of unified operational guidelines, creation of database, debt control, early payment incentives, and effective disconnection policy); and (vii) Customer side management;

The Distribution System Master Plan, which is to be developed by NEA under the funding of the ADB already covers the preparation of the GIS database of the overall distribution system of Nepal. It is recommended that the consultant work in close co-ordination with the Consultant of the Distribution System Master Plan for the preparation of GIS database for Loss Reduction Master Plan and implementation of Loss Reduction Activities.

a. Data collection and Identification of Issues

The Consultant will carry out (with the assistance of NEA staff) an extensive data collection exercise on technical and commercial issues related to distribution system losses. The Consultant will build on the dataset, which are collected in order to develop a computer model used for system simulation. This exercise will include data gathering on load levels of distribution lines, network parameters, information from consumer billing systems, field visit observations, etc. Extensive field visits and investigative work in determining technical and operational problems are envisaged during this phase of the assignment. The information gathered will be studied and analyzed to present the key parameters leading to high system losses, in order to enable an effective loss reduction and efficiency improvement program, based on similar proven and successful operational experience, to be put in place.

The Consultants will analyze the overall system losses (from generation output to customer billing) to technical and commercial components and also present a loss analysis table indicating breakdown of losses by voltage level. The analysis will also cover system losses, address different loss levels in the various regions, and include an identification of the causes of losses that exceed acceptable levels.

b. Technical Loss Reduction

To aid in the study of technical losses, the Consultants will introduce a computerized distribution system technical analysis program. The software introduced should enable network studies to be conducted for distribution planning purposes, in particular for the effective planning of investments to quantify and reduce losses and improve distribution system efficiency. It should be possible to enter system data through a GIS methodology or from system geographic maps using a digitizing procedure. The software should also enable a load flow presentation with indication of voltage and loss levels in the system components. The software shall also allow for the calculation of cost benefits analysis of network development works.

The Consultant will utilize the software introduced to carry out studies to improve technical performance of the networks and prepare a proposal for implementation by NEA. An indication of savings to be achieved by these proposals should also be presented in peak power, energy, and financial and economic terms. The key activities to be considered in technical loss reduction shall include but not limited to the following:

- (i) Re-conductoring and load balancing
- (ii) Use of Capacitor bank
- (iii) Transformer management
- (iv) New feeder
- (v) Data base development
- (vi) Meter calibration and smart meters

c. Non-Technical Loss Reduction:

The Consultant will follow up the identification of non-technical losses by a package of proposals to undertake a reduction of these losses to acceptable levels. In this context, the Consultant will review the work presently being conducted by the NEA and suggest improvements required in approach, methodology, and organizational aspects necessary to develop an efficient and timely non-technical loss reduction program. The Consultant will also participate along with NEA staff in implementing some of these proposals as pilot exercises. The exercise should be followed up from detection of regularization and collection of billing records, as well as recovery of any dues from consumers, ensuring that particular exercises result in reduction of non-technical losses in selected systems/groups to accepted levels.

The Consultant will follow up on the recommendations of the preparatory study in the areas of the non-technical loss activities. The activities include meter quality management, billing procedure management, and customer side management. The Consultant is expected to work in close coordination with the Client. The Consultant will assist the Client in carrying out systematic management of meter quality, as well as regular inspection of consumer connections. This activity requires skill development at the level of local branch offices. Likewise, training and incentives schemes should be developed for meter readers and bill collectors. Standard manual and training materials should be provided.

An analysis of the feasibility, losses reduction, efficiency and cost effectiveness of deploying smart metering on specific zones, based on proven operational smart metering deployment by the consultant, will be conducted.

The Consultant will also propose specific network standards in order to limit the possibility of commercial losses.

d. Training of NEA Staff:

Capacity building of counterpart personnel is very critical to the achievement of the task objectives.

Therefore, an important component of the assignment is the training of the Client staff in carrying out all the related activities from data gathering through the analytical tasks to loss reduction project implementation and improved bill connection.

On loss reduction activities, a very operational expertise has to be developed. The consultant is expected to master such operational expertise and capabilities to train NEA staff.

The consultant shall identify the capacity gap and accordingly prepare the training programs, Manuals and Guidelines. The Consultant shall propose and conduct relevant trainings (any software required for loss reduction program, financial modality ,

economic analysis, procurement activities as required) to facilitate capacity enhancement of the NEA counterpart staffs and also ensure that the NEA counterpart staffs receive appropriate on-the-job skills in all aspects of preparation of Master Plan and implementation of loss reduction activities. The consultant shall propose appropriate software to carry out the afore-mentioned assignment and shall handover the software to NEA for future use. It is envisaged that the Consultants will provide a week-long residential training to seven staffs of NEA at the Consultant's home country office, costs for which (including costs of accommodation and fooding) will be included in the financial proposal. The international travel costs will be borne by NEA.

After the implementation of loss reduction activities, the NEA staffs should have the knowledge and expertise to update the Loss Reduction Master Plan and also replicate the loss reduction activities in other distribution centers. The consultant shall develop Monitoring & Evaluation manuals for measuring the outcome and impact of the loss reduction activities in the overall distribution system of NEA.

3.2 Loss Reduction Project Implementation

In phase I, loss reduction project will be implemented in five distribution centers based on the recommendation of the DLRMP. Subject to satisfactory performance of the loss reduction in these five DCs, additional 10 DCs will be considered for Phase II loss reduction project. A consulting firm will be responsible to develop a detail scheme for implementation, supervise and monitor as follows:

- (i) Data Collections:1-3 months
- (ii) Inventory verification
- (iii) Assessment of additional procurement need
- (iv) Prepare bidding document
- (v) Supervise and Monitoring of the implementation of loss reduction projects as owners engineers.
- (vi) Assessment and Evaluation of the result
- (vii) Model Calibration.

4. Expertise

It is expected that about 59 person-months of international consulting services and 55 Person-months of local consultants will be needed from a firm specializing in distribution, electrification and loss reduction master planning. Indicative expertise required to execute the services is identified in Table 1.

Table 1: Indicative Expertise and Person-Months		
Expertise	International Consultants	Domestic Consultants
	(pm)	(pm)
Team Leader/Distribution Expert	12	-
Distribution System Planner	6	6
Distribution System Engineer	24	24
Policy Expert	1	-
Institutional / Capacity Building	1	2
Social Specialist	2	2
Environmental Specialist	2	2
Financial / Economic Expert	3	3
Procurement Specialist	4	4
Monitoring and Evaluation	4	12
TOTAL	59	55

Individual Expert's Qualification and Experience

The consulting firm/utility firm as a minimum shall have the above mentioned staffs with stipulated academic qualifications and professional experience for carrying out the assignment mentioned in this Terms of Reference.

Key Experts: International

(i) Team Leader/Distribution Expert

The Team Leader shall have preferably Master's Degree in Electrical Engineering/ Power System Engineering with over 15 years of experience in distribution system planning and loss reduction related activities of 33 kV and 11 kV distribution networks. The expert shall have previous team leader experience in developing loss reduction master plan and implementation of loss reduction activities.

(ii) Distribution System Planner

The planner shall have Master's Degree in Power System Engineering/Electrical Engineering/High Voltage Engineering. He/she shall preferably have over 10 years of experience in planning and analysis of distribution system including distribution sectoral load forecast, load flows, short circuit analysis and have received training in Power system analysis of distribution system.

(iii) Distribution System Engineer

The engineer shall have Master's Degree in Power System Engineering/Electrical Engineering/High Voltage Engineering. He/she shall preferably have over 10

years of experience in planning expansion of distribution networks, loss optimization and reinforcement of distribution system.

(iv) Policy Expert

The expert shall have Master's Degree in Energy Economics/Development Economics. He/she shall have over 10 years of experience in experience in developing/drafting policies for distribution system (including expansion, reinforcement, upgrading) and developing action plans to implement those policies.

(v) Institutional/Capacity Building Expert

The expert shall have Master's Degree in Business Management or Human Resources Development. He/she shall also have over 10 years of experience in developing training programs, training curricula, conducting training programs.

(vi) Social Specialist

The Specialist shall have Masters' Degree in Sociology /Development Studies/Development Economies with over 10 years of experience in conducting social impact assessments (including Social Management Plans, Resettlement Action Plans) for Transmission/Distribution Networks and with knowledge of social safeguard and resettlement policies of Nepal and the World Bank.

(vii) Environment Specialist

The Specialist shall have Masters Degree in Environmental Science/Environment Management/Environmental Engineering with over 10 years of experience in conducting Environment Impact Assessment (EIA) or Initial Environment Examination (IEE) of Transmission/Distribution networks and with knowledge of environments and safeguard policies of Nepal and the World Bank.

(viii) Financial/Economic Expert

The Expert shall have Master's Degree in Finance/ Engineering Economics with over 10 years of experience in economic and financial analysis of loss reduction activities as financial specialist.

(ix) Procurement Specialist

The Specialist shall have Masters Degree in Mechanical/Electrical/Civil Engineering with over 10 years of experience as a Procurement Specialist in Donor Funded Projects.

(x) Monitoring and Evaluation Specialist

The Specialist shall have Masters Degree in Project Management & Planning /Electrical Engineering/ Power System Engineering/ Civil Engineering with over 10 years of experience in developing and implementing M&E frameworks, with experience in Transmission/Distribution Networks M&E systems.

Non Key Experts: Local

The Local Experts as shown in the Table1 shall have at least Bachelor's Degree in the respective subject areas and shall have a work experience of over 3years in the respective field.

5. Implementation arrangements

The Consultants will report to the Client's Project Manager and carry out the work utilizing the counterpart staff provided while imparting on-the-job training under the assignment. The required computer facilities, measuring equipment, and specialized application software needed for the study will be purchased by the Consultant under funds provided for in the Contract and transfer all licenses to the Client after the assignment. Consultant will arrange the office space and vehicle at its own. NEA will provide counterpart personnel comprising of one middle level engineer conversant in planning activities and 6 other engineers who will form the core support staff for the assignment. All of the core support staff will be released to work with the Consultant on a full time basis. In addition to the core counterpart staff detailed above support will be provided from the distribution operations units of NEA. Training the Client staff and ensuring that they will be able to carry out the work on an ongoing basis will be an important part of the assignment.

The Consultant's staff will need to carry out substantial field visits to ascertain the state of the distribution systems.

6. Report preparation:

The Consultant shall produce the following deliverables during execution of the services:

- (i) An Inception Report within 6 weeks of commencement;
- (i) Quarterly progress reports, detailing work undertaken and work planned for the subsequent quarter;
- (ii) Two interim reports, the first within 3months of commencement and the second within 6months of commencement;
- (iii) A Draft Final Report within 9months of commencement, including the draft master plan; and
- (iv) The final Distribution Loss Reduction Master Plan must be submitted no later than eight weeks after approval of the draft

Furthermore, the Consultant must organize one inception workshop approximately ten days after submission of the inception report and another workshop ten days after draft Master Plan.

Each of the above reports other than the quarterly progress reports will be first submitted in draft and thereafter finalized after reviewing the comments received from the Client and WB. All reports will be submitted in ten (10) copies and one electronic copy

The consultant shall submit the monthly progress report during the project supervision and monitoring.

7. Term of Payment for Consulting Service

Payment shall be made on a monthly basis as per the provisions of the contract signed between the Consultant and the Client.

8. Duration of Assignment

8.1 DLRMP: This assignment is expected to be completed with 12 months

8.2 Design and supervision of loss reduction project: This assignment is expected to be completed within 24 months after preparation of DLRMP.

9. Consultant's Selection Method

Consultant will be selected as set out in the World Bank's Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers dated January 2011, revised July 2014.