Initial Environment Examination

Project Number: 46390
September 2013

Proposed Loan
Republic of the Union of Myanmar: Power Distribution Improvement Project

Prepared by Ministry of Electric Power for the Asian Development Bank

CURRENCY EQUIVALENTS
(as of 18 September 2013)

1 US Dollar (USD) = 997.039 Myanmar Kyat (MMK)
1 MMK = 0.00102 USD

ABBREVIATIONS

ADB	–	Asian Development Bank
CHSP	–	Community Health and Safety Plan
EIA	–	Environmental Impact Assessment
EMF	–	Electromagnetic field
EMoP	–	Environmental Monitoring Plan
EMP	–	Environmental Management Plan
IA	–	Implementing Agency
IEE	–	Initial Environmental Examination
MOECAF	–	Ministry of Environmental, Conservation and Forestry
PCBs	–	polychlorinated biphenyls
PIC	–	Project implementation consultant
PPE	–	Personal Protective Equipment
REA	–	Rapid Environmental Assessment
ROW	–	right-of-way
SPS	–	Safeguard Policy Statement (2009)
UNFCCC	–	United Nations Framework Convention on Climate Change
WHO	–	World Health Organization

WEIGHTS AND MEASURES

^{o}C	–	Celsius (centigrade)
km	–	kilometer
kV	–	kilovolt
kWh	–	kilowatt-hour
LV	–	low voltage
m	–	meter
mm	–	millimeter
mm/kV	–	millimeter per kilovolt

NOTE

In this report, “$” refers to US dollars.

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EXECUTIVE SUMMARY

1. Electricity consumption in Myanmar has doubled during the last 10 years. As compared with other Southeast Asian Nations (ASEAN), Myanmar's per capita electricity consumption is the lowest with only 160 kilowatt-hours (kWH) per year[1]. This is primarily due to the low electrification rate, low industrial development and lack of investment. The power sector in Myanmar needs significant investment to (i) improve and upgrade the distribution system, especially in the urbanized regions of Yangon and Mandalay; (ii) address the current shortage of power generation through rehabilitation and new additions; (iii) reinforce the transmission grid and associated substations; and (iv) extend transmission and distribution network to connect more consumers in the rural areas.

2. The proposed project will involve the rehabilitation of existing run-down power distribution networks in four (4) project areas which were selected in consultation with the Yangon City Electricity Supply Board (YESB) and the Electricity Supply Enterprise (ESE) based on prioritized areas in dire need of rehabilitation and with existing high losses. The following are the target areas for rehabilitation of the power distribution system (Figure 1):

a. five townships in Yangon region: Hlaingthaya, Insein, Kamayut, Mayangone, and Mingalone;
b. four districts in Mandalay region: Kyaukse, Meikhtila, Myingyan, and Yameethin;
c. five districts in Sagaing region: Kalay, Katha, Monywa, Sagaing, and Shwebo; and
d. two townships in Magway region: Aunglan and Magway.

3. The proposed project aims to help reduce the systems losses and increase reliability of electricity supply to urban and rural consumers for the country's inclusive and sustainable economic development. The scope of the rehabilitation works includes:

a. upgrading existing 66/11 kilovolt (kV) and 33/11 kV substations;
b. replacing existing 33 kV and 11 kV distribution lines;
c. replacing existing 11/0.4 kV transformers;
d. replacing existing bare low voltage distribution lines with more efficient aerial bundled conductor (ABC) distribution; and
e. replacing existing old revenue meters with digital revenue meters.

4. The proposed project is classified as Category B for environment since the rehabilitation and replacement of electricity distribution system will generate potential impacts to the environment and the community in the project areas. An Initial Environmental Examination (IEE) is required under ADB Safeguards Policy Statement (2009) to ensure that environmental impacts are identified and that appropriate mitigation measures are designed for the protection of the environment, workers' health and safety, and to provide for environmentally sound material recovery and disposal of replaced materials and equipment.

5. The following methodologies were used in the preparation of the IEE:

a. Review of project-related documents and literature
b. Site visits to project sites and areas of influence
c. Consultation and meeting with stakeholders

[1] Source: New Energy Architecture: Myanmar, World Economic Forum, June 2013.

d. Screening and scoping of environmental impacts
e. Preparation and discussion with YESB and ESE on Grievance Redress Mechanism
f. Preparation of the findings and analysis of impacts
g. Preparation of the Environmental Management Plan and Environmental Monitoring Plan.

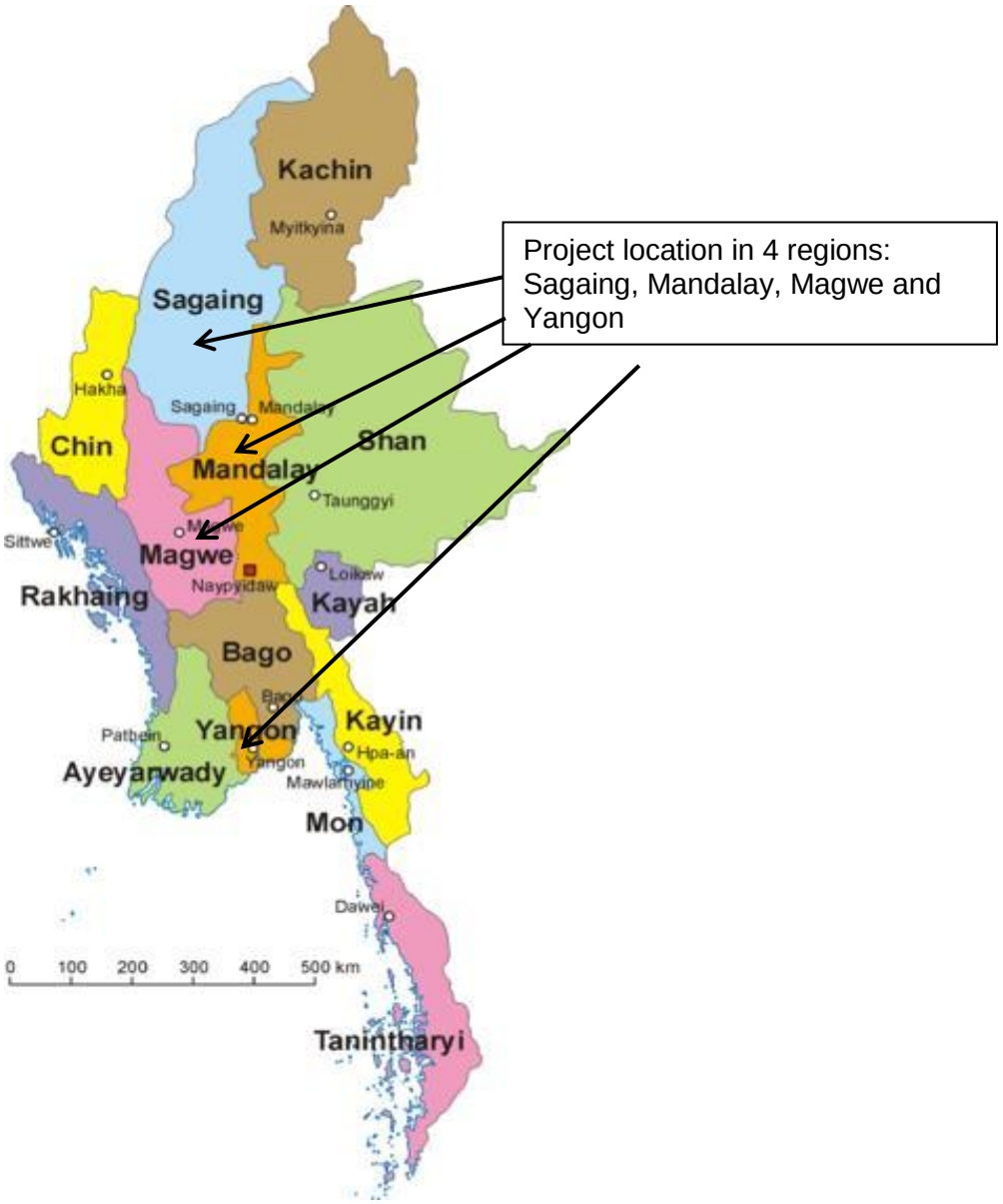


Figure 1. Location Map

6. The preparation of this IEE is guided by the requirements outlined in SPS 2009. Information in the IEE is based on available information, plans, and documents about the project, reports from the ADB TA 8251 (Capacity Building Support for Project Identification) and from field inspection and information gathered during stakeholder consultations. The

environmental impact assessment was carried out with the objective of (i) establishing current environmental conditions; (ii) identifying key environmental issues; (iii) assessing magnitude of impacts and to provide mitigating measures; (iv) integrating the environmental issues in the project planning and design stage; and (v) developing an environmental management plan (EMP) for implementation, monitoring and reporting of the environmental mitigation and enhancement measures.

7. **Public Consultation.** Currently, the Government of Myanmar has not established a public consultation process. While this concept is relatively new to the country, best efforts were made to gather information from affected stakeholders and key informants from the YESB and ESE. Consultations and interviews with the YESB, ESE, and some stakeholders were carried out from 19–24 September 2013. The representatives from YESB and ESE and stakeholders were asked about the environmental issues and concerns on the current electrification and distribution system, perceived project benefits and adverse effects, and recommendations and suggestions for implementation. In general, the stakeholders welcome the proposed rehabilitation project because of the benefits that will be gained from improved electricity supply.

8. Prior to the implementation of the proposed distribution line rehabilitation project, the township and district offices will notify the public through issuance of advisories for the installation. Project affected households close to power lines and distribution transformers will be informed about the scheduled works. The consumers will also be informed about the schedule of temporary power interruption that may occur during the line and equipment installation.

9. **Summary of Impacts and Mitigation Measures.** In general, the proposed project will not involve any significant civil works since most of the activities will be replacement of old wooden poles or metal poles with new concrete poles, stringing of new low voltage wire, and installation of new equipment. The proposed distribution line project will generate minimal environmental impacts that can be reduced to acceptable levels through the implementation of practical mitigation measures normally associated with internationally accepted good engineering practices. The key findings of the IEE are summarized below:

(i) The rehabilitation and installation phase of the project will not cause significant impacts to natural habitats since the project components will be located along existing distribution line right-of-way (ROW) and within existing substation sites. These areas are already modified as they are located in residential and agricultural areas.

(ii) There are no environmentally sensitive areas that will be affected by the proposed project. The vicinity is generally characterized as agricultural areas and populated community who are electricity consumers.

(iii) Environmental impacts that may be generated during the rehabilitation of the distribution line are primarily due to the generation of decommissioned equipment, poles and other waste materials, risks to workers and the community, and temporary disturbance from dust, soil runoff, noise and traffic.

(iv) A material recovery/temporary waste storage facility will be provided by YESB in Yangon and the ESE of Mandalay, Sagaing, and Magway to properly manage the materials and wastes generated during the decommissioning of equipment

and distribution lines. Recyclable materials will be reused for other remote areas to be serviced by YESB and the ESE while materials that cannot be reused will be handled properly in line with acceptable disposal practices.

(v) An EMP has been prepared for implementation during the rehabilitation/installation and operational phases of the project. This shall provide guidance to the YESB and the ESE in carrying out the EMP during the installation activities. The EMP identifies the potential environmental impacts and the corresponding mitigating measures to reduce the impacts to acceptable levels using best available technology and practices. It also provides the institutional responsibilities in environmental management and monitoring within the MOEP, YESB, and the ESE in Mandalay, Sagaing, and Magway. An institutional capacity development for environmental safeguards and occupational health and safety is recommended to ensure sustainable implementation of the EMP.

10. The MOEP, YESB, and ESE do not have any personnel in-charge of ensuring the environmental soundness of operations. In order to strengthen the capacity of the implementing agencies in the implementation of the EMP and the Environmental Monitoring Plan (EMoP), YESB and ESE will each have an Environmental Officer. A capacity development program for MOEP, YESB, and the ESE in Mandalay, Sagaing and Magway is developed in order to strengthen their capacity to implement the EMP and EMoP. The program will focus on community safety, environmental impact assessment (EIA), EMP implementation, inspection and corrective action, environmental standard operating procedures, protection of local vegetation and water resources, and avoiding impacts on local population from noise and dust-generating activities during the rehabilitation phase, and the proper management of waste materials. The MOEP will hire the services of consultants to assist the YESB and the ESE in the monitoring of the implementation of environmental mitigation measures.

11. A Grievance Redress Mechanism was established to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project, particularly on resolution of environment-related complaints during the rehabilitation and operational phases of the project.

12. Overall, the improvement of the power distribution grid is expected to contribute positively to the economic development of Myanmar and in particular in the Divisions of Yangon, Mandalay, Sagaing, and Magway. The project is also expected to improve reliability and security of power supply that would boost economic development and long-term investment goals of the country.

13. Based on this assessment, it is concluded that overall, the project will result in significant positive socio-economic benefits, and any potential negative environmental impacts are small-scale and localized, and can be minimized adequately through good design and implementation of appropriate mitigation measures.

14. It is therefore recommended that the project be supported by ADB, subject to the implementation of the commitments contained in the EMP and allocation of appropriate technical, financial and human resources by MOEP to ensure these commitments are effectively and expediently implemented.

15. This IEE, including the EMP, is considered to be sufficient to meet ADB's environmental safeguards requirements for the project. Therefore, further detailed assessment by way of an environmental impact assessment (EIA) is no longer required.

I. INTRODUCTION

1. The Asian Development Bank (ADB) provided assistance to the Government of Myanmar in the conduct of a feasibility study for the rehabilitation of power distribution networks. The project forms part of the first Country Operation and Business Plan to Myanmar and is in line with the ADB's Myanmar Interim Country Partnership Strategy 2012–2014 which emphasizes the need to support the energy infrastructure in the power sector.

A. PURPOSE OF THE REPORT

2. This IEE report assesses the environmental impacts associated with the rehabilitation and operation of the electricity distribution lines in the areas of Yangon, Mandalay, Sagaing, and Magway. The report aims to describe the proposed project, its location, and assess the potential impacts of the project in the existing environment and to the adjoining community. It also suggests the mitigating measures to lessen any adverse environmental impacts of the project.

3. The IEE is intended to meet the requirements of SPS 2009 for Category B project.

4. The objectives of the IEE are to:

(i) Assess the existing environmental conditions in the project area including the identification of environmentally sensitive areas;

(ii) Assess the proposed location, design, rehabilitation and operation activities to identify and evaluate the potential impacts, and determine their significance;

(iii) Develop an EMP that will prevent or minimize adverse environmental impacts to acceptable levels; and

(iv) Develop an EMoP, including an institutional plan that will sustain the implementation of significant environmental parameters of the project.

B. APPROACH TO IEE PREPARATION

5. The Environmental Categorization Form and Rapid Environmental Assessment (REA) checklist were used for environmental categorization purposes and in screening the environmental impacts of the proposed project. The environmental impacts of the proposed project have been analyzed within the primary impact zone encompassed by and adjacent to the substations, transformer area, and ROW of the distribution line up.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB'S ENVIRONMENTAL POLICIES

6. The ADB's Environmental Assessment Policy as outlined in the SPS (2009) requires that all ADB financed projects should undergo an environmental assessment to ensure the environmental soundness and sustainability of projects. It also aims to support the integration of environmental considerations in the project decision-making process by developing safeguards to avoid adverse impacts of projects on the environment and affected people, minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible, and to help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

7. Environmental assessments are classified into different categories based on complexity, scale and level of impact, ranging from the largest and most complex - Category A, to the smallest and least complex– Category C. For all the categories, the environmental assessment should take into account the global environmental aspects on biodiversity and institutional capabilities related to environmental and social aspects.

8. The SPS 2009 clarifies the rationale, scope and content of an environmental assessment as supported by technical guidelines (Environmental Assessment Guidelines 2003). The environmental assessment process calls for the initial screening of the project to determine, at the early stage, the level of assessment that is required so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.

9. The SPS contains a number of operational principles that includes the requirement to ensure that the measures identified during the impact assessment are included in the EMP and were implemented in agreement with the borrower. The borrower/client is required to monitor the progress of implementation of the EMP, document the monitoring results, identify necessary corrective actions, and reflect them in a corrective action plan. Periodic monitoring reports on progress of implementation of the EMP and the corrective actions, if any, are submitted to ADB on a semi-annual basis during the construction of projects with significant adverse environmental impacts and quarterly for highly complex and sensitive projects. During operation, reporting to ADB by projects with significant adverse impacts is required on an annual basis at the minimum.

10. Under SPS, the project has been evaluated considering the completion of the Environmental Categorization Form and Rapid Environmental Assessment Checklist (Appendix A). The adverse environmental impacts of the project are considered site-specific and reversible. Therefore, it has been classified as Category B, requiring an IEE.

B. MYANMAR'S ENVIRONMENTAL POLICIES

1. EIA REQUIREMENTS IN MYANMAR

11. Under Section 45 of the Constitution of the Republic of the Union of Myanmar, 2008, the Union has proclaimed that it will *protect and conserve the natural environment*. This section of the Constitution has been followed through the enactment of the *Environmental Conservation*

Law 2012 (ECL 2012) and the development of the draft Environmental Impact Assessment (EIA) Procedures.

12. The ECL 2012 provides an overarching framework for environmental management in Myanmar. It contains a broad definition of "environment" which refers to physical, biological, historical, cultural, social and aesthetic factors, what could be called all encompassing. While it does not specifically include qualities and characteristics of places and amenity, and the sense of community, it could be suggested that these aspects come within the areas of the last four factors highlighted within the definition.

13. The ECL 2012 also sets out definitions that could be considered as equivalent with the ADB *Safeguards Policy Statement* (2009) including for example *Cleaner Production* (the continuous application of multi-strategy on environmental conservation to processes, products and services to improve the use of resource efficiently, minimize waste, polluted water and emissions and conserve the healthy nature and human environment); *ecosystem* (natural system existing living, non-living substances and plants in compatibility and the natural environment which have been evolving due to such system) and *pollution* (any direct or indirect alteration, effect of the physical, thermal, chemical or biological properties of any part of the environment including land, water and atmosphere by discharging, emitting or depositing environmental hazardous substances, pollutants or wastes so as to affect beneficial use of environment, or to affect public health, safety or welfare, or animals and plants or to contravene any condition, limitation or prohibition contained in the prior permission issued under this Law) among others. It is noted that the ADB assisted Myanmar in the development of the Law.

14. The overall objectives of the ECL 2012 are:

(a) to enable to implement the Myanmar National Environmental Policy;

(b) to enable to lay down the basic principles and give guidance for systematic integration of the matters of environmental conservation in the sustainable development process;

(c) to enable to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;

(d) to reclaim ecosystems as may be possible which are starting to degenerate and disappear;

(e) to enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;

(f) to enable to implement for promoting public awareness and cooperation in educational programs for dissemination of environmental perception;

(g) to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation; and

(h) to enable to cooperate with Government departments, Government organizations, international organizations, non-government organizations and individuals in matters of environmental conservation.

15. The ECL 2012 establishes the Environmental Conservation Committee (ECC). The ECC is the entity to oversee all projects with respect to environmental assessments, with initial environmental examinations (IEEs), or an EIA and any flowing approvals, conditioning, non-approval and the relevant appeal processes. The ECC and its decisions are very important to the future of Myanmar's environment.

16. Section 10 of the ECL 2012 sets out a broad list of Environmental Quality Standards (EQS). The proposed ESQs cover inland and coastal waters, groundwater, atmospheric, emissions, effluent and solid waste. It is acknowledged that the ESQs need to be developed and until such time, it is proposed to utilize the International Finance Corporations (IFC) *Environmental, Health, and Safety Guidelines*.

MOECAF ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

17. The ADB through the Environmental Operations Centre in Bangkok has been assisting the Government of Myanmar to develop the EIA Procedure. The procedures are currently in draft form (version 37); however based on discussions within the Ministry of Environmental, Conservation and Forestry (MOECAF) in September 2013, the procedures are likely to be approved by Cabinet in the very near foreseeable future.

18. The procedures define an *Environmental Impact* as the probable effects or consequence on the natural environment and people of a proposed project or businesses or activities or undertaking. Impacts can be direct or indirect, cumulative, and positive or adverse or both. For purposes of the Procedures, an environmental impacts include occupational, community health, and safety issues. Projects involving resettlement or potentially affecting Indigenous People are required to also comply with separate procedures issued by responsible ministries. While it is noted that the current procedures do not specifically adress involuntary resettlement and indigenous peoples, it is noted that the MOECAF adviced the ADB during its September 2013 Mission that Social Impact Assessment Procedures were currently being formulated and would be introduced by the end of 2013. In the absence of these procedures, there is a requirement that any project should adhere to international best practice on Involuntary Resettlement and Indigenous Peoples.

19. The proposed Procedures provide an excellent basis for the transition to a formal IEE/EIA process in Myanmar. Chapter II of the Procedures sets out the establishment of the EIA Process. The procedures set out a structure where for major activities, proponents approach Ministries with preliminary project proposal and the process evolves from there. There is also inclusion of projects proposed by the Myanmar Investment Commission.

20. As for an EIA, it refer to this being a report contemplated in Chapter V of the Procedures (discussed below) with form, content and structure in accordance with the Ministry's requirements and guidelines and international best practice, and includes the EMP. The requirements are consistent with the approach adopted in the ADB SPS (2009). The procedures define an IEE Type Project as being a project judged by the Ministry to have some adverse Impacts, but of lesser degree and/or significance than those for EIA Type Projects.

21. Pursuant to Section 7 of the ECL 2012, all projects undertaken in Myanmar by almost any entity including individuals that have the potential to cause significant adverse impacts, are required to undertake an EIA and to obtain an Environmental Compliance Certificate (ECC), this being a legal document which approves an IEE or an EIA, or an EMP in accordance with the Procedure.

22. The current procedures at Chapter II set out the screening and scoping phase for a project. Under Article 18, the Ministry is required to, within 15 days of receiving a project proposal, determine the type of environmental assessment (eg, IEE, EIA or none required). It is noted that at this moment in time, the MOECAF have limited capacity to determine whether a

project will be required to undertake an IEE or EIA, although it is anticipated that the work being undertaken under TA7566 REG will assist MOECAF in this decision making process.

23. Specifically with respect to this IEE, Chapter III sets out the process for IEEs within the procedures. Specifically, the proponent shall issue a letter of endorsement in a format prescribed by the Ministry. The letter shall be submitted to the Ministry together with the IEE Report confirming the following:

(a) the accuracy and completeness of the IEE;
(b) that the IEE has been prepared in strict compliance with applicable laws including this Procedure; and
(c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the IEE Report.

24. Under the Procedures, Article 25 requires that an IEE shall contain the following:

(a) Project description in reasonable detail together with overview and layout maps in proper scale indicating all relevant features;
(b) identification of the proponent (including where the proponent is not a natural person), the identification of the owners, directors (if any) and day to day management and officers of the proponent;
(c) identification of the IEE experts, including which expert is responsible for which part of the IEE;
(d) description of the surrounding environmental conditions of the project including maps of all relevant physical, biological, social and cultural features;
(e) identification and assessment of potential adverse impacts including presentation of maps in proper scale;
(f) results of the public consultation/public participation process and the proponent's written response to comments received during that process;
(g) the environmental protection measures of the project;
(h) the conclusion of the IEE;
(i) the EMP; and
(j) the budget needed for implementation of the EMP.

25. After completing all investigations, public consultation and participation processes required for the IEE, the proponent shall submit the IEE to the Ministry. The Ministry is then required to disclose the IEE to civil society, PAPs, local communities and other concerned stakeholders by means of local media, at public meeting places (e.g., libraries, community halls) and at the offices of the proponent within ten days after submission.

26. If it is determined by the Ministry that the IEE does not satisfy requirements, then the proponent shall be called upon to undertake necessary amendments and/or to provide supplementary information as directed by the Ministry.

27. Under the Guidance of the EIA Report Review Body (comprising technical experts from relevant government departments, government organizations, technical organizations and civil society responsible), the IEE/EIA will be reviewed and assessed with recommendations made on its approval. Upon completion of its review of the IEE, the Ministry shall:

(a) either

(i) approve the IEE, subject to any conditions as may be prescribed, and issue an ECC, or

(ii) require that the project undergo EIA and cite the reasons for this decision;

(b) inform the proponent of its decision; and

(c) publicly disclose its decision.

28. The Ministry is required to deliver its final decision within sixty (60) days of receipt of an IEE.

29. Once the IEE has been approved, the Ministry will grant an Environmental Compliance Certificate (ECC).

30. The Procedures also set out the requirements for all approvals and subsequent monitoring that are conditions of the approval. The Procedures also set out penalty provisions for non-compliance with approval conditions and/or proposed monitoring. While the Procedures are not currently enforceable, it is highly likely they will be approved by Cabinet by the end of 2013. The Procedures are very close to being fully equivalent with the ADB SPS 2009.

2. INTERNATIONAL ENVIRONMENTAL CONVENTIONS

31. Myanmar's commitment to global environmental protection is manifested by its concurrence with various international environmental agreements. These conventions/treaties and protocols include:

- United Nations Framework Convention on Climate Change (UNFCCC) or the Kyoto Protocol, 1992, which entered into force on 16 February 2005.
- United Nations Conference on Environment and Development (UNCED) which calls for the management and integrated decision making process that considers environment protection in various sectors of development like agriculture, forestry, land, trade, changing consumption patters, and sustainable tourism.
- Convention Concerning the Protection of the World Cultural and Natural Heritage which are signed by Myanmar on 29 April 1994.
- Convention on Biological Diversity which was ratified by Myanmar on 25 November 1994
- Vienna Convention for the Protection of the Ozone Layer, entered into force on 22 September 1988 and acceded by Myanmar on 24 November 1993
- Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, entered into force on 1 January 1989
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which entered into force on 11 September 1997 and was acceded by Myan on 13 June 1997
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) which was entered into force on 17 March 2005
- International Tropical Timber Agreement which was signed by Myanmar on 06 July 1995 and was approved on 31 January 1996
- United Nations Convention to Combat Desertification, entered into force on 02 April 1997
- Basel Convention on the Transboundary Movement of Hazardous Wastes, entered into force on 05 May 1992.
- Stockholm Convention on Persistent Organic Pollutants which was signed in 2001 and became effective from May 2004.

III. DESCRIPTION OF THE PROJECT

32. Myanmar's power sector has operated satisfactorily for many decades but, because of lack normal rehabilitation work, now suffers from overloading, poor reliability and extremely high losses. The project provides for the rehabilitation of existing run-down power distribution networks in the following four project areas, selected in consultation with MoEP, YESB and ESE and based on prioritized areas in dire need of rehabilitation and with existing high losses:

a. five townships in Yangon region: Hlaingthaya, Insein, Kamayut, Mayangone, and Mingalone;
b. four districts in Mandalay region: Kyaukse, Meikhtila, Myingyan, and Yameethin;
c. five districts in Sagaing region: Kalay, Katha, Monywa, Sagaing, and Shwebo; and
d. two townships in Magway region: Aunglan and Magway.

33. The project will help reduce the system losses and increase reliable electricity supply to urban and rural consumers for the country's inclusive and sustainable economic development. The project was included in the first Country Operation and Business Plan to Myanmar and in line with the ADB's Myanmar Interim Country Partnership Strategy 2012-2014 which emphasizes the need to support the energy infrastructure in the power sector.

34. The scope of rehabilitation works includes:

a. upgrading existing 66/11 kilovolt (kV) and 33/11 kV substations;
b. replacing existing 33 kV and 11 kV distribution lines;
c. replacing existing 11/0.4 kV transformers;
d. replacing existing bare low voltage distribution lines with more efficient aerial bundled conductor (ABC) distribution; and
e. replacing existing old revenue meters with digital revenue meters.

35. YESB and ESE, under the guidance of MoEP, have developed plans covering the rehabilitation and expansion of the distribution networks for each of the four project areas over the period 2014 to 2016. In some cases, the plans are more detailed than in other cases where the information required further investigation.

36. One benefit of the proposed project will be to introduce international practice and techniques in modern power distribution systems into Myanmar. This will contribute to the reduction in losses, both technical and non-technical. In particular, this will include:

(a) ABC conductors, fittings and IPC connectors for LV distribution to replace the existing bare open wire system
(b) Use of connectors to replace all existing hook and twisted-wire connections, which have high losses and result in flickering voltage in the house
(c) Use of MCCBs (Moulded Case Circuit Breaker) to protect LV circuits from both short-circuit faults and overloading out of distribution transformers, to replace the existing horn-gap practice
(d) Use of dropout fuses on the primary of 33/0.4 kV and 11/0.4 kV distribution transformers, to replace the existing fuse wire practice
(e) Use of digital meters mounted on poles, to replace existing electro-mechanical relays, with remote hand-held reading to eliminate reading errors.

37. Table 1 presents the scope of work and estimated cost for the four project areas.

Table 1. Scope of Work and Estimated Cost

Project Area	Scope of Work	Customers in Project Areas	Estimated Cost (US$)
Yangon Region • Hlaingtaya • Insein • Kamayut • Mayangone • Mingalone	• Rehabilitation of 4 x 66 kV (Kamayut and Mayangone) and 4 x 33 kV substations (Mingalone and Hlaingtaya townships) • Rehabilitation of 7 km of 33 kV line • Rehabilitation of 86 km 11 kV overhead lines in all five townships • Installation of 187 km of new 0.4 kV ABC line to replace old LV open wire overhead distribution lines in all five townships • Installation of 36 x 11/0.4 kV distribution transformers to replace old equipment in all five townships.	167,379	USD 28.549 million
Mandalay Region • Kyaukse • Mandalay • Meikhtila • Myingyan • Nyaungoo • Pyinoolwin • Yameethin	• Rehabilitation of 2 x 66 kV (Nyaungoo district) and 20 x 33 kV (Kyaukse, Mandalay, Meikhtila and Pyinoolwin districts) substations • Installation of 228 km of new ABC to replace old LV open wire overhead distribution lines in Kyaukse, Meikhtila, Myingyan and Yameethin districts • Installation of 71 x 11/0.4 kV distribution transformers to replace old equipment in Kyaukse, Meikhtila, Myingyan and Yameethin districts. • Installation of 55,000 digital revenue meters in Kyaukse, Meikhtila, Myingyan and Yameethin districts.	127,910	USD 15.082 million
Magway Region • Magway • Aunglan	• Rehabilitation of 1 x 66 kV substation in Aunglan township • Rehabilitation of 7 km of 33 kV (Magway) and 44 km 11 kV overhead lines (Magway and Aunglan) • Installation of 127 km of new ABC to replace old LV open wire overhead distribution lines in both townships • Installation of 107 x 11/0.4 kV distribution transformers to replace old equipment in both townships • Installation of 1,937 digital revenue meters in both townships.	29,116	USD 8.658 million
Sagaing Region • Sagaing • Monywa • Shwebo • Katha	• Rehabilitation and extension of 1 x 33 kV substations (Monywa, Shwebo) • Rehabilitation of 11 km 11 kV overhead lines in Kalay region • Installation of 78 km of new ABC to replace	156,199	USD 7.738 million

Project Area	Scope of Work	Customers in Project Areas	Estimated Cost (US$)
• Kalay	old LV open wire overhead distribution lines in all five regions • Installation of 75 x 11/0.4 kV distribution transformers to replace old equipment in all five regions • Installation of 1,202 digital revenue meters (Sagaing, Monywa, Shwebo regions).		

A. PROJECT IMPLEMENTATION PHASES

1. REHABILITATION AND INSTALLATION PHASE

38. In general, the activities to be implemented during the rehabilitation and installation of the distribution line involves the completion of the detailed design, bidding, evaluation and approval of contract packages, procurement, and the installation of equipment, testing and commissioning.

39. **Replacement of Wooden Poles with Concrete Poles.** For packages that involve the replacement of the wooden poles with concrete poles, MoEP will procure the pre-stressed concrete poles from the fabrication plant of YESB in Hliantharyar. Notice to affected consumers and consent of the local authorities shall be secured during the installation of the poles. After verification of the location of the pole foundation, installation will begin with the excavation of the pole foundations. Materials such as cement, sand, stone and equipment parts of the concrete pole, insulators and conductors will be transported to the site of the electric poles using trucks and unloaded along road sides near the sites of each pole. All excavated soil will be retained and used for backfilling of the pole foundations.

Photo 1. Wooden poles and distribution lines to be replaced with concrete poles

Photo 2. The concrete pole fabrication facility of MoEP in Hliantaryar, Yangon

40. For wide roadstrip, cranes will be utilized during tower installation and line stringing to maximize the number of poles that can be installed in a day. For narrow roads, the YESB and ESE will be required to use small vehicles to avoid significant disturbance to traffic flow. The conductor and lightning wire are then stretched at each anchor in a mechanical and tension stringing operation to prevent damage to the wires and conductors caused by scrubbing on the ground or vegetation. The tensioning of wires and conductors shall be carried out in accordance with the prescribed international procedures, taking into consideration safety to prevent workers accident and damage to facilities and properties. The line shall be tested and adjusted prior to full commissioning.

41. **Rehabilitation of Substations and Replacement of Transformers and Equipment.** After the design of the substation has been finalized, the site will be cleared of obstructions such as vegetation. Old equipment and cables and faulty transformers will be dismantled and wastes will be temporarily stockpiled in a designated area within each substation site before it is transported to the central materials and wastes warehouse of either YESB and the ESE . The transformer pad and other appurtenant structures will be constructed to support the equipment at the substation. This will be followed by the installation of the substation equipment, testing, and commissioning.

A substation in Yangon 21-mile substation in Pyinoolwin, Mandalay

Photo 3. View of substations where rehabilitation will take place.

2. OPERATIONAL PHASE

42. The activities that will be implemented during the operational phase of the distribution line include the routine monitoring and inspection to check if the required clearances of trees and houses below the line are maintained. Maintenance activities include the trimming of trees if above 20 ft. high. The regular maintenance and trimming of vegetation within the ROW is necessary to prevent damage to overhead distribution lines. The clearing of vegetation shall be undertaken manually, without the use of heavy equipment and herbicides.

43. During the operational phase, there will be about 2-5 workers per township office of YESB and ESE who will be assigned to maintain the power line.

B. PROJECT PROPONENT

44. The executing agency (EA) will be the Ministry of Electric Power (MoEP) and will be responsible for overall project implementation and management. A project steering committee will monitor and coordinate project implementation.

45. MOEP will establish a Project Management Unit (PMU) which will be responsible for the day-to-day implementation and preparation of progress reports, ensuring that financial and reporting requirements are met and ADB procurement procedures followed with full coordination with project implementation units (PIUs) for the four project areas: Yangon Electricity Supply Board (YESB) for the five townships in Yangon City and Electricity Supply Enterprise (ESE) for each of the regions of Mandalay, Sagaing and Magway. The PMU comprise three full-time counterpart staff and supported by the Project Implementation Consultant (PIC).

IV. DESCRIPTION OF THE ENVIRONMENT

46. Baseline information on the relevant physical, biological, and socio-economic conditions of the existing environment of the project area is described in this section. Aspects on various environmental parameters which are likely to be directly or indirectly affected by the proposed rehabilitation of the distribution line project are discussed. In addition, current and proposed development activities within the area of influence of the project are presented.

A. PHYSICAL RESOURCES

1. GEOGRAPHY

47. The Union of Myanmar is the second largest country in south-east Asia and the 40th largest country in the world, with a total land area of 658,000 km^2. It is geographically located between 9°58' to 28°31'N and 9°29' to 10°10'E. Myanmar is bordered by India, Bangladesh, China, Lao PDR and Thailand. One-third of its total perimeter of 1,930 km forms an uninterrupted coastline along the Bay of Bengal and the Andaman Sea. The Hengduan Shan mountains serve as border between Myanmar and China in the north. Mountain ranges which runs from the north to south from the Himalayas divide the four river systems of the country, namely, the Irrawaddy (or Ayeyarwady), Chindwin, Salween (Thanlwin), and the Sittaung rivers. The Ayeyarwaddy River has a length of 2,170 km and is considered as the longest river in the country. Majority of the population lives in the Ayeyarwaddy valley which is situated between Rakhine Yoma and the Shan Plateau.

48. The country is divided into the following States and Divisions[2]:

Table 2. States and Divisions in Myanmar

States	Divisions
(1) Kachin	(1) Sagaing
(2) Kayah	(2) Tanintharyi
(3) Kayin	(3) Bago
(4) Chin	(4) Magway
(5) Mon	(5) Mandalay
(6) Rakhaing	(6) Yangon
(7) Shan	(7) Ayeyarwaddy

49. The project sites are located within the Divisions of Yangon, Mandalay, Sagaing, and Magway.

2. LAND USE

50. Electric posts and distribution transformers are situated along roads. There are substations that are located adjacent to residential houses and commercial areas. In Yangon, there are substations which are located right next to high-density residential areas. Meanwhile, in the areas of Mandalay, Sagaing, and Magway, the substations are located in relatively large area with wide open and vacant areas.

[2] Divisions are sometimes referred to as Regions.

51. In the areas of Mandalay, Magway and Sagaing, the land uses in the area of characterized as primarily agricultural. In general, about 12% of land in Myanmar is under cultivation, 16% under fallow and 74% under forests and other uses. Approximately 35% of the cultivable land is in the dry zone which is planted with rice (60%), millet and corn (5%), oil crops (15%), legumes (7%), and the rest with fruits, rubber, tea, and other crops.[3]

52. The four project areas are located within the central lowlands. The following describes the features of the project areas:

53. **Yangon.** The distribution line project will be located in the townships of Hliantaya, Insein, Kamayut, Mayangone, and Mingalone. These are the central lowlands of Myanmar which are ringed by steep and rugged highlands. The project area is located at the northern area of Yangon which is characterized by many high rise residential, commercial and colonial buildings. Industries can be found primarily along the banks of rivers. It is the most developed area of the country and is the main international gateway.

Photo 4. A distribution transformer along the road in Yangon

54. **Mandalay.** The Division of Mandalay is the second largest city of Myanmar. It is located in the central dry zone by the Irrawaddy River. Rehabilitation of distribution lines will occur primarily in populated areas characterized with a mixture of residential and commercial activities. There are some areas where small-scale industries operate. Agricultural land are planted with rice, corn, mango, and other crops. There are also grazing areas located in Meikhtila.

55. **Magway** Division is in the central region of Myanmar. The division is bordered by Sagaing Dvision to the north, the Mandalay Division to the south, and Rakhine State and Chin State to the west. Magway is divided by the Irrawaddy and by the road system on the western side. The road system is less developed. Oil and natural gas production are the principal economic activities in Magway, along with agricultural production.

[3] Source: Hazard Profile of Myanmar, Union of Myanmar, et.al., July 2009

Photo 5. Typical rural setting in the project areas

56. **Sagaing** is primarily an agricultural region which is known for rice, wheat, and peanut production. Majority of the area in the region is arable land. The Sagaing Division is at the northwestern part of Myanmar. It is bordered by Nagaland and Manipur States of India, Kachin State, Shan State, and Mandalay Division to the east, Mandalay and Magway to the south. The Ayeyarwaddy River forms a greater part of its eastern and southern boundary.

3. TOPOGRAPHY

57. Myanmar is roughly divided into three areas, namely, (1) Western Hills Region, (2) the Central Valley Region, and the (3) Eastern Hill Region. The proposed project components are located within the Central Valley Region. This region is considered as the broadest valley of Ayeyarwaddy River which originates from the first part of the river to Mandalay; the second part constitutes from Mandalay to Pyay; and the third part from Pyay to the mouth of the river. The Central Valley Region consists of Sittaung Valley and Chindwin Valley.

58. The Dry Zone (Figure 2) in the central inner Myanmar basin is surrounded by mountain ranges on three sides and opens towards the sea. It consists of an undulating plateau with elevation of 150-200 meters and a number of steep hilly chains which rise above the plateau with peaks of hill reaching altitude of 300 – 400m.

Yangon

59. Yangon Division borders the Bago Division in the north and east, Gulf of Mottama in the south and the Ayeyarwaddy Division in the west. Yangon is the southernmost part of the central plains. It is situated at 16.81^{o} North latitude and 96.16^{o} East longitude. Average elevation is 13 meters above sea level.

Mandalay

60. Mandalay Division falls in the Dry Zone in the central part of Myanmar. It is situated at 21.97^{o} North latitude and 96.08^{o} East longitude. Average elevation is 63 meters above sea level. The western hilly Myanmar Division whose rainfall is slightly more than other parts of Magway, Bago Mountain Range and the southernmost part have the tropical Savannah climate.

Magway

61. A major part of Magway Division is within the Dry Zone. It is situated at 20.15° North latitude and 94.92° East longitude. Average elevation is 50 meters above sea level. It has a common boundary with Mandalay Division and Bago Division as well as Rakhine and Chin States in Myanmar. Similar to Mandalay, the western hilly region has slightly more rainfall than other parts of Magway, Bago Mountain Range.

Sagaing

62. Sagaing Division is situated in the northwest of Myanmar. It is situated at 21.88° North latitude, 95.98° East longitude. Average elevation is 60 meters above sea level.

Figure 2. Dry Zone Map of Myanmar
Source: Hazard Profile of Myanmar, July 2009

4. GEOLOGY

63. The area's geology is characterized by clay, sandy loam and sandy soils that include gravel. Soils across the dry zone includes yellow-brown forest soil, dark compact clays, red brown stony dry savannah soils, gravelly compact soils, alluvial soils, mountain red-brown forest soils, Mount Popa soil. The soils clearly vary with topography.

64. Soil erosion is a serious problem in the Dry Zone. Soil can be completely removed by water and wind erosion brought about by high intensity of rainfall and rapid surface runoff. This is particularly severe in the upland areas of Kyaukpadaung and Chaung U. However, because of the moderate slope of 5-15%, the erodibility of the soil is high.

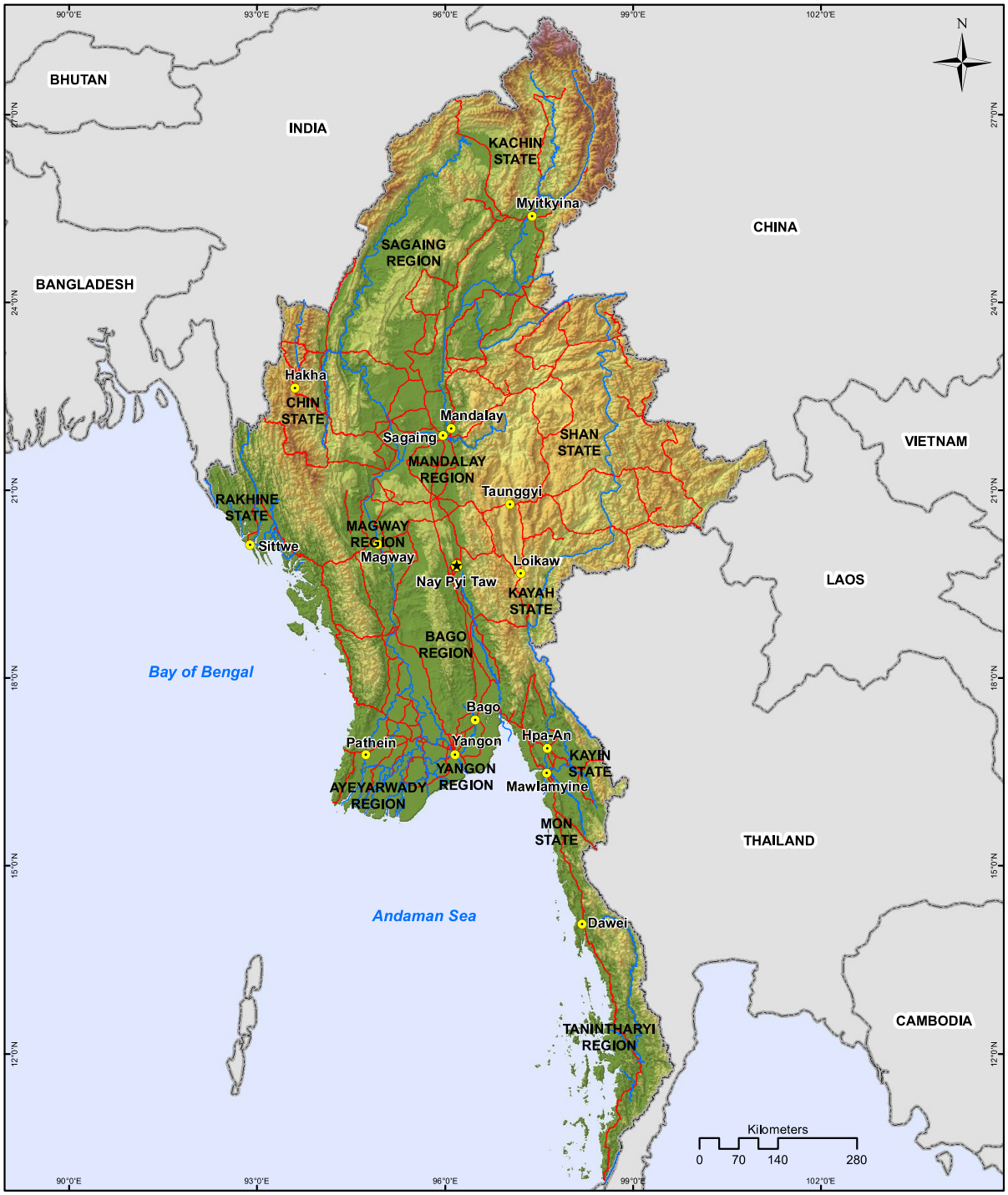
65. Sandy topsoil can be found in Magway, making it susceptible to soil erosion compounded by the high level of rainfall occurring over short periods. Therefore, during the excavation of pole foundations and civil works for the substations, appropriate mitigation measures should be instituted to prevent and control runoff of excavated soil material.

EARTHQUAKE

66. The major seismic generators in Myanmar (Figure 4) are the following:

- Subduction (with collision only in the north) of the northward-moving Indian Plant underneath the Burma Platelet which is a part of the Eurasian Plate
- Northward movement of the Burma Platelet from a spreading center in the Andaman Sea.

67. Other major seismotectonically important faults are some unnamed major thrust faults in the north-western Myanmar, Kabaw Fault along the Kabaw Valley in wester Myanmar, the Sagaing Fault, and the Kyaukkyan Fault situated west of Naungcho. The Sagaing Fault is the most prominent active fault in Myanmar which trends roughly north-south. The said fault has been the originator of a large proportion of destructive earthquakes in Myanmar and that many large urban centers lie in or near this fault.



Map ID: MIMU982v01
Completion Date: 5 March 2013.A4
Projection/Datum: Geographic/WGS84

info.mimu@undp.org
www.themimu.info

Legend

- Capital
- State Capital
- Water Body
- Major Road
- International Boundary

Elevation-metres

- 0 - 250
- 251 - 500
- 501 - 750
- 751 - 1,000
- 1,001 - 1,500
- 1,501 - 2,000
- 2,001 - 2,500
- 2,501 - 3,000
- 3,001 - 4,000
- 4,001 - 5,000
- 5,001 - 7,002

Data Sources :
Base Map - MIMU
Boundaries - WFP/MIMU
Place names - Ministry of Home Affairs (GAD) translated by MIMU

Figure 3. Topographic Map
Source: Myanmar Information Management Unit

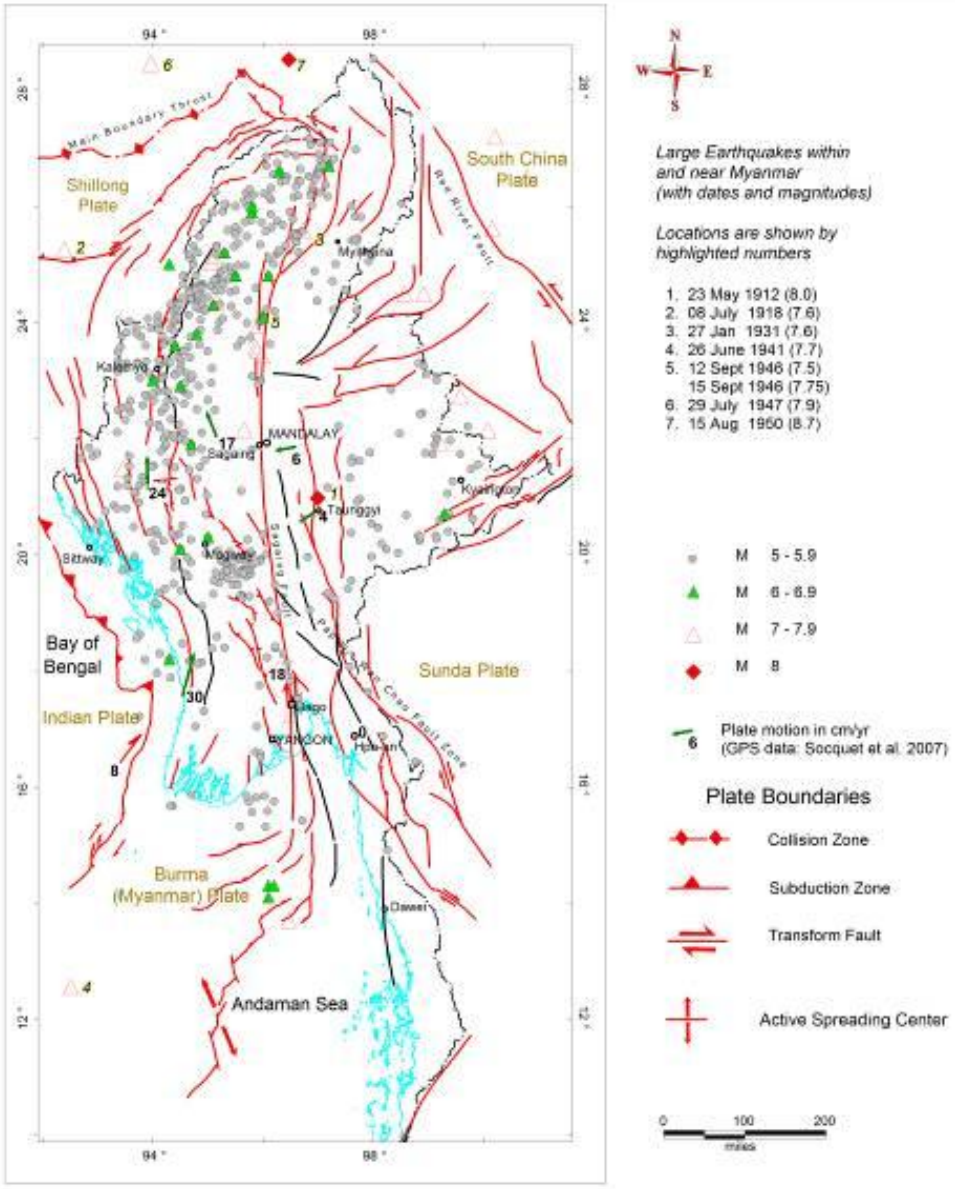


Figure 4. Seismotectonic Map of Myanmar
Source: Hazard Profile of Myanmar, July 2009

5. CLIMATE

68. The climate of Myanmar is roughly divided into three seasons: summer, rainy season and cold season. From March to mid-May are summer months; the rain falls from mid-May to the end of October and the cold season starts in November and ends in the end of February. Generally, Myanmar enjoys a tropical monsoon climate. However, climatic conditions differ widely from place to place due to widely differing topographical situations. For instance, Central Myanmar has an annual rainfall of less than 40 inches while the Rakhine coast gets about 200 inches.

69. In Yangon, the average daily temperature ranges from 18o to 32oC in January. The area has a tropical monsoon climate with short dry season. Warm season lasts from March to May with an average daily high temperature above 36^{o}C. The cold season lasts from May to September with an average high daily temperature below 31^{o}C. During the warm season, there is 18% average chance of rainfall during a given day while in the cold season precipitation is experienced with 89% average chance. Average annual rainfall in Yangon Division is 103 inches.

70. The project area in Mandalay, Magway, and Sagaing experiences temperatures which are very high, with April and May as the hottest months. The highest mean temperature is about 32^{o}C and the range maximum and minimum temperature is 15^{o}C. The average annual humidity is 63% but in the hottest months, the temperature drops to 42% while in the wettest months is increased up to 80%. The southwest monsoon starts in late March or early April with local turbulence that includes tornadoes and cyclones. This causes strong winds which are laden with soil and sand. This is considered as one of the causes of loss of top soil in the dry zone. The northwest monsoon period starts from October to mid-March and is characterized by dry and cool weather.

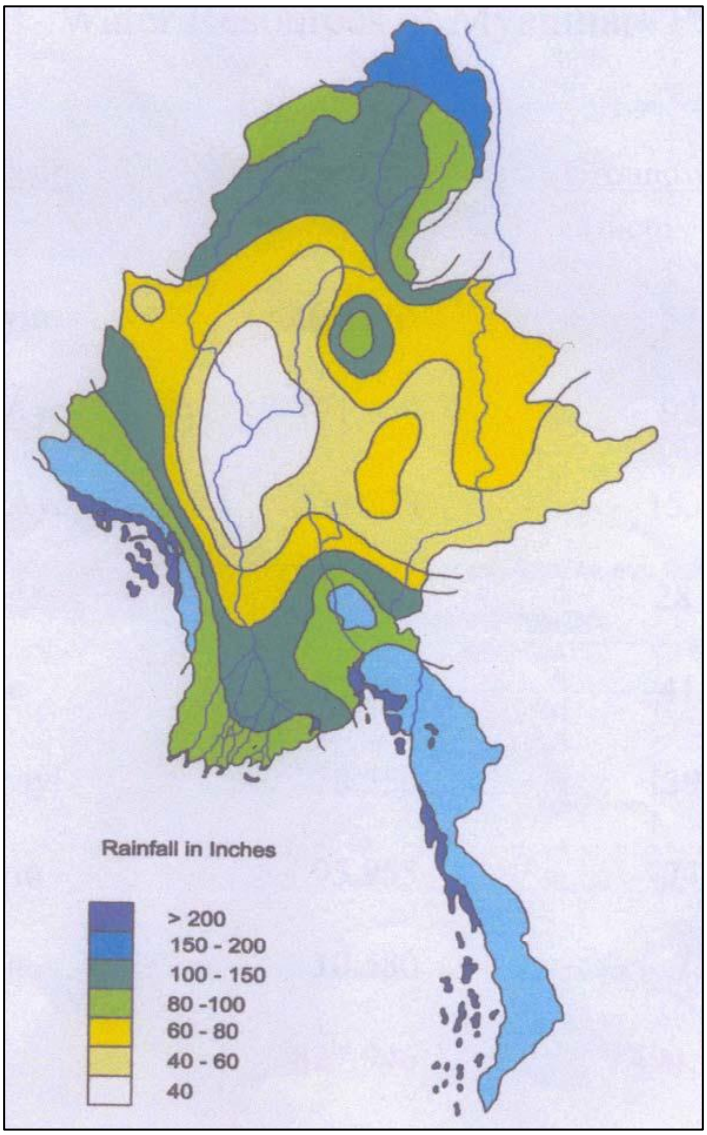


Figure 5. Rainfall Map of the Union of Myanmar
Source: Ministry of Agriculture and Irrigation

B. BIOLOGICAL RESOURCES

71. The project sites are located in an urban and semi-urban environment and most of the land area has been disturbed by human activities. In the rehabilitation of substations and transformer sites, there are a few trees and shrubs which are most likely to be removed to maintain conductor clearance and for safety and line integrity purposes.

72. The distribution line will not pass through forested areas and national parks. The nearest environmentally sensitive area to one of the project site is the National Kandawgyi Gardens which is a 24-acre state-owned botanical garden and forest reserve which was declared by the Directorate of Forestry on December 1, 1924. The said nature reserve is located about 42 miles from the Mandalay city center and about 21 miles from the 21-mile substation in Pyoolwin.

73. Typical terrestrial vegetation along the distribution line ROW consists of the bamboo, acacia, rattan, fruit trees, rice, and other shrubs. In the dry zone, an almost continuous ring of dry tropical shrub savanna with grasses and deciduous trees can be found. Trees are hardly grown on the agricultural land. There are no identified endangered species that will be affected by the project.

C. HYDROLOGY

74. The Ayeyarwaddy River basin and the catchment occupy about 60% of the country. It traverses the States of Chin, Kachin, and Shan and Mandalay, Magway, Bago, Yangon, and Ayeyarwady Divisions. In general, the catchment areas of major rivers in the north and central zone are prone to flooding caused by swollen rivers. The southern delta in Yangon experience flood tide and high river water flow but these areas are protected with earthen dikes.

75. Of the project areas affected by the rehabilitation of the distribution line, the following townships are considered as flood-prone areas and have experienced major flood events based on records from 1997 to 2007.

Table 3. Project Areas Affected by Flooding (1997-2007)

Location	Date	No. of Affected Village Tracts and Villages	No. of Affected Families	Affected Population
Monywa, Sagaing Division	18/8/02	-	9,460	48,746
Kyaukse District, Mandalay Division	9/10/06	All villages in 4 wards	1,763	7,045
Sagaing Division	11/9/06	6 villages near Yaymyetgyi Lake	791	5,372

Source: Hazard Profile of Myanmar, July 2009

76. There are also localized flooding which occurs in low-lying areas and those near rivers.

D. AIR QUALITY

77. The quality of ambient air in the project areas is primarily good. There are no major sources of air pollution except for the movement of vehicles, wind-blown dusts, and rehabilitation activities.

E. SOCIO-ECONOMIC CONDITIONS

1. POPULATION AND AFFECTED COMMUNITIES

78. Myanmar has a total population of 54,584,650 as of 2012. The country has a population growth rate of 1.07% while population density in 2011 is 71.4 persons per sq km[4]. Female population (24,517,413) is almost equivalent to the male population (23,819,350). In terms of age structure, about 42.5% of the population are within the age structure of 24 – 54 years or belongs to the working age group (Table 4).

[4] Source: www.data.un.org

Table 4. Age Structure in Myanmar (2012)

Age Structure	Total Percentage	Male Population	Female Population
0 – 14 years	27.1%	7,534,762	7,250,582
15 – 24 years	18.8%	5,198,588	5,078,286
25 – 54 years	42.5%	11,513,896	11,679,972
55 – 64 years	6.5%	1,673,039	1,868,857
65 years and over	5.1%	1,213,487	1,573,181

79. The country is made up of 135 national races, of which the main national races are Kachin, Kayah, Kayin, Chin, Bamar, Mon, Rakhine, and Shan[5]. The main religions are Buddhism (89.2%), Christianity (5.0%), Islam (3.8%), Hinduism (0.5%), Spiritualism (1.2%) and others (0.2%).

80. About 70% of Myanmar's population reside in rural areas and are dependent on agriculture for their livelihood[6]. Moreover, about 36% of the rural populations, many of whom are landless laborers, live below the poverty line.

81. Historically, Myanmar's diverse ethnic make-up has been delineated by its topography. At present, rural incomes are constrained by high transaction costs for agricultural production and marketing (due largely to the poor condition of access roads, tracks, bridges, and boat landing sites as well as irrigation, drainage, and flood control structures), sparse opportunities for alternative employment and limited access to markets, social and technical services. Investments in improving rural infrastructure will reduce these constraints.

2. ECONOMY

82. Myanmar has abundant natural resources including oil, natural gas, hydropower, timber, tin, antimony, zinc, copper, tungsten, lead, coal, marble, limestone and many precious stones, such as rubies, sapphires, pearls and jade. Main industries include agricultural goods, textiles, wood products, construction materials, gems, metals, oil and natural gas. The major agricultural product is rice which covers about 60% of the country's total cultivated land area.

3. POWER SUPPLY

Yangon

83. Demand for electricity is growing rapidly year by year in Yangon region. There are an estimated 1.27 m households (HH) in Yangon and 71% of these are already electrified. YESB expect an annual increase of 58,700 HH to be connected to their power supply.
Transmission and distribution facilities are old and need to be improved because T&D losses are high. YESB want to obtain more sophisticated technologies to solve the problems in their power system; and to achieve several new substations and distribution lines to improve distribution efficiency, enhance power capability of transmission lines, control steady-state and temporary over voltage and avoid disastrous blackouts in the power system.

84. Peak loads as of July 2013 were 850 MW daytime and 750 MW nighttime. YESB predict that the peak will reach 950 MW and 4.25 GWh in 2014, further rising to 1,400 MW and 7.070 GWh by 2016 being the last year of their 5th five fiscal year plan. The load is currently supplied by about 318 MW (increased from 292 MW in 2012) of gas turbines in Yangon, with the

[5] Source: Ministry of Foreign Affairs, www.mofa.gov.mm
[6] Source: Country Profile, Health in Myanmar, 2013

remainder having to be supplied through the national transmission grid from generating plant in the north of Myanmar. Because of a shortage of generation, load shedding is necessary in the dry months; for example, a peak of nearly 200 MW of loading shedding occurred on March 2013, but since 02 June 2013 at the onset of the wet season there has been sufficient generation to meet demand. During load shedding, it is common to see shop owners operating their own small generators typically located on the footpaths in front of their premises. There is a significant amount of old lines and substation equipment in dire need of replacement. This includes the 6.6 kV distribution network, which is now an redundant voltage with high losses.

Mandalay

85. Electricity consumption in Mandalay has doubled during last 10 years and the total installed capacity of Mandalay region is now equal to the national demand of the last 20 years. Total installed capacity in Mandalay Region is 871 MW from three major hydropower stations and two medium hydropower stations. In 2012, total electricity consumption was 1,775.5 GWh. With a population of about 5.3 million, Mandalay Region's per capita electricity consumption was only 80 kWh per year. After changing the national administration policy in 2011, the electrification ratio is increased from 31% in 2011 to 40.60% in 2013. Electricity Supply Enterprise (Mandalay Region) consists of voltage level - 33 kV, 11 kV, 0.4 kV. Technical and non-technical losses of distribution in Mandalay Region are 25% in 2011; reduced to 15.8% in 2013. But losses of Yameethin District are still high at 33%, followed by MeikHVila District 28.9% and Myingyan District 24.78%.

86. Power distribution in Mandalay City is the responsibility of the Mandalay Division of the Electric Supply Enterprise, under MoEP. Distribution in Mandalay Region comprises a network of 33 kV and 11 kV emanating from the grid substations to connect to the distribution transformers to supply single and three phase 400/200 V to the consumers.

Magway

87. Power distribution in Magway Region is the responsibility of the Magway Division of the Electric Supply Enterprise, under MoEP. They have 506 employees, including 80 engineers and officers.

88. As of March 2013, there were a total of 131,000 customers in Magway Region, including 127,000 general purpose and domestic. Total monthly sales in March 2013 was 38.109 GWh. Distribution loses are currently 15%.

Sagaing

89. Power distribution in Sagaing Region is the responsibility of the Sagaing Division of the Electric Supply Enterprise, under MoEP. They have 776 employees, including 103 engineers and officers.

90. As of March 2013, there were a total of 201,000 customers in Sagaing Region, including 198,000 general purpose and domestic. Total monthly sales in March 2013 was 31.095 GWh. Distribution loses are currently 17%.

4. HEALTH

91. Based on information from the Ministry of Health, the leading causes of morbidity in the country are injuries, complications of pregnancy and delivery, single spontaneous delivery, diarrhea and gastroenteritis, malaria, other pregnancies of abortive outcome, viral diseases, gastritis and duodenitis, cataract, and other acute upper respiratory infections (Table 5).

Meanwhile the leading causes of mortality are human immunodeficiency virus (HIV), septicemia, other diseases of the respiratory system, respiratory tuberculosis, diseases of the liver, slow fetal growth/malnutrition, stroke, heart failure, and malaria (Table 6).

Table 5. Leading Causes of Morbidity (2011)

Causes	Percent
1. Other injuries of specified unspecified and multiple body regions	10.6
2. Other complications of pregnancy and delivery	6.7
3. Single spontaneous delivery	6.0
4. Diarrhea and gastroenteritis of presumed infectious origin	5.4
5. Malaria	3.2
6. Other pregnancies with abortive outcome	2.9
7. Other viral diseases	2.6
8. Gastritis and duodenitis	2.1
9. Cataract and other disorders of lens	2.0
10. Other acute upper respiratory infections	1.8

Source: Ministry of Health, www.moh.gov.mm

Table 6. Leading Causes of Mortality (2011)

11. Cause	Percentage
1. Human immunodeficiency virus (HIV) disease	6.3
2. Septicemia	5.0
3. Other diseases of the respiratory system	3.9
4. Respiratory tuberculosis	3.9
5. Other diseases of liver	3.8
6. Slow fetal growth, fetal malnutrition and disorders related to short gestation and low birth weight	3.7
7. Stroke, not specified as hemorrhage or infraction	3.6
8. Heart failure	3.2
9. Malaria	3.1
10. Other heart diseases	2.3

Source: Ministry of Health, www.moh.gov.mm

92. Health services are provided by a mixture of public and private health facilities. The Department of Health, one of the departments under the Ministry of Health provides comprehensive health care throughout the country including those located in remote and hard to reach border areas. There is also traditional medicine in Myanmar's health system which is well accepted and utilized by the people throughout the history.

5. DRAINAGE AND SEWER SYSTEM

93. Myanmar's drainage system is composed of drainage canals along roads that drain towards a water body. In some areas, there are open drainage canals that were noted to be clogged with garbage and sediments. There is no sewerage system for wastewater generated by the population.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

94. In general, the nature of the project will yield greater environmental and social benefits than adverse impacts. Most of the impacts are expected to be site-specific and temporary in nature since these will mainly occur during the installation of the poles and equipment. The main environmental impacts during the initial operational phase are the management of decommissioned transformers and other equipment.

95. The following presents the potential environmental impacts of the project and the recommended mitigating measures to address adverse environmental impacts. The impacts are structured into the (i) rehabilitation and installation phase of the project and (ii) operation phase of the distribution line.

A. BENEFITS OF THE PROJECT

96. The project is largely expected to have positive impacts on the local community due to the improvement of the distribution system's reliability. In addition, with the proposed rehabilitation of the substations and distribution lines, better and safer equipment will be installed that will reduce risks to workers and the community associated with staying too close to such installations. At the same time, the substations will be provided with security fence which will not make the facility not readily accessible to the general public.

97. On a larger scale, the proposed project is expected to contribute to the economic development of these service areas in Myanmar. More business, investment and employment opportunities are anticipated with the reliability of power supply.

B. IMPACTS AND MITIGATION MEASURES DURING REHABILITATION AND INSTALLATION PHASE

98. The following are the anticipated impacts during the rehabilitation work.

1. OIL SPILLAGES AND LEAKS

99. Based on observations at existing substations, traces of oil spills presumably coming from the regular maintenance of transformers were noticed. The ESE also undertakes transformer rewinding and draining of oil within the substation itself which result to leaks within the work area. The oil leaks and spillages will immediately cause pollution of the soil in the affected area and in the long-term cause groundwater pollution as oil seeps through the soil.

100. The current standard substation design does not include a transformer oil containment system that can collect oil spills. To avoid adverse effects of oil spills, an oil/grease pit shall be included in the design of the transformer pad to contain any possible leaks and spills. In addition, the draining of transformer oil and rewinding activities should be undertaken in a concreted area with oil pit to avoid oil from being directed towards the soil or drainage canals.

Photo 6. A substation in Yangon to be rehabilitated. Note the traces of oil spill around the transformer area.

Photo 7. Transformer rewinding activities at a substation in Sagaing.

2. DECOMMISSIONING OF OLD EQUIPMENT AND MATERIALS

101. **Lack of Storage for Decommissioned Equipment and other Materials.** Old cables, transformers, switches, wooden poles, and other waste materials will be generated when the old power lines are removed and the substations are rehabilitated. The YESB and ESE will utilize some of the decommissioned equipment in other remote areas in need of electricity. However, the dismantled equipment from the line will constitute to the generation of materials which will overburden the existing central materials storage areas of MoEP, YESB and the ESE in Mandalay, Sagaing, and Magway. There is very limited space available at the YESB central materials storage warehouse and at existing substation sites in Yangon to accommodate the bulk of waste materials that will be generated from the decommissioning of equipment. The substation areas of the ESE in Mandalay, Sagaing and Magway have open and vacant areas which can be utilized as temporary waste storage area during decommissioning works. Since there is limited space at the YESB substation areas and at the central materials storage warehouse in Yangon, the YESB should find a suitable area for the decommissioned equipment and should prepare a phased-in schedule for the dismantling of equipment.

102. YESB and the ESE should also be able to identify a recycler or buyer of the cables or other decommissioned materials to avoid long storage on-site.

Photo 8. The central materials warehouse of YESB.

103. **Removal of Suspected PCB-Containing Transformer.** Based on discussion with YESB and ESE, PCBs are no longer used in their transformers and distribution system. Traditionally, transformer oil used to contain polychlorinated biphenyls (PCBs), a chemical known as one of the persistent organic pollutants (POPs). In accordance to the Stockholm Convention, PCBs is now being eliminated globally because of its negative effects to the environment. Since the 1970s, the production of PCBs is not allowed anymore but reports of PCB-containing transformers are still around globally.

104. Based on information taken from MOECAF, Myanmar is a signatory to the Stockholm Convention that banned POPs, including PCBs. The MOECAF is the focal point for the Stockholm Convention, which confirmed that they will start the inventory of POPs this year with assistance from the United Nations Industrial Development Organization (UNIDO) and with funding from the Global Environment Facility (GEF). A National Waste Management Plan is also being developed with support from the United Nations Environment Program (UNEP). As a policy, YESB and the ESE will no longer utilize transformers containing PCBs in compliance with the Stockholm Convention on POPs.

105. **Waste Generation.** Lubricants and oil recovered from dismantled transformers and busted batteries would need proper disposal system. While the country still do not have a sanitary landfill or a licensed waste hauler, all waste materials such as used oil, lubricants, oily rags and materials should be stored temporarily in a secured waste storage area to be identified by MoEP, YESB and the ESE. The National Waste Management Plan that will be developed by MOECAF in cooperation with the UNEP will help the country deal with the proper management of special waste materials including suspected PCB-containing equipment.

106. Other waste materials such as wires, cables, switches, conductors, and packaging materials (wooden pallets, plastic, foam, and cardboard boxes) are recyclable materials which may be sold to a scrap facility.

3. IMPACT ON INFRASTRUCTURES AND VEGETATION

107. The distribution lines and substations are located in populated areas. There will be some short sections of drain/canal embankments and road gutters that will be temporarily affected. Towards the end of the rehabilitation and installation of the power distribution poles, the YESB and ESE will clean-up the site and to ensure that all waste materials are collected and that the disturbed area has been rehabilitated appropriately.

108. There will also be temporary disturbance or removal of vegetation for activities such as assembly of concrete poles and line stringing. Trees higher than 20 ft. in the ROW will be trimmed down. Most of the areas require only cutting or trimming of tall vegetation in the ROW for conductor clearance.

4. IMPACT ON CULTURAL AND HERITAGE SITES

109. There are no project components that will affect cultural and heritage sites since the project areas will be located within existing distribution line ROW and substations. There are some distribution line transformers that will be located in new areas but are still along the ROW of the distribution line. These are all along the roadsides. When excavating pole foundations, any chance finds, any antiques, cultural and historical artifacts that may be discovered should be reported to local authorities.

5. GENERATION OF DUST AND EROSION OF SEDIMENTS

110. During the laying of power distribution poles, piles of exposed subsoil and topsoil from exposed excavations of about 1 meter in depth will be generated. Soils along the ROW of the distribution line are generally prone to erosion, therefore, ground disturbance has the potential to create erosion hazard. This exposed soil may result in negative effects to the surrounding environment due to fugitive dust emissions and runoff of sediments in nearby lands, canals and watercourses. Excavations associated with the rehabilitation work and laying of pole foundations will entail the generation of dust. By nature, dust is fugitive and tends to affect communities far from the sites where it would have been generated.

111. As part of the project's mitigation plans, stockpiles of soil will be covered with tarps or plastic sheeting in the event of prolonged stoppages to prevent erosion, runoff and fugitive dust emissions. Vegetation removal adjacent to water bodies will be avoided to the extent possible to reduce potential sedimentation of watercourses.

112. At substation sites where civil and earth works are to be undertaken, silt traps will be constructed on the stockpiles of materials to control the flow of sediments during rainfall events. Once the rehabilitation activities are completed, excavated soil will be restored to the original land.

113. The irrigation canals and streams that will be traversed by the distribution line will be the receiving point of potential runoff during the construction of the foundations for the concrete poles. These water bodies will likely be impacted to some extent by runoff from the pole foundations and from frequent movement of construction vehicles to the site during the rehabilitation phase.

114. Timing is also one of the critical factors involved in erosion and sedimentation control in construction sites. Careful scheduling of activities during the dry season can minimize the exposed area prone to soil erosion during the rainy season. Other measures that can be implemented to control soil runoff include the following:

(i) Limit clearing to areas necessary for construction.
(ii) Locate potential sources of pollution away from water bodies or other critical areas.
(iii) Cover and stabilize stockpile of topsoil.

6. DISRUPTION TO TRAFFIC FLOW

115. The distribution lines will consist of power poles and cables that run along existing easement or public ROW and may cause temporary disruption of traffic along these roads. In particular, the village roads are relatively narrow and movement of cranes and large construction vehicles carrying the power poles along these roads might cause temporary blockage and nuisance to villagers. This will disrupt the normal traffic patterns and may expose the villagers to risk of injury or accidents. This is particularly pronounced in Yangon where vehicular movement is busier than in Mandalay, Sagaing, and Magway.

116. To mitigate traffic disturbances, collaboration with the township governments will be undertaken. The YESB and ESE will be required to ensure safe conditions are maintained, particularly in areas near schools and universities, in agricultural areas, high-density residential areas, and on public roads. Prior to decommissioning of the power lines, the YESB and ESE

will obtain the required road use clearance and negotiate conditions of use with the township prior to start of the activities.

117. The YESB and ESE should ensure that established practices of posting warning signs and managing traffic to protect the travelling public and workers will be properly implemented. Advisories and notices to the public about the implementation of the power distribution line project and the temporary road blockage should be issued. The YESB and ESE should closely coordinate with the local communities and engage good practices for traffic management.

7. NOISE

118. At the proposed project sites, the main source of noise emission is the movement of vehicles since these are primarily located along roads. There are also road construction activities which may contribute to the increase in noise levels. During the installation of poles and rehabilitation of substations, noise will be temporary, minor, and localized in nature.

8. OCCUPATIONAL HEALTH AND SAFETY

119. Accidents can occur to the workers and local people during the rehabilitation and installation works if safety regulations are not observed. Rehabilitation activities may cause harm and danger to the lives and welfare of workers. The wearing of Personal Protective Equipment (PPE) such as hard hats and safety gloves should be strictly imposed. A construction health and safety plan needs to be prepared and implemented by the YESB and ESE . This shall also include the provision of barricades around the site where construction and rehabilitation works are to be undertaken. The construction safety plan should be required in the bidding documents and contracts. The existing health services in the vicinity are located in the townships and divisions. During the rehabilitation phase, the YESB and ESE will be required to provide first-aid facilities for the workers.

9. COMMUNITY HEALTH AND SAFETY

120. The project will result to impacts to community health and safety such as construction traffic, transport of materials, fires, emergency spills of materials, and unauthorized entry by the villagers into working areas.

121. To mitigate these potential impacts, the YESB and ESE will be required to develop a Community Health and Safety Plan (CHSP) that incorporates good international practice and recognized standards. The CHSP should include emergency response and preparedness procedures to be developed in close consultation with potentially affected communities and local township authorities. The plan should include specific emergency response procedures, communication systems and protocols, and interaction with local and regional emergency and health authorities. The plan should include the setting up of warning signages at the sites where pole erection are to be undertaken.

C. IMPACTS DURING THE OPERATIONAL PHASE

122. The expected adverse impacts during the operational phase of the rehabilitation of the distribution line are generally related to the occupational and community health and safety issues. The impacts are reversible, manageable, and can be mitigated with proper engineering and management controls.

1. Oil Spillages During Transfer of Oil Between Containers and Transformers

123. Spillage of oil may occur during the process of filing the new transformers with oil or the use of mobile equipment. This will immediately pollute the soil in the affected area and in the long-term cause ground water pollution as oil seeps through the soil.

124. A maintenance yard space should be provided within the substation. This area should be concreted and provided with an oil pit to avoid the discharge of oil into the soil or existing water courses and drains. Workers undertaking the oil draining activities should be forewarned to exercise care in handling oil and in avoiding spills.

2. Occupational Health and Safety

125. The occupational health and safety issues inherent to the operation of distribution line include hazards due to exposure to live power lines, working in heights and risks of accidents, and potential exposure to electric and magnetic fields. Accidents that may occur include electrocution, lightning, fires, and explosion.

126. In existing substations, the personnel and operators manning the substations are not equipped with the basic safety equipment and special clothing such as insulating gloves, helmets, visors, safety shoes, and raincoats. There are, however, fire extinguishers at substations. There are also no first-aid kits inside the substation for use during electrical burns and other accidents and emergencies. Safety practice falls well below international practice and needs to be addressed to ensure the on-going safety of their staff. Extensive training in operations and safety practices is recommended for the personnel of YESB and ESE .

127. **Exposure to Live Power Lines.** Workers may come in contact with live power lines during the maintenance of the facilities and electrocution from direct contact with electricity is a hazard directly related to power transmission lines and facilities.[7]

128. The MOEP and YESB/ESE should be guided by the "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC) dated 30 April 2007 when working at the distribution line facilities. Some of the prevention and control measures when working with live power lines are:

(i) Restricting access to electrical equipment by workers only trained and certified to work on electrical equipment.

(ii) Adherence to electrical safety standards.

(iii) Proper grounding and deactivation of live power distribution lines during maintenance work or if working in close proximity to the lines.

(iv) Provision of PPE for workers, safety measures, personal safety devices, and other precautions

[7] International Finance Corporation (IFC), *Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution.* 30 April 2007.

(v) Observe guidelines to minimum approach distances for excavations, tools, vehicles, pruning, and other activities when working around power lines and the substation.

(vi) The entrance to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors should be kept locked unless such entrances are under the observation of a qualified person at all times.

129. **Working in Heights.** Accidents may happen when working in heights. However, a worker safety plan may be implemented to reduce risks that include testing of structural integrity prior to proceeding with the work and the use of fall protection measures.

3. COMMUNITY HEALTH AND SAFETY

130. **Electrocution.** The community may also be exposed to electrocution hazards as a result of direct contact with live conductors, flashover from the conductor to a pole and conductor breakage. Contact with live conductors or flashover to a person or object near a live line may occur without a safe vertical clearance. To prevent these hazards, MOEP needs to observe the minimum vertical clearance as well as protection which can be detected immediately including conductor snapping and de-energizing of the line within three cycles, thus, largely avoiding the potential for electrocution from a breakage.

131. **Exposure to Electromagnetic Field.** The transmission frequency commonly used in power distribution systems is considered as extremely low frequency[8], with impacts becoming low with distance from the source. The electric fields become shielded by trees, buildings, and other materials that conduct electricity. In general, the electric fields are strongest close to the source and diminish with distance.

132. The World Health Organization (WHO) reported that there is still weak evidence about substantive long-term health issues related to low frequency electric fields at levels generally encountered by members of the public. The potential health effects associated with exposure to EMF is not well-established due to lack of empirical data demonstrating adverse health effects. However, the public should be warned about the safety distances from the power lines through warning signages.

4. RISKS AND EMERGENCIES ASSOCIATED WITH DISTRIBUTION LINES

133. There are several risks that could occur with the operation of the distribution line. Among these are the likelihood of cable being damaged, vandalism of the equipment along the power line, degradation of the poles over time which could compromise its structural integrity, potential fire events, explosion of equipment, and being hit by lightning.

134. Lightning arresters will be provided at the distribution line. There should also be provision for ensuring security of the cable and transformers to avoid vandalism. Regular inspections of the line and the facilities would help identify missing or corroded parts.

135. In case of fire events, explosion, and other related situations, a fire management strategy which may be included in the emergency preparedness and response plan of the project should be developed.

136. Workers should be trained on emergency preparedness and response procedures and a manual on safety and emergency procedures should be prepared and disseminated to workers like fighting oil fires, e.g. from transformer. The procedure should outline the system to identify potential emergency situations and potential accidents that can have an impact to the health and safety of the workers and to the community.

5. TRIMMING OF VEGETATION

137. One of the regular programs to maintain the integrity of the distribution line is the trimming of tall trees and vegetation along the ROW and on the concrete poles. This is being done to maintain the necessary conductor clearance of the line. In addition, the presence of vegetation along the ROW provides habitat for birds.

Photo 9. Vegetation growth on an electric pole.

138. Private and communal trees and plants about 20 ft. height within the ROW will be either removed or pruned to provide the necessary conductor clearance distance. In addition, large trees within 20 ft. of the base of the poles will be selectively removed or pruned to reduce the potential to fall and strike these structures. Tree removal or pruning will also be undertaken immediately outside the ROW to prevent trees from falling and striking the lowest conductor.

139. The vegetation maintenance activities may cause minor disturbance to local people. This can be mitigated by limiting use to already existing roads or tracks to reach the distribution lines and informing the locals in advance through the village heads on the schedule of the maintenance works. Care should be observed to avoid encroachment into rice or crop land of villagers by workers who will undertake vegetation trimming.

140. MOEP will not allow the use of herbicides and pesticides to control vegetation growth. Burning to control vegetation along the ROW is also prohibited.

VI. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

141. This Chapter presents the public consultation process that was undertaken for the project, the concerns raised by the stakeholders, and plans of the implementing agencies to disclose the project to the community. As of the moment, the Government of Myanmar is still in the process of establishing its public consultation procedures which they target to finalize by the end of 2013.

142. Interviews were undertaken to gather information from stakeholders and consumers about their perception on the proposed rehabilitation of the power distribution project. Those who were interviewed agreed that the proposed project will be beneficial to the community and will help in improving the current system.

143. Representatives from the ESE and YESB informed that power distribution project is generally a welcome development in every community. Some of the community issues that they encounter during the implementation of distribution lines and substation projects are related to requests from a community to install the power lines near their residences.

144. In order to ensure the public disclosure of the project prior to implementation, the following programs will be observed during the consultation and disclosure of information to the community:

- Inform the local township authorities about the proposed rehabilitation of distribution and substation system prior to actual rehabilitation.
- In coordination with the local township authorities, meetings with the project affected households will be conducted to inform them of the proposed line rehabilitation works.
- The consumers will also be informed about the schedule of the power interruption, that may occur during the line and equipment installation.
- Announcements about the schedule of power outage, environmental management plan, and traffic rerouting plan will be done through the township office.

VII. GRIEVANCE REDRESS MECHANISM

145. A grievance redress mechanism will be established to address concerns of the stakeholders about the project. The grievance redress procedure will comply with the requirements of ADB SPS (2009) in addressing people's concerns and complaints promptly and in a transparent manner.

146. Grievances during the rehabilitation of the power distribution may include impacts related to physical works on the distribution line and the site clearing activities. During the operational phase of the project, the complaints that may be anticipated are related to maintenance activities of the distribution lines and facilities.

147. Any complaint is acted and facilitated by the Supervisor of the YESB/ESE through the township authorities. Complaints received during the operational phase are facilitated through the YESB/ESE or through the township or substation office.

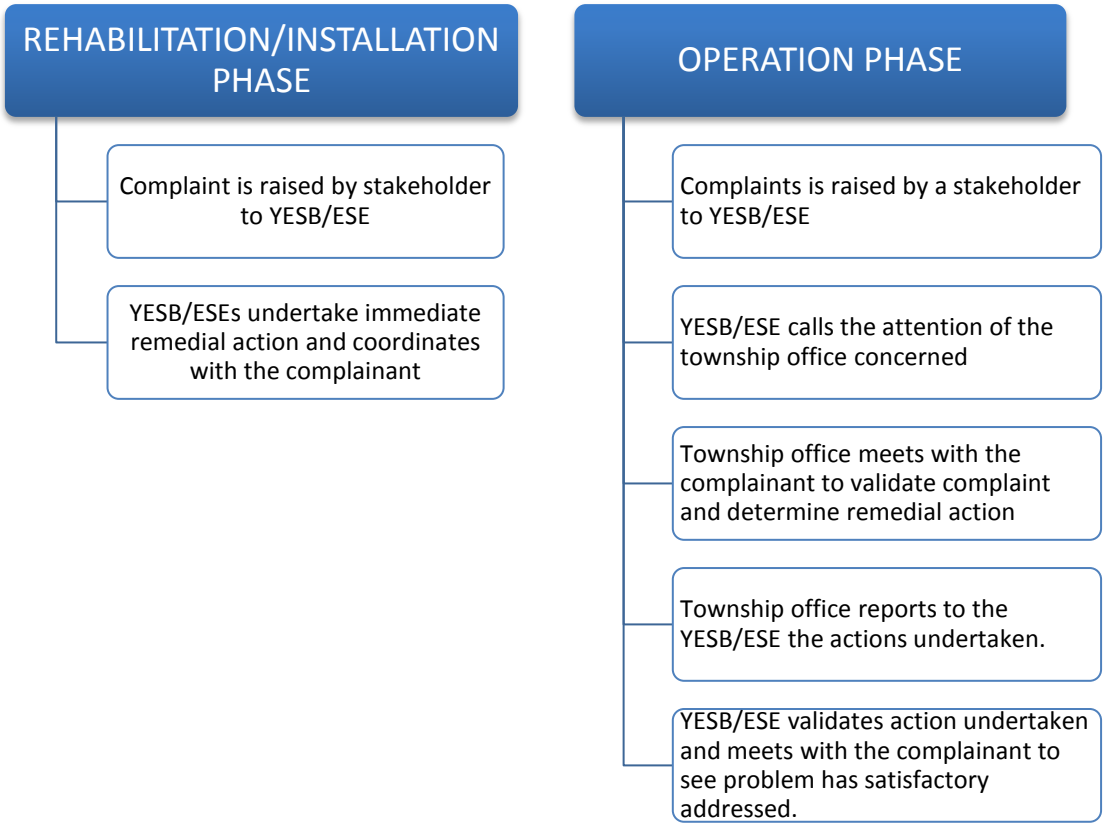


Figure 6: Grievance Redress Procedure

VIII. ENVIRONMENTAL MANAGEMENT PLAN

148. This chapter presents the mitigation measures, environmental monitoring plan, and institutional arrangements to address adverse environmental impacts of the project.

A. MITIGATION PLAN

149. The rehabilitation and operation phase mitigation measures identified in Chapter 5 are summarized in Table 7, together with the schedule, estimated cost and responsible entity for implementation.

Table 7: Environmental Management Plan

Potential Environmental Impact	Mitigating Measures	Schedule	Estimated Cost (US$)	Responsible Entity
REHABILITATION AND INSTALLATION PHASE				
Project Disclosure	Issue advisories and notices to the public about the proposed project.	Upon completion of detailed design	Operational requirement	YESB/ESE
Oil spillages and leaks from transformers	Incorporate the provision of a transformer containment system (oil/grease pit) in the standard design of substations	Included in the detailed design of substation	Pre-installation requirement	YESB/ESE
Decommissioning of old equipment and materials				
Lack of storage for decommissioned equipment and materials	The generation of decommissioned equipment overburden the existing central waste materials storage areas of MoEP, YESB and the ESE . At the substation areas of ESE in Mandalay, Sagaing and Magway, the open and vacant areas can be utilized as materials recovery/temporary waste storage area during decommissioning works. YESB will develop a phased-in schedule of dismantling and identify enough area for the temporary materials	Upon completion of detailed design	Pre-installation requirement	YESB/ESE

Potential Environmental Impact	Mitigating Measures	Schedule	Estimated Cost (US$)	Responsible Entity
	storage for decommissioned equipment. YESB/ESE will identify a recycler or buyer of the cable or other decommissioned materials to avoid long storage on-site.			
Removal of suspected PCB-containing transformer	Inventory of PCB-containing transformers will be conducted in coordination with MOECAF as focal point for the Stockholm Convention. A National Waste Management Plan will be developed by MOECAF with UNEP assistance. As a policy, YESB and ESE will no longer utilize transformers containing PCBs.	Before and during rehabilitation	c/o assistance from UNIDO and UNEP to MOECAF	YESB/ESE MOECAF
Waste generation	Lubricants, oil recovered from dismantled transformers, batteries, oily rags, and other related materials should be treated as special waste materials. MoEP, YESB and ESE will have a temporary and separate storage area for these waste materials. The National Waste Management Plan that will be developed by MOECAF in cooperation with the UNEP will help the country deal with the management of these special waste materials, including PCB-containing equipment.	Before and during the rehabilitation	Part of the EMP cost	YESB/ESE MOECAF
Impact on infrastructures and vegetation				
Damage to vegetation and existing	At the end of the rehabilitation and installation of the power distribution	At the end of rehabilitation phase	Part of rehabilitation cost	YESB/ESE

Potential Environmental Impact	Mitigating Measures	Schedule	Estimated Cost (US$)	Responsible Entity
infrastructures due to temporary site disturbance	poles, the YESB/ESE will clean-up the site and to ensure that all waste materials are collected and that the disturbed area has been rehabilitated appropriately.			
Impact on cultural and heritage sites				
Chance finds during excavation works	There are no project components that will affect cultural and heritage sites. In case of chance finds, any antiques, cultural and historical artifacts that may be discovered will be reported to local authorities.	During the excavation of foundations of poles and distribution transformer pad.	Part of rehabilitation cost	YESB/ESE
Air Pollution				
Dust emission from laying of power distribution poles	Exposed subsoil and topsoil from excavations may result to fugitive dust emissions. Stockpiles of soil will be covered with tarps or plastic sheeting.	During excavation of pole foundation and transformer pad.	Part of rehabilitation cost	YESB/ESE
Water Pollution				
Soil runoff from exposed excavations and ground disturbance.	Provide silt traps on the stockpiles of materials to control flow of sediments during rainfall events.	During excavation of pole foundation and transformer pad.	Part of rehabilitation cost	YESB/ESE
Traffic				
Disruption to traffic flow	Narrow roads may have to be closed during the pole installation because of the movement of cranes and large construction vehicles carrying the power poles. There will be more impacts in Yangon since some of the power poles are located along narrow roads with more traffic.	During pole installation.	Part of rehabilitation cost	YESB/ESE

Potential Environmental Impact	Mitigating Measures	Schedule	Estimated Cost (US$)	Responsible Entity
	YESB/ESE will coordinate with the township authorities to secure road use clearance and negotiate conditions of use prior to start of the activities. YESB and ESE will post warning signs and manage traffic to protect the travelling public and workers. Advisories and notices to the public on the project implementation and temporary road blockage will be issued.			
Occupational Health and Safety				
Accidents during rehabilitation and installation works	Wearing of PPEs such as hard hats and safety gloves should be strictly implemented. YESB and ESE will prepare and implement a construction health and safety plan as part of the bid documents. Provision of barricades around site where construction and rehabilitation works are to be undertaken.	During rehabilitation works.	Part of rehabilitation cost.	YESB/ESE
Community Health and Safety				
Impacts to community health and safety due to construction traffic, transport of materials, fires, emergency spill of materials, and unauthorized entry	YESB and ESE will ensure community health and safety that incorporates good international practice and recognized standards, emergency response and preparedness procedures. YESB and ESE will	During rehabilitation works.	Part of rehabilitation cost	YESB/ESE

Potential Environmental Impact	Mitigating Measures	Schedule	Estimated Cost (US$)	Responsible Entity
of villagers into working areas.	coordinate with the affected communities and township authorities. Post warning signages at the sites. Provision of security fence on the distribution transformers.			
OPERATION PHASE				
Oil spillages during transfer of oil between containers and transformers causing pollution of the soil and in the long-term ground water pollution.	Maintenance yard space should be concreted and provided with an oil pit. Warn workers to exercise care in handling oil and in avoiding spills.	During transformer oil draining activities.	Part of substation cost	YESB/ESE
Occupational Health and Safety				
Health and safety; injury to workers due to electrocution/ exposure to live power lines, working in heights, risks of accidents, and potential exposure to electric and magnetic fields.	Health and safety plan will be implemented throughout the operation phase. Conduct training/seminar on occupational health and safety Periodic health and safety training and practice drills Restricting access to electrical equipment by workers only trained and certified to work on electrical equipment Provision of PPE for workers, safety measures, personal safety devices, and other precautions	Part of the operations plan.	Operational requirement	YESB/ESE
Working in heights	Testing of structural integrity prior to proceeding with the work	Part of the operations plan.	Operational requirement	YESB/ESE

Potential Environmental Impact	Mitigating Measures	Schedule	Estimated Cost (US$)	Responsible Entity
	Use of fall protection measures			
Community Health and Safety	Provision of safety and danger warning signs on distribution transformers. Conduct orientation seminar on community health and safety programs. Conduct regular inspections of the line to help identify missing or corroded parts.	Part of the operations plan.	Operational requirement	YESB/ESE
Waste Management	PCB-containing equipment are not be procured under this project. Provision of secondary spill containment for fuel storage facilities, areas around maintenance yard. Direct discharges contaminated with oil from spill bunds into oil-water separators. Implementation of approved disposal options for all waste transformer oil, equipment maintenance, residually contaminated soils, and scrap metal.	Part of the operations plan.	Operational requirement	YESB/ESE
Management and Control of Vegetation at Distribution line	Inform locals in advance through the village heads on the schedule of maintenance and trimming works Herbicides and pesticides to control vegetation growth.	Part of the operations plan.	Operational requirement	YESB/ESE

150. **Material Recovery Plan (MRP).** Most of the replaced materials consisting of old distribution lines, substation equipment, wooden poles, and meters can be reused and recycled. A Material Recovery Plan for Replaced Materials will be developed by the PMU with support from PIC. To be identified for each project area, the MRP consists of (i) types and volumes of materials to be replaced, including a detailed inventory of transformers (ii) recyclable and non-

recyclable materials, (iii) current practices of storage, recycling and disposal and, (iv) proposed collection, storage, recovery and disposal measures, (v) list of reputable recycling service providers, and (vi) monitoring and reporting.

B. MONITORING PLAN

151. The actual implementation of the project will be managed by YESB and the ESE in Mandalay, Sagaing, and Magway. These agencies will also be responsible for implementation and monitoring of the EMP and EMoP as well as coordination with local authorities and the affected persons during the rehabilitation and operation of the project.

152. During the operational phase, the township office of the YESB and ESE will be the first contact on the ground directly. These township offices are located in the substation areas and are manned by 2 – 4 persons depending on the scale of the service area. The township offices are also involved in the maintenance and inspection of the distribution line, trimming of trees, and are the first responders in case of emergencies related to line operation.

153. The YESB and ESE will hire the services of consultants to assist the company in monitoring the implementation of the EMP as well as in developing its capacity to implement environmental management measures. The capacity development program will focus on community safety, environmental impact assessment (EIA), EMP implementation, inspection and corrective action, environmental standard operating procedures, proper handling and disposal of wastes, protection of local vegetation and water resources, and avoiding impacts on local population from noise and dust-generating activities during the construction phase.

154. The proposed monitoring plan, duration and schedule and responsible entities to be involved in the monitoring and evaluation is shown in Table 8. The EMoP focuses on implementation of the EMP and compliance monitoring of YESB and ESE .

Table 8: Environmental Monitoring Plan

Parameter	Location	Method of Monitoring	Monitoring Frequency	Responsibility
Rehabilitation/Installation Phase				
Project disclosure – issuance of advisories and notices to the public	Affected areas/ROW	Observation, reporting	Prior to start of rehabilitation activities	YESB/ESE Regional Offices
Provision of transformer containment system (oil/grease pit)	Sites of substation and distribution transformer	Check design, observation, reporting	Pre-installation requirement	YESB/ESE Regional Offices
Provision of materials recovery/temporary materials storage areas	Substation sites and central materials storage area of YESB and ESE	Observation, reporting	Pre-installation requirement	YESB/ESE Regional Offices
Clean-up of sites	Affected areas	Observation,	Weekly and at	YESB/ESE

Parameter	Location	Method of Monitoring	Monitoring Frequency	Responsibility
		reporting	the end of rehabilitation phase	Regional Offices
Air quality	Along ROW	Site inspection and observation	Weekly	YESB/ESE Regional Offices
Soil erosion	Pole foundation sites	Site inspection of excavation works, silt arising from exposed soil surface, condition of erosion control measures	Weekly monitor throughout construction period	YESB/ESE Regional Offices
Damage or nuisance to nearby areas	Along ROW and at substation sites	Monitor and inspect rehabilitation works especially impact to communities, river, and irrigation, drainage canals.	Weekly	YESB/ESE Regional Offices
Improper disposal of solid waste	Workers' camp sites	Inspection of worker camp site condition to check proper solid waste disposal	Weekly	YESB/ESE Regional Offices
Health and safety	Along ROW, construction camp	Review construction worker health and safety plan and training activities on health and safety	At least monthly review of health and safety plan	YESB/ESE Regional Offices
Interference with road transportation infrastructure	Along ROW	Monitoring and inspect road condition and measures used to protect road and ensure public safety	Weekly, continuous throughout line rehabilitation period	YESB/ESE Regional Offices
Dust	Local road and village nearby where trucks pass through and construction sites	Monitor and inspect dust condition in areas that are sprayed with water.	Weekly, continuous throughout line rehabilitation period	YESB/ESE Regional Offices
Noise	Local road and village nearby where trucks pass through as well as at various construction	Observe/monitor noise during delivery of materials Coordinate with villagers	Weekly, continuous throughout line rehabilitation period	YESB/ESE Regional Offices

Parameter	Location	Method of Monitoring	Monitoring Frequency	Responsibility
	sites			
OPERATION PHASE				
Oil spill during oil draining at maintenance yard space	Substation sites	Monitoring oil draining activities. Observe if maintenance yard concreted and provided with an oil pit.	During oil draining activities	YESB/ESE Regional Offices
Trees and vegetation control	Along the ROW	Inspect the status of tree and vegetation growth that may damage or threaten the integrity of the lines.	Weekly	YESB/ESE Regional Offices
Health and safety; injury to workers and villagers	Electric poles	Inspect integrity of the poles and distribution line in order to maintain and ensure good condition Inspect Warning Signs/Boards if placed well on poles	Monthly	YESB/ESE Regional Offices

155. **Reporting.** YESB/ESE will prepare quarterly progress reports on the implementation of the EMP and on the environmental monitoring program. The report shall contain a summary of the environmental effects which have been observed and the project's compliance with the EMP. Recommended adjustments in the project operation, if any, and other observations and recommendations shall form part of the report. Semi-annual monitoring reports are to be submitted to ADB during the rehabilitation phase.

C. INSTITUTIONAL ARRANGEMENTS AND RESPONSIBILITIES

156. The MOEP, YESB and ESE do not have any personnel in-charge of ensuring the environmental soundness of operations. In order to strengthen the capacity of the implementing agencies in the implementation of the EMP and the EMoP, YESB and ESE will each have an Environmental Officer. These Environmental Officers will be trained on environmental impact assessment, implementation of EMP and in environmental monitoring. The following outlines the responsibilities of the environmental officer:

- Ensure the conduct of screening of environmental impacts of proposed project;
- Ensure that the project implementation is in accordance with the requirements of the Union of Myanmar and ADB on environmental management and protection;
- Prepare an environmental management plan of projects to be implemented by YESB;
- Ensure that proper management of materials and wastes is undertaken according to environmentally sound and best available practice;

- Ensure that occupational health and safety practices are observed within YESB facilities;
- Supervise the implementation of the environmental management plan and conduct regular inspections;
- Coordinate with and advise the local stakeholders about project plans and schedule of rehabilitation works particularly for those affected by the project; and
- Submit environmental monitoring reports on a semi-annual basis to MoEP for submission to ADB.

157. In addition, a Project Implementation Consultant (PIC) will be commissioned to assist MoEP in the overall project management.

158. To strengthen the capacity of YESB and the ESE to manage the environmental impacts of its projects and in implementing the EMP and EMoP, training of key personnel on best international environmental practices, implementation of the EMP and EMoP, and on occupational health and safety will be designed.

159. The capacity building and training activities will be delivered prior to the start of the rehabilitation activities and should be followed-up prior to the commissioning of the project.

D. EMP BUDGET

160. The costs for most of the EMP and EMoP measures are part of engineering, rehabilitation, and procurement budget. An amount of USD200,000 is allocated mainly for the implementation of the EMP, including the following:

- Provision of the materials recovery/temporary waste storage area for YESB and the ESE
- Hiring of two (2) environmental officers for YESB and ESE
- Capacity building and training of environmental officers and staff on environmental management, health and safety.

161. The Personal Protective Equipment (PPE) for workers in all the project areas will be purchased under the Tools and Equipment budget. The Project Implementation Consultant (PIC) will conduct training on use of PPEs, occupational health and safety and community health and safety/awareness.

IX. CONCLUSION AND RECOMMENDATION

162. The proposed distribution line project will generate minimal environmental impacts that can be reduced to acceptable levels through the implementation of practical mitigation measures normally associated with internationally accepted good engineering practices.

163. There are no environmentally sensitive areas that will be affected by the proposed project. The vicinity is generally characterized as a populated community and agricultural areas. Any impacts of the project during the rehabilitation phase are temporary and limited to the surrounding area and can be readily mitigated through proper design and implementation. These impacts are primarily due to the generation of decommissioned equipment, poles and other waste materials, hazards to workers and the community, and temporary disturbance from dust, soil runoff, noise, and traffic. These are briefly described below:

(i) The rehabilitation and installation phase of the project will not cause any impacts to natural habitats since the project components will be located along existing distribution line right-of-way (ROW) and within existing substation sites. These areas are already modified because of human settlements and agricultural activities.

(ii) There are no environmentally sensitive areas that will be affected by the proposed project. The vicinity is generally characterized as a populated community within a rural area.

(iii) Soil erosion may potentially occur during the construction of the foundations for the poles. Immediate rehabilitation and covering of exposed ground should be undertaken.

(iv) The rehabilitation activities and movement of construction vehicles along the access roads would contribute to the increase in ground level concentration of dust, noise, deterioration of existing roads, and could also result to accidents and hazards to communities living along the access roads. Notices and advisories to the public should be issued about the project and the proposed activities to be implemented at the affected sites. The YESB and ESE shall be required to rehabilitate any damaged portion of the roads and other structures in the community immediately upon completion of works.

(v) Environmental impacts that may be generated during the rehabilitation of the distribution line are primarily due to the generation of decommissioned equipment, poles and other waste materials, hazards to workers and the community and temporary disturbance from dust, soil runoff, noise and traffic.

(vi) A materials recovery/temporary waste storage facility will be provided by YESB and the ESE of Mandalay, Sagaing, and Magway to properly manage the materials and wastes generated during the decommissioning of equipment and distribution lines. Recyclable materials will be reused for other remote areas to be serviced by YESB and the ESE. Materials that cannot be reused will be handled properly in line with acceptable disposal practices.

(vii) Potential impacts related to community health and safety due to construction traffic, transport of materials, fires, and spills will be mitigated through the development of a Community Health and Safety Plan that may include barricading of construction area, posting of warning signs in the local language, emergency response and preparedness procedures, communication systems and protocols, and arrangement with local health authorities.

(viii) The potential impacts during the operational phase could be due to electrocution, explosion of transformers, and poor management of wastes. These could be prevented through regular inspection and maintenance of facilities and proper warning signages.

164. An EMP has been prepared and will be implemented during all phases of the project cycle. The EMP identifies the environmental mitigating measures as well as the institutional arrangements for its implementation.

165. Based on this assessment, it is concluded that overall, the project will result in significant positive socio-economic benefits, and any potential negative environmental impacts are small-

scale and localized, and can be minimized adequately through good design and implementation of appropriate mitigation measures.

166. It is therefore recommended that the project be supported by ADB, subject to the implementation of the commitments contained in the EMP and allocation of appropriate technical, financial and human resources by MOEP to ensure these commitments are effectively and expediently implemented.

167. This IEE, including the EMP, is considered to be sufficient to meet ADB's environmental safeguards requirements for the project. Therefore, further detailed assessment by way of an environmental impact assessment (EIA) is no longer required.

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APPENDICES

A. Rapid Environmental Assessment Checklist
B. Photographs of consultations and meetings

Appendix A: **Rapid Environmental Assessment (REA) Checklist**

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to Environment and Safeguards Division (RSES) for endorsement by Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title MYA: Power Distribution Improvement Project

Sector Division: SEEN

Screening Questions	Yes	No	Remarks
A. PROJECT SITING IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?		X	
▪ CULTURAL HERITAGE SITE	X		To be confirmed during due diligence
▪ PROTECTED AREA		X	
▪ WETLAND		X	
▪ MANGROVE		X	
▪ ESTUARINE		X	
▪ BUFFER ZONE OF PROTECTED AREA		X	
▪ SPECIAL AREA FOR PROTECTING BIODIVERSITY		X	
B. POTENTIAL ENVIRONMENTAL IMPACTS WILL THE PROJECT CAUSE…			
▪ encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?		X	

Screening Questions	Yes	No	Remarks
▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)?		X	
▪ alteration of surface water hydrology of waterways crossed by roads and resulting in increased sediment in streams affected by increased soil erosion at the construction site?		X	
▪ damage to sensitive coastal/marine habitats by construction of submarine cables?		X	
▪ deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction?		X	
▪ increased local air pollution due to rock crushing, cutting and filling?		X	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		To be confirmed during due diligence.
▪ chemical pollution resulting from chemical clearing of vegetation for construction site?		X	
▪ noise and vibration due to blasting and other civil works?		X	
▪ dislocation or involuntary resettlement of people?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?	X		To be confirmed during due diligence.
▪ hazardous driving conditions where construction interferes with pre-existing roads?	X		To be confirmed during due diligence.

Screening Questions	Yes	No	Remarks
▪ creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?		X	
▪ dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?		X	
▪ environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?		X	
▪ facilitation of access to protected areas in case corridors traverse protected areas?		X	
▪ disturbances (e.g. noise and chemical pollutants) if herbicides are used to control vegetative height?		X	
▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	
▪ social conflicts if workers from other regions or countries are hired?	X		To be confirmed during due diligence.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	X		The Project will ensure through covenants with the Government that any civil works will not have any environmental or health effects and if so, measures are in place to deal with them.
▪ risks to community safety associated with maintenance of lines and related facilities?	X		The Project will ensure through covenants with the Government that any civil works will not have any environmental or health effects and if so, measures are in place to deal with them.
▪ community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?		X	

Screening Questions	Yes	No	Remarks
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., high voltage wires, and transmission towers and lines) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	X		The Project will ensure through covenants with the Government that there is no displacement of people in the project site during the construction/improvement of facilities. Similar covenant will be made to ensure that any civil works will not have any environmental or health effects, and if so, measures are in place to deal with them.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
▪ Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?		X	
▪ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		X	
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		X	

▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		X	

Appendix I: Environments, Hazards and Climate Changes

Environment	Natural Hazards and Climate Change
Arid/Semi-arid and desert environments	Low erratic rainfall of up to 500 mm rainfall per annum with periodic droughts and high rainfall variability. Low vegetative cover. Resilient ecosystems & complex pastoral and systems, but medium certainty that 10–20% of drylands degraded; 10-30% projected decrease in water availability in next 40 years; projected increase in drought duration and severity under climate change. Increased mobilization of sand dunes and other soils as vegetation cover declines; likely overall decrease in agricultural productivity, with rain-fed agriculture yield reduced by 30% or more by 2020. Earthquakes and other geophysical hazards may also occur in these environments.
Humid and sub-humid plains, foothills and hill country	More than 500 mm precipitation/yr. Resilient ecosystems & complex human pastoral and cropping systems. 10-30% projected decrease in water availability in next 40 years; projected increase in droughts, heatwaves and floods; increased erosion of loess-mantled landscapes by wind and water; increased gully erosion; landslides likely on steeper slopes. Likely overall decrease in agricultural productivity & compromised food production from variability, with rain-fed agriculture yield reduced by 30% or more by 2020. Increased incidence of forest and agriculture-based insect infestations. Earthquakes and other geophysical hazards may also occur in these environments.
River valleys/ deltas and estuaries and other low-lying coastal areas	River basins, deltas and estuaries in low-lying areas are vulnerable to riverine floods, storm surges associated with tropical cyclones/typhoons and sea level rise; natural (and human-induced) subsidence resulting from sediment compaction and ground water extraction; liquefaction of soft sediments as result of earthquake ground shaking. Tsunami possible/likely on some coasts. Lowland agri-business and subsistence farming in these regions at significant risk.
Small islands	Small islands generally have land areas of less than 10,000km^2 in area, though Papua New Guinea and Timor with much larger land areas are commonly included in lists of small island developing states. Low-lying islands are especially vulnerable to storm surge, tsunami and sea-level rise and, frequently, coastal erosion, with coral reefs threatened by ocean warming in some areas. Sea level rise is likely to threaten the limited ground water resources. High islands often experience high rainfall intensities, frequent landslides and tectonic environments in which landslides and earthquakes are not uncommon with (occasional) volcanic eruptions. Small islands may have low adaptive capacity and high adaptation costs relative to GDP.
Mountain ecosystems	Accelerated glacial melting, rockfalls/landslides and glacial lake outburst floods, leading to increased debris flows, river bank erosion and floods and more extensive outwash plains and, possibly, more frequent wind erosion in intermontane valleys. Enhanced snow melt and fluctuating stream flows may produce seasonal floods and droughts. Melting of permafrost in some environments. Faunal and floral species migration. Earthquakes, landslides and other geophysical hazards may also occur in these environments.
Volcanic environments	Recently active volcanoes (erupted in last 10,000 years – see www.volcano.si.edu). Often fertile soils with intensive agriculture and landslides on steep slopes. Subject to earthquakes and volcanic eruptions

	including pyroclastic flows and mudflows/lahars and/or gas emissions and occasionally widespread ashfall.

Appendix B: **Photographs of Consultations and Meetings**