Initial Environmental Examination

March 2018

MYA: Power Network Development Project—Distribution Component

Prepared by AF-Consult Switzerland Ltd. for the Electricity Supply Enterprise and the Asian Development Bank.

Client: Asian Development Bank

Project: Proposed Loan Republic of the Union of Myanmar: Power Network Development Project DISTRIBUTION COMPONENT

Document Type: Initial Environmental Examination (DRAFT)

Document number: 50020-002

January 2018

Client
Asian Development Bank
6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines

Consultant
AF-Consult Switzerland Ltd
Täfernstrasse 26
5405 Baden/Dättwil

Document Information

Project	Proposed Loan Republic of the Union of Myanmar: Power Network Development Project DISTRIBUTION COMPONENT
Proposal	Initial Environmental Examination (DRAFT)
Proposal number	50020-002
Department	Transmission & Distribution
Person responsible	Eduard Feser
Telefon	+41 (0) 56 483 15 39
Fax	+41 (0) 56 483 17 99
eMail	Eduard.Feser@afconsult.com
Reference	FES
Document path	G:\Meine Ablage\PPTA Myanmar\Reports\Submission 2017-11-30\Distribution\AFC TA 9179 Distribution 2017-11-30 Draft Report_Initial Environmental Examination.docx

Content

Index of Figures

Index of Tables

List of Abbreviations

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and
DPTSC	Department of Power Transmission and System Control
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
EIA	Environmental impact assessment
EMF	Electromagnetic field
EMoP	Environmental monitoring plan
EMP	Environmental management plan
ERC	Electricity Regulatory Commission
ESE	Electricity Supply Enterprise
FD	Forest Department

GAD	General Administration Department
GRM	Grievance redress mechanism
IEE	Initial Environmental Examination
IEE	Initial Environmental Examination
MIMU	Myanmar Information Management Unit
MOECAF	Ministry of Environmental Conservation and Forestry
MOEE	Ministry of Electricity and Energy
MOEP	Ministry of Electric Power
MONREC	Ministry of Natural Resources and Environmental Conservation
NECCC	National Environmental Conservation Coordination Committee
NEQEG	National Environmental Quality Emissions Guidelines
PCD	Pollution Control Division
PIB	Project Information Booklet
PPE	Personal protective equipment
PPTA	Project Preparatory Technical Assistance
REA	Rapid environmental assessment
SIA	Social impact assessment
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change

CURRENCY EQUIVALENTS

(as of 24 November 2017)

Currency unit	–	Kyat (MMK)
MMK1.00	=	$0.00073
$1.00	=	MMK1364.74

NOTE

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

1 Executive Summary

1.1 Objectives of Study

1. The power sector in Myanmar is faced with insufficient and obsolete transmission and distribution infrastructure to provide adequate electricity supply that will support economic development and reduce poverty. Between 2010 and 2015, the annual electricity consumption grew by 16% and per capita consumption more than doubled from 108 kilowatt-hour (kWH) to 264 kWH.[1] The per capita electricity consumption of the country is considered as the lowest among the ASEAN countries, with only 34% of household electrified.[2] The rural areas have limited access to electricity while the urban centers face power shortages and regular blackouts. The power sector in Myanmar needs significant investment to (i) improve and upgrade the distribution system; (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 Myanmar: Power Network Development Project is a proposed loan from the Asian Development Bank (ADB) by the Ministry of Electricity and Energy (MOEE). ADB approved a project preparatory technical assistance (PPTA) to conduct due diligence that includes environmental and social assessment of the project in accordance with ADB's requirements for project approval.

1.2 Project Scope - Components

3. The Project consists of two components: (i) Transmission Component and (ii) Distribution Component. The transmission component is under the responsibility of the Department of Power Transmission and System Control (DPTSC) while the distribution component is under the responsibility of the Electricity Supply Enterprise (ESE). Both departments are under the MOEE.

4. This Initial Environmental Examination (IEE) is prepared for the distribution component of the Project. The target areas for rehabilitation of the power distribution system are in five project regions/states, namely: (Figure 1)

i. Ayeyarwaddy Region

ii. Bago region

iii. Mon State

iv. Kayin State

v. Rakhine State.

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

[1] Concept Paper. Proposed Loan Republic of the Union of Myanmar: Power Network Development Project. Project Number 50020-002. ADB. September 2016

[2] Country Partnership Strategy. Myanmar 2017-2021. Building the Foundations for Inclusive Growth. ADB. March 2017

i. Upgrading of 66/11kV and 33/11kV substations through extension of existing substations and installation of additional new equipment in six substations;

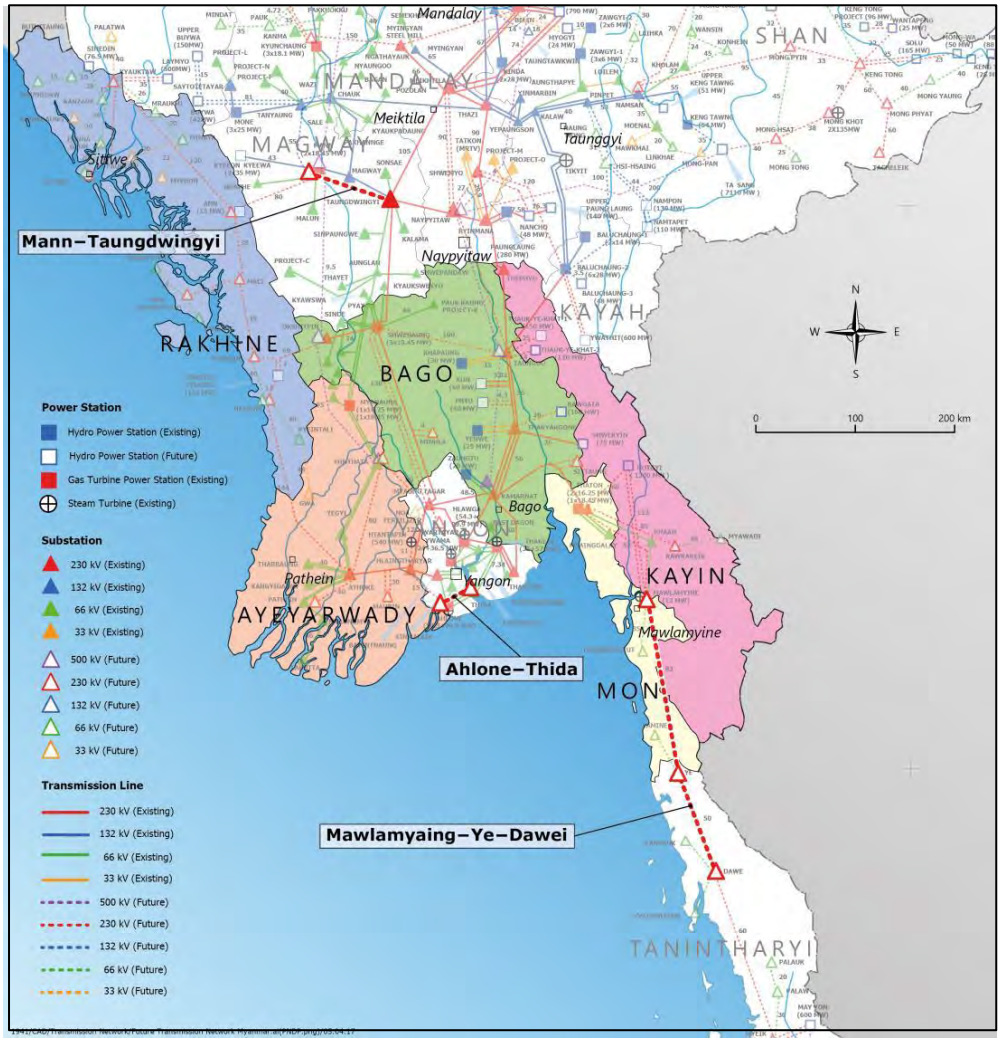
ii. Construction of new 66/11kV and 33/11kV substations in 42 locations;

iii. Extension of 33kV and 66kV transmission lines with a total length of 843.6 kilometers; and

iv. Installation of switchbays within substation areas.

6. The proposed project aims to expand the distribution networks to connect more customers to the electricity grid, particularly in rural areas, help reduce poverty and improve lives of communities by increasing access to electricity, contribute to economic development and promote investments and businesses. Overall, the proposed project targets to improve electricity distribution in 25 towns and 2,232 villages and provide electricity connection to additional 343,788 households.

Figure 1 Project Location



7. The distribution component of the project is classified as Category B for environment based on ADB Safeguard Policy Statement (2009) since there are no components that will traverse environmentally or culturally sensitive areas and that adverse environmental impacts are confined within the project areas and immediate surrounding

areas. The footprint of impact of the substations and transmission lines during construction is small and adverse impacts can be reduced to acceptable levels through the implementation of practical mitigation measures normally associated with internationally accepted good engineering practices. An IEE is prepared in compliance with ADB Safeguard Policy Statement (2009) for Category B projects.

8. The following methodologies and activities were undertaken in the conduct of the environmental assessment and preparation of the IEE:

i. Review of subproject components and locations based on ESE proposed list of subprojects under the Power Network Development Project;

ii. Site visit to subproject sites and areas of influence in Ayeyarwaddy Region, Bago Region, Mon State, Kayin State, and Rakhine State to identify environment and social issues at project locations. Of the total 48 subprojects in the 5 regions/states, 6 subproject sites in Rakhine State were not visited due to unrest and security issues;

iii. Environmental due diligence of existing substations, transmission lines, and central and regional warehouses to assess current operation and waste management practices and to identify corrective actions and measures that will be implemented under the proposed project;

iv. Conduct of public consultation meetings by ESE with the assistance of the PPTA team. Consultations in Rakhine State were postponed upon advice of ADB Project Officer due to security issues;

v. Group discussions and random interviews with stakeholders/villagers, representatives of General Administration Department of townships and local authorities of village/wards to gather information on environmental and social issues at subproject locations;

vi. Meetings with the Environmental Conservation Department (ECD), Pollution Control Division (PCD), and Forest Department (FD) of the Ministry of Natural Resources and Environmental Conservation (MONREC);

vii. Meeting with the Department of Meteorology and Hydrology;

viii. Meetings with the Department of Agriculture and the Department of Agricultural Land Management and Statistics of the Ministry of Agriculture, Livestock and Irrigation;

ix. Screening and assessment of environmental impacts;

x. Discussions with ESE on project impacts, mitigation measures, institutional arrangements, and grievance redress mechanism;

xi. Preparation of the Environmental Management Plan and Environmental Monitoring Plan.

9. The preparation of the IEE is guided by the requirements outlined in ADB Safeguard Policy Statement (2009), Public Communication Policy, and IFC Environmental, Health and Safety Guidelines. The environmental impact assessment was carried out with the objective of: (i) establishing current environmental conditions, (ii) identifying key environmental issues, (iii) assessing the magnitude of impacts, and (iv) developing mitigation measures through an environmental management plan (EMP) for implementation, monitoring and reporting of mitigation and enhancement measures.

1.3 Impacts and Mitigation Measures

1.3.1 Impact Footprints

10. The substations and transmission lines will be built in rural areas and near/within town centers. In general, the sites of the substations and transmission lines are rural/semi-urban environments that are in proximity to community areas to be served with electricity. The new substations will be primarily built within or adjacent to existing substation compound and will require a land area of about 0.6 hectare. The transmission poles will have a height of 12 − 15 meters from the ground and borehole diameter of 18 inches (0.5 meter). The poles will be placed at a depth of approximately 1.8 to 2.5 meters below ground surface. During pole installation, a minimum of distance of 4-meter radius from the pole location will be temporarily disturbed as well as access paths to be used to deliver the poles and other equipment to the installation sites.

1.3.2 Public Consultation

11. A Public Consultation Plan was prepared with the assistance of PPTA consultants that covers the consultation and information disclosure activities to be implemented by the ESE/MOEE. The public consultation and disclosure aims to inform the stakeholders about the proposed project and its objectives and to gather concerns and suggestions from the stakeholders on environmental and social issues related to the implementation of the proposed distribution component. Project Information Booklet (PIB) was prepared for each region/state to provide an overview of the project, the subproject components and location, and the scope of works involved in the implementation of each subproject. The PIB was translated in Burmese language and distributed prior to and during the consultation meetings. Powerpoint presentation was also prepared and shown during the regional/state and township consultation meetings.

12. Three modes of consultation and information disclosure was implemented: (i) small group meetings and random interviews with village/ward stakeholders and township representatives held from 16 August − 13 September 2017, (ii) consultation meetings at the regional/state and township level in Ayeyarwaddy, Bago, Kayin, and Mon held from 30 September − 20 October 2017, and (iii) one-on-one meetings with national Government agencies from 11 − 22 September 2017.

13. The small group meetings and random interviews were undertaken with ward, village and township representatives such as village/ward heads, monks, land owners and farmers who were met during the reconnaissance survey of the subproject sites. Questions on project awareness, perception on the project, land ownership, environmental issues in the project area such as flooding, waste management, and concerns/suggestions/recommendations on project implementation were discussed with the stakeholder/village representatives.

14. Stakeholders invited during the consultation meetings at the regional/state and selected townships are: state, district and township level representatives of the General Administration Department (GAD), Agriculture Department, Forestry Department, Environmental Conservation Department, Land Records Department, village/ward administrators, Parliament representatives, civil society groups, community-based organizations, non-government organizations, women's groups (e.g. Women's Affairs), township elders, and impacted land owners. The relevant national Government agencies in Naypyitaw that were met are the Environment Conservation Department (ECD), Forest Department (FD), and Pollution Control Division (PCD) and Natural Resource nd Environmental Impact Assessment Division (NR-EIA) of the Ministry of Natural Resources

and Environmental Conservation (MONREC), Department of Meteorology and Hydrology of the Ministry of Transport and Communications, and Department of Agriculture and Department of Agricultural Land Management and Statistics of the Ministry of Agriculture, Livestock and Irrigation.

15. In general, the stakeholders welcome the proposed project because of the expected benefits of electrification in the villages and townships. There are even land owners who are willing to donate their land to the Government to help the community get electricity from ESE. The concerns raised by the participants are on the following:

a. There should be fair compensation for affected land and damage to crops.

b. The implementation of the project should be done during the summer season to avoid damage to crops.

c. Safety clearance should be complied with in terms of distance from houses and trees.

d. Community members can be hired during the construction.

e. Cuttings from tree branches should be given to the community for free.

f. Trainings and information materials should be given to households to increase awareness of the community on electrical safety.

g. In case of trees along the line alignment, the ESE should inform the Forest Department prior to implementation so that survey can be conducted first.

h. Areas prone to landslides should be avoided when installing lines.

i. Protection against lightning should be provided in the substations.

1.3.3 Summary of Impacts and Mitigation Measures

16. The key findings of the IEE are summarized below:

i. The project will not cause impacts to natural habitats since the project components will be located in modified habitats characterized as agricultural areas and settlement areas.

ii. Environmental impacts that may be generated during the construction of new and expansion of are primarily due to the generation of old equipment, risks to workers during construction and equipment installation and commissioning, and temporary disturbance from construction activities such as dust, soil runoff, noise and traffic. However, these impacts are not expected to be significant, given the short duration of the construction phase, i.e. 1 − 2 weeks for pole and line installation within a distribution line span of about 600 meters and about 6 months for new substation construction.

iii. There are subprojects which require rehabilitation and upgrading of and lines, thus, will generate wastes such as old equipment and electrical accessories (cables, conductors, switches, etc.). A material management plan will be implemented in coordination with the ESE regional/state warehouses.

iv. The extension of transmission lines will generally take place either parallel to existing roads or in agricultural areas which are already subject to human disturbance. The installation of new equipment and expansion of substations will be either within existing substation compound, properties owned by Government, or in privately owned land. The ESE will coordinate with the land owner and township authorities for new substations and pole locations.

v. During pole installation, agricultural areas, primarily rice paddies, will be affected. The affected area would be about 4-meter radius from the pole area. In addition, temporary access paths to the pole areas will cause damage to rice paddies. To avoid adverse impacts to agricultural crops, the pole and line installation will be undertaken during the dry season when there is no planting being done by farmers. Coordination with the affected farmers, landowners and General Administration Department will be undertaken prior to implementation.

vi. There are areas where there are trees along the proposed transmission line alignment and at new substation areas. The ESE will avoid cutting of large trees to the extent possible. If cutting of large trees cannot be avoided due to technical and safety issues, the ESE will coordinate with the Forest Department with regards to the cutting of trees on Government land and comply with the requirements of the Forestry Law. For trees that will be affected in privately owned land along the transmission line alignment, the ESE will discuss with the land owner about the need to trim or cut the trees to comply with the electrical safety clearance requirements.

vii. There are areas where the transmission lines will be parallel to existing roads. Some roads are narrow roads and construction activities may obstruct passage of vehicles and people because of parking of large trucks. In such cases, the ESE will require the contractor to coordinate with the village/ward heads regarding the schedule of construction activities and the temporary closure of road sections. Traffic signs and notices for public information will also be installed at the affected area. Traffic aides will be assigned to facilitate traffic flow.

viii. Some new substations will require landfilling to elevate the ground level up to the level of existing roads. It is estimated that for one substation, an average of 9,000 cubic meters of soil will be needed to backfill the area. The contractor will be required to gather borrow materials from permitted sources only.

ix. The earthworks will also potentially cause soil runoff into adjacent areas. During construction, the contractor will be required to provide soil erosion control methods such as silt traps. In addition, adequately sized drainage canals leading to the main drainage canals along roads should be included in the design of the substation to avoid runoff into adjacent land.

x. There will be construction camps where materials such as poles, cables, and other accessories will be temporarily stored including office and housing for some workers. The location of the construction camps should be properly coordinated with the local authorities. The construction camps will generate solid wastes and sewage that could cause pollution of soil and water. The contractor will be required to provide sanitation facilities at the construction camp to include adequate clean water supply, sanitation facilities, and solid waste disposal area. Upon completion of construction works, the contractor will be required to rehabilitate any damaged land or structures in the community including the area used as construction camp. In addition, the contractor will be required to implement a construction safety and health plan and provide workers with personal protective equipment (PPE). For electrical works, only trained workers will be hired to avoid accidents such as electrocution. These areas are mostly located in agricultural areas.

xi. The operation phase will involve maintenance and testing of substation equipment and regular inspection of safety clearance of transmission lines and trimming of trees. ESE personnel will continue to use appropriate PPEs and to attend annual safety training. Substations will be provided with adequate fire fighting equipment/extinguishers.

1.3.4 Environmental Compliance Audit of Existing Substations

17. Environmental due diligence of the existing substations at the regions/states in Ayeyarwaddy, Bago, Mon, Kayin and Rakhine was conducted in accordance with the requirements of ADB SPS (2009) to determine existence of any areas which may cause or is causing environmental risks or impacts.

18. Audit findings reveal the following:

i. There were traces of oil spill surrounding transformer areas notably from periodic testing of oil and replenishment of oil.

ii. The existing design of transformer pads in all the substations do not have oil pits that could contain spill in case of breakdown of the transformer.

iii. Lack of hazardous waste management system, i.e for old batteries, damaged equipment. There is a substation in Kanyuktwin where a damaged suspected PCB transformer was found.

iv. Lack of new materials and equipment storage area at substations. The substations have limited area for the control room, office and staff house. A substation in Oktwin temporarily stores new batteries in a makeshift hut which exposes the new batteries to environmental elements.

v. Drainage canals do not drain towards the road canal but to adjacent land or paddy field. There are substations which will require backfilling to elevate the land up to the level of existing substation and road such as in the case of Oktwin and Kanyuktwin substations. Backfilling would result to soil runoff into adjacent paddy fields since the substations do not have drainage canals leading to the road canal.

vi. Lack of appropriate fence and warning signs at substations that could deter animals and unathorized persons from entering the compound. Existing substation

fence typically consists of barbed wire which will not restrict entry of unauthorized persons and animals to the substation compound. A newly built substation in Nga Yoke Kaung has a sturdy fence but it is not high enough to prevent people from going over the fence. Warning signs are also not available that would deter people from entering dangerous electrified areas in the substation.

vii. Lack of personnel protective equipment (PPE) for workers. Substation workers were found to be wearing only bare slippers and no hard hats while roaming around the substation premises. There were also not enough working fire extinguishers.

viii. There is no monitoring of electromagnetic field (EMF).

ix. There are still sulfur hexafluoride (SF_6) circuit breakers with ceramic insulators at the existing substations which are more prone to breaking and explosion and release of SF_6 gas[3].

19. Areas for improvement in the management of the environment, health and safety were observed and will be considered in the design and operation of the proposed ADB-funded project. Details of the environmental due diligence of existing substations is presented in Appendix C.

20. Among the major areas for improvement to incorporate environmental considerations in the design of the substations are:

i. The design of the transformer pad area will include an oil pit to ensure that any leak from the transformer can be collected, thus, avoiding any spill to the ground and the surrounding areas.

ii. Storage area for new materials and spares will be provided at the substation to avoid damage and exposure of new materials and parts to environmental elements. An inventory of spares will be kept at the substation.

iii. Adequately sized drainage canals at the substations will be provided. The drainage canals should drain towards the road canal and not towards adjoining areas and paddy fields.

iv. The substations will be provided with security fence to avoid animals and unauthorized persons from entering the compound. The proposed fence will be galvanized mesh wire, 2.2-meter high, with an outgoing anti-climbing section and with concrete below to prevent animals from entering. In addition, warning signs will be provided to inform the people about dangerous electrified areas in the substation.

v. The technical design of the substations will use SF_6 circuit breakers because of its technical and economical advantages. To minimize damage in case of explosion that would cause the release of SF_6 gas, the project will use SF_6 circuit breakers with insulators made of composite and rubber instead of ceramic insulators.

vi. Non-PCB containing transformers will be installed at the substations.

[3] SF_6 is a potent greenhouse gas that was evaluated by the Intergovernmental Panel on Climate Change (IPCC) with a global warming potential of 23,900 times more than carbon dioxide (CO_2)

vii. Waste segregation areas will be designated at the substation compound for hazardous wastes and damaged materials. The different types of hazardous wastes such as old batteries, damaged meters, capacitors, switches, used oil, and transformers will be placed in the hazardous waste storage area before these are collected by the ESE regional warehouses.

viii. Waste segregation areas for regular solid wastes will be designated inside the substation compound. Biodegradable and non-biodegradable waste bins will be provided with appropriate labels to guide substation staff of the types of wastes that will be disposed in each bin.

ix. Electromagnetic field (EMF) will be regularly monitored at the substations and at the periphery particularly those near residential houses and sensitive receptors.

1.3.5 Environmental Due Diligence of Existing Waste Materials Management

21. The operation and maintenance of the substations and transmission lines generate old equipment such as batteries, meters, capacitors, used oil, and transformers. The capacitors and transformers will last for 30 – 50 years. Batteries would last for five years or more while meters last for about 20 years. The most common type of old equipment temporarily stored at the existing substations are old batteries.

22. Each regional/state ESE has a waste storage warehouse to properly manage the materials and wastes generated during the decommissioning of equipment and transmission lines. The substations also store some old transformers while waiting for transport to the ESE regional/state warehouse for repair by a private company.

23. The current practice of ESE for old transformers is to reuse these in other ESE substations or townships/villages. The old transformers are tested first to check if these can still be reused and those that cannot be reused are temporarily stored at existing substations while waiting for transport to the regional/state ESE warehouses to further check if minor repair works can be undertaken. The minor works include replacement of oil, bushing, and insulation. Transformer manufacturing companies undertake the major repair works.

24. The non-reusable materials and old equipment are still considered as assets of MOEE and are bidded out. Designated areas for materials, old equipment and waste materials storage should be included in the design of the substations. Details of the environmental due diligence of waste materials management is presented in Appendix D.

1.3.6 Institutional Capacity Development

25. Currently, the MOEE and ESE do not have any dedicated staff to handle and supervise environmental management and is not yet ready to establish an Environment and Social (E&S) Unit. The ESE will propose to MOEE for the designation of E&S staff who will serve not only ADB projects but also other projects funded by World Bank, JICa and KFW. The E&S staffing will be composed of an E&S manager and two staff to handle environmental concerns and social issues of the project. The E&S staff will be supported by a staff from each PIU to be assigned as environment and social safeguards focal person, concurrent to existing assignment.

26. To strengthen the capacity of the ESE/PMU, PIUs and the E&S staff in environmental management and monitoring, a capacity development program will be developed and implemented by the PIC. The program will focus on community safety, EMP preparation and implementation, inspection and corrective action, and the proper management of waste materials.

27. An EMP has been developed in this IEE as a guide to the MOEE/ESE in the preparation of EMPs of the various subprojects of the distribution component. The EMP includes: (i) specific mitigation measures formulated to avoid or minimize the adverse impacts of the pre-construction, construction, and operation of the distribution component; (ii) a plan to monitor the implementation of the mitigation measures; (iii) institutional arrangements for EMP implementation, monitoring, and reporting; and (iv) a proposed budget.

28. The subproject EMPs will be prepared with the assistance of the Project Implementation Consultant (PIC) during detailed design and will be included in the tender documents.

29. The EMPs should conform to the requirements of the Myanmar EIA Procedures (2015) and ADB SPS (2009). These EMPs will be submitted to the ECD in securing approval from MONREC.

1.3.7 Grievance Redress Mechanism

30. A Grievance Redress Mechanism is recommended to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project, particularly on environment-related issues during the construction and operational phases of the project. Details of the GRM is presented in Chapter IX.

1.3.8 Conclusion

31. Overall, the improvement of the power distribution grid is expected to contribute positively to the economic development of Myanmar and in particular in the regions/states of Ayeyarwaddy, Bago, Mon, Kayin, and Rakhine. 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.

32. Based on this assessment, it is concluded that overall, the project will result in significant positive socio-economic benefits. The project will not cause significant adverse environment impacts 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. Assuming that the mitigation measures and monitoring requirements in the Environmental Management Plan (EMP) are effectively implemented, the project is not expected to have significant adverse environmental impacts.

33. As part of the requirements of the Environment Conservation Department (ECD) under the Myanmar EIA Procedure (2015), an EMP will be prepared for each transmission line and for each substation. As it is not possible to prepare all the necessary EMPs during project preparation due to limited time and financial resources, the EMPs will be prepared during project implementation by the Project Implementation Consultant (PIC). These EMP reports must be prepared prior to tendering as the EMPs must be included in the bidding documents. An Environmental Management Plan Framework is presented in Appendix F for guidance of ESE and the PIC.

2 Introduction

2.1 Background to IEE

34. The Government of the Republic of the Union of Myanmar through the Ministry of Electricity and Energy (MOEE) has requested the Asian Development Bank (ADB) to provide financial assistance for the Power Network Development Project. A project preparatory technical assistance (PPTA) was approved by ADB to conduct due diligence in accordance with the requirements for project approval by ADB and the Government.

35. The Project consists of two components: (i) transmission component and (ii) distribution component. The transmission component includes the design, supply, installation and commissioning of three 230 kilovolt (kV) transmission lines and related substations. The responsible organization for this component is the Department of Power Transmission and System Control (DPTSC) of the MOEE.

36. The Distribution Component involves the design, supply, installation and commissioning of 66/33kV, 66/11kV, and 33/11kV substations and related transmission lines in five states and regions, namely: (i) Ayeyarwaddy Region, (ii) Bago Region, (iii) Mon State, (iv) Kayin State, and (v) Rakhine State. The responsible entity for the Distribution Component is the Electricity Supply Enterprise (ESE).

37. This Initial Environmental Examination (IEE) is prepared for the Distribution Component of the Project.

2.2 Assessment Context

38. The Distribution Component has been assigned Environment Category B pursuant to the ADB's Safeguard Policy[4] and ADB good practice sourcebook guidance[5]. Appendix A provides the results of the rapid environmental assessment (REA) of the Distribution Component including the initial climate risk and vulnerability assessment. A Category B project will have potential adverse impacts that are less adverse than the impacts of Category A project. The impacts are site-specific, largely reversible, and can be mitigated with the project environmental management plan (EMP)[6].

39. The scope of the Distribution Component is based on the electricity distribution development plan of MOEE and ESE for the five regions/states that presents the list of subprojects, scope of works, and the target number of households to be electrified. From the list of subprojects, the PPTA distribution team conducted the assessment of the technical, engineering, environmental and social issues of each of the subprojects. Of the total 48 subprojects in the five regions/states, 6 subprojects in Rakhine State were not visited due to ongoing unrest and security issues. The summary of the results of the environmental due diligence of the subprojects of the distribution component is presented in Appendix C.

40. In addition to the assessment of the subprojects and its locations, environmental audits of existing substations, transmission lines, and waste materials warehouses were

[4] ADB, 2009. Safeguard Policy Statement, ADB Policy Paper.
[5] ADB, 2012, Environmental Safeguards, A Good Practice Sourcebook.

[6] Footnote 2, pg 19.

also undertaken as part of the environment safeguard due diligence to determine aspects of existing practices and systems that may affect the environmental performance of the proposed project. The report of the environmental compliance audit on existing substations and waste materials warehouses are presented Appendices D and E.

41. Public consultations and key informant interviews were also held to gather views of stakeholders about the proposed project and to identify environment and social-related issues to be considered in the project design. Meetings were held with relevant agencies such as the Environment Conservation Department (ECD), Forest Department (FD), and Pollution Control Division (PCD) of the Ministry of Natural Resources and Environmental Conservation (MONREC), Department of Meteorology and Hydrology and Department of Agriculture and Department of Agricultural Land Management and Statistics of the Ministry of Agriculture, Livestock and Irrigation. Interviews with General Administration Department administrators, township engineers and officers, and representatives of wards were also conducted during the site reconnaissance survey to gather information about environmental and social issues related to locations of substations and transmission lines, established land uses, land ownership, common environmental problems in the community, community concerns, perception about the proposed project, and suggestions/recommendations for project design and implementation. The documentation of the results of the public consultation and key informant interviews are presented in Chapter Vi.

3 Environmental Policy, Legal, and Administrative Framework

42. Myanmar established a regime of policies related to environmental management. The principal legal instruments that presently have bearing on environmental management, health and safety of the Distribution Component of the Myanmar: Power Network Development Project are the Constitution of the Republic of the Union of Myanmar (2008), Environmental Conservation Law and subsequent rules and regulations, and the Electricity Law. There are also environmental policies such as the Myanmar Agenda 21 and National Sustainable Development Strategy that provided recommendations to existing policies, plans and programs of the government on environmental management.

3.1 Framework for Environmental Management in Myanmar

3.1.1 Constitution of the Republic of the Union of Myanmar (2008)

43. Under Section 45 of the Constitution (2008), the Union has proclaimed that it will protect and conserve the natural environment. Chapter 4, Section 96 also stipulates that the national legislature can enact laws on environmental protection and natural resources conservation while the state and division legislatures are given the power to regulate environmental protection within the boundaries of national legislation.

3.1.2 National Environmental Policy

44. The policy, dated 5 December 1994, became the basis for the integration of environmental consideration into social and economic development in Myanmar. It highlights the government's commitment to sustainable development, and stipulates that the state has the responsibility to preserve natural resources in the interest of present and future generations.

3.1.3 Myanmar Agenda 21

45. Following the National Environmental Policy, the Myanmar Agenda 21 was developed in 1997 as the blueprint for natural resources management, environmental conservation work, and pursuit of activities contributing to biodiversity conservation nationwide. The Myanmar Agenda 21 became the framework for a multi-pronged approach to sustainable development. The Agenda 21 resulted to the signing of about 30 international environmental treaties and conventions by Myanmar.

3.1.4 Environmental Conservation Law (2012)

46. The Environmental Conservation Law (ECL), also known as the Pyidaungsu Hluttaw Law No. 9/2012, was issued on 30 March 2012 to facilitate the implementation of the country's National Environmental Policy. The law promotes the basic principles for systematic integration of environmental conservation in a sustainable development process. The law encourages healthy and clean environment, conservation of natural and

cultural heritage, reclamation of degenerated and disappearing ecosystems, management of natural resources for sustainable use, creating public understanding on environmental conservation and protection, international, regional and bilateral cooperation, and collaboration within different government departments and organizations, and with non-government organizations and other stakeholders.

47. The National Environmental Conservation Coordination Committee (NECCC) was formed for effective coordination among stakeholders from various agencies while the Environmental Conservation Department (ECD)[7] was also created to regulate the environmental concerns in the country, including monitoring and development of environmental quality standards.

48. Other policies and strategies are under preparation including the Green Economy Policy Framework, a National Climate Change Strategy and Action Plan, National and City Waste Management Strategies, and a National Framework for Community Disaster Resilience.

3.2 Regulations on Environmental Impact Assessment in Myanmar

3.2.1 Environmental Conservation Law Rules (2014)

49. The ECL Rules was published on 5 June 2014 which includes (i) a proposal for incentive mechanisms, terms, and conditions for green initiatives for sustainable development to mainstream into the development sectors; (ii) establishment of the integrated environmental monitoring system (iii) conduct of environmental impact assessments (EIAs) and social impact assessments (SIAs); (iv) development of environmental quality standards; (v) sustainable management and utilization of natural resources, (vi) waste management; and (vii) establishment of Environmental Management Fund for the implementation of measures to reduce adverse environmental effects including the cost of monitoring various environmental parameters during project implementation.

50. The rules empower the Ministry of Environmental Conservation and Forestry (MOECAF) through Notification No. 50/2014 to regulate business activities that may cause impact on environmental quality. In 2016, MOECAF was reorganized into the Ministry of Natural Resources and Environmental Conservation (MONREC).

3.2.2 Environmental Impact Assessment (EIA) Procedure (2015)

51. The EIA Procedure was issued on 29 December 2015 pursuant to Section 21 of the ECL and Articles 52, 53, and 33 of the ECL Rules. All projects undertaken by government and private companies that cause impacts on environmental quality are required to obtain prior permission from the Environmental Conservation Department (ECD) by undertaking an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) and obtaining an Environmental Compliance Certificate (ECC). A list of projects that are required to secure an ECC are presented in Annex 1 (Categorization of Economic Activities for Assessment Purposes) of the EIA Procedure (2015).

[7] The ECD was previously under the Ministry of Environmental Conservation and Forestry (MOECAF). Following the Government reorganization in 2016, the ECD is now under the Ministry of Natural Resources and Environmental Conservation (MONREC).

52. The impact assessment thresholds for electrical power transmission lines and transformer substations from Annex 1 of the EIA rules are summarized in Table 1. Transmission lines and substations with capacity of 66kV/33kV/11kV are not included in the list in Annex 1 and are therefore not required to undertake an EIA or IEE.

Table 1 Assessment thresholds for electrical power transmission lines and substations based on the Myanmar EIA Procedure (2015)

Type of Economic Activity	Criteria for IEE Type Economic Activities	Criteria for EIA Type Economic Activities
Electrical power transmission lines ≥ 115kV but < 230 kV	≥ 50 km	All activities where the Ministry requires that the Project shall undergo EIA
Electrical power transmission lines ≥ 230 kV	All sizes	All activities where the Ministry requires that the Project shall undergo EIA
High voltage (230 kV and 500 kV) transformer substations	≥ 4 ha	All activities where the Ministry requires that the Project shall undergo EIA

Source: Annex 1 – Categorization of Economic Activities for Assessment Purposes, page 3. EIA Procedures

53. Under Chapter II, Section 5 the EIA Rules, the ECD shall make the determination on whether a project is required to develop an EIA, IEE or an environmental management plan (EMP) after submitting a project proposal for screening to the ECD. Following the preliminary screening and verification of the project proposal, the ECD will make a determination of the type of environmental assessment.

54. An EIA is required in cases where the project will have adverse effects on legally protected areas including: (i) forest conservation area (including biodiversity reserve area); (ii) public forest; (iii) park (including marine parks; (iv) mangrove swamp; (v) any other sensitive coastal area; (vi) wildlife sanctuary; (vii) scientific reserve; (viii) nature reserve; (ix) geophysically significant reserve; (x) any other nature reserve nominated by the Minister; (xi) protected cultural heritage area; and (xii) protected archaeological area or area of historical significance.

55. Projects that could cause adverse environmental or social impacts are subjected to screening for either an IEE or EIA, and ultimately require an ECC from MONREC before being allowed to proceed. The EIA process involves (i) screening, (ii) scoping for EIA, (iii) EIA/IEE preparation and review, (iv) EIA/IEE approval, and (v) appeal. Before an EIA or IEE is prepared, a project proposal together with the profile of the organization and/or persons to undertake the IEE/EIA investigation and reporting must be submitted to the ECD/MONREC in Naypyitaw. The project proposal is screened by ECD using mostly quantitative criteria annexed to the EIA rules to determine whether a project requires an EIA or an IEE.

3.2.3 ECD Screening of the Distribution Component

56. In compliance with the EIA Rules, a Project Proposal was submitted by MOEE to ECD in August 2017 to obtain recommendation from the ECD on the requirements to secure the ECC. The MOEE proposed to prepare an IEE in securing the ECC.

57. A presentation of the Project and anticipated environmental and social impacts was made to ECD on 11 September 2017, wherein, the ECD decided to require the Distribution Component to submit an Environmental Management Plan (EMP) in securing the ECC in view of the relatively minor and manageable impacts that are anticipated from the scope of works of the Distribution Component. The official letter issued by MONREC on 16 October 2017 stipulates the following requirements for the distribution component of the Power Network Development Project:

a) Upgrading of 66kV distribution system – separate EMP for each 66kV substation

b) Construction of 33kV substation – separate EMP for each 33kV substation

c) Construction of 66kV transmission line – EMP

d) Construction of 33kV transmission line - EMP

58. The MOEE seeked further clarification on the requirements of ECD through a meeting held on 24 November 2017 wherein it was discussed that the distribution component will be treated as distribution system which will consist of contiguously located substations and transmission lines together in an EMP.

59. The subproject EMPs will be submitted to ECD in fulfillment of the requirements to seek the approval letter / ECC from MONREC. Under the EIA Procedures, the subproject EMP to be submitted to ECD shall contain the following details:

i. Project Description by project phase

ii. Project's environmental, socio-economic and where relevant, health policies and commitments, legal requirements and institutional arrangements

iii. Summary of impacts and mitigation measures

iv. Overall budget for implementation of the EMP

v. Management and monitoring sub-plans by project phase (pre-construction, construction, operation, decommissioning, closure and post-closure); the management and monitoring sub-plans shall address and satisfy all relevant environmental and social management and monitoring issues such as but not limited to noise, vibration, waste, hazardous waste, wastewater and storm water, air quality, odor, chemicals, water quality, erosion and sedimentation, biodiversity, occupational and community health and safety, cultural heritage, employment and training and emergency response.

vi. Sub-plans containing the following: (i) objectives, (ii) legal requirements; (iii) overview maps and site layout maps, images, aerial photos, satellite images, (iv) implementation schedule, (v) management actions, (vi) monitoring plans, and (vii) projected budgets and responsibilities.

60. Public and stakeholder consultation and disclosure of the project is not required under the EIA Procedure (2015) for projects that are to submit an EMP only.

3.3 Provisions of National Environmental Quality (Emissions) Guidelines (2015) Applicable to the Distribution Component

61. As required in the Environmental Conservation Law, environmental quality guidelines and standards surface water quality, underground water quality, noise and

vibration, emissions, effluent, solid waste, and others are to be established by the Union Government. The government has already established the National Environmental Quality (Emissions) Guidelines (NEQEG) in 2015 that includes guidelines for air emissions, wastewater, noise levels, odor and sector-specific requirements including those for electric power transmission and distribution projects.

3.3.1 Effluent Limits

62. Under Section 2.1.10 of the NEQEG (Electric Power Transmission and Distribution), effluent limits are prescribed. This is presented in Table 2.

Table 2 NEQEG Effluent Limits applicable to electric power transmission and distribution

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	Standard unit	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

Source: NEQEG (2015)

63. During the construction phase, the NEQG also prescribes the standards for site runoff and wastewater discharges. These are presented in Table 3.

Table 3 NEQEG Limits for Site Runoff and Wastewater Discharges (Construction Phase)

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	Standard unit	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

Source: NEQEG (2015)

3.3.2 Electric and Magnetic Fields

64. The NEQEG states that exposure limits for general public to electric and magnetic fields should comply with the International Commission on Non-ionized Radiation Protection Guidelines for limiting general public exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 Gigahertz).

Table 4 NEQEG Exposure Limits to Electric and Magnetic Fields

Frequency	Electric Field (V/m^3)	Magnetic Field (μT)
50 Hz	5000	100
60 Hz	4150	83

Notes: V/m^3 = volts per meter; μT = micro tesla; Hz = Hertz

Source: NEQEG (2015)

3.3.3 Noise Levels

65. The allowable noise levels should not exceed the levels in Table 5 or result to a maximum increase in background noise levels of 3 dB at the nearest receptor location. The standards are aligned with the IFC Environment, Health, and Safety (EHS) guidelines.

Table 5 NEQEG Allowable Noise Levels

Receptor	One hour LAeq (dBA)	
	Daytime 0700-22:00 (10:00 – 22:00 for Public holidays)	Nighttime 22:00 – 07:00 (22:00 – 10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Note: LAeq is the equivalent continuous sound level in decibels

Source: NEQEG (2015)

3.4 Electricity Law (2014)

66. The new Electricity Law (2014) repeals the 1984 Electricity Law and the Electricity Act of 1948 (as amended in 1967). The new law establishes the Electricity Regulatory Commission (ERC) and grants some regulatory responsibilities to the ERC and authorities the then Ministry of Electric Power (MOEP), now MOEE, region and state governments, and leading bodies of self-administered zones and self-administered divisions the power to grant permits to entities to engage in electricity-related works such as generation, transmission, and distribution.

67. Despite the promulgation of the new Electricity Law, the Electricity Rules (1985) is still in effect because the new rules have not yet been issued as of this date. The conduct of environmental and social impact assessments for power generation and

transmission projects is prescribed in the Electricity Rules (1985) to minimize negative impacts.

68. Specific provisions of the Electricity Rules (1985) that are related to environment, health and safety are with regards to the safety clearances. The required clearance from the ground for 66kV and 33kV lines are shown in Table 6.

Table 6 Transmission Line Minimum Safety Clearance based on Electricity Rules (1985)

Location	33kV	66kV
Paddy field	18 ft (5.49 m)	19 ft (5.79 m)
Parallel to road	20 ft (6.10 m)	22 ft (6.70 m)
Passing through a road	20 ft (6.10 m)	22 ft (6.70 m)
Building		
Horizontal clearance	12 ft (3.66 m)	13 ft (3.96 m)
Vertical clearance	10 ft (3.05 m)	15 ft (4.57 m)
Passing through a railway	24 ft (7.32 m)	24 ft (7.32 m)

Source: Electricity Rules (1985)

3.5 Other Related Environmental Regulations

69. Other laws and regulations related to environmental management and protection in Myanmar are presented in Table 7.

Table 7 Other Related Environmental Laws and Regulations in Myanmar

Laws and Regulations	Description
Forest Law, 1992	The 1992 Forest Law is the fundamental law for the forestry sector. It highlights forest protection, environmental and biodiversity conservation and extended set-up of the permanent forest estates and protected areas system (PAS). The 1992 Forest Law is supported by the Forest Rules 1995 and Forest Policy 1995.
National Environmental Policy, 1994	The 1994 National Environmental Policy became the basis for the integration of environmental consideration into social and economic development in Myanmar. The National Environmental Policy (1994) proclaims the Government's commitment to the principle of sustainable development. It also highlights the integration of environmental considerations into the development process to enhance the quality of life of all its citizens. The State has the responsibility to preserve its

Laws and Regulations	Description
	natural resources in the interest of present and future generations and that environmental protection should always be the primary objective in seeking development.
Protection and Wildlife and Conservation of Natural Areas Law, 1994	The law mandates the protection of wild flora and fauna and their habitats and representative ecosystems within Myanmar. The law highlights habitat maintenance and restoration, protection of endangered and rare species of both flora and fauna, establishment of new parks and protected areas, and buffer zone management. A list of protected species was developed in 1996 to provide various levels of protection to wild plants and animals according to their designation.
Protection and Preservation of Cultural Heritage Regions Law, 1998	The law was signed on September 10, 1998 to implement the protection and preservation policy with respect to perpetuation of cultural heritage that has existed for many years. The law prescribes that protection and preservation of cultural heritage regions should be in conformity with the International Convention approved by the State.
Conservation of Water Resources and Rivers Law, 2006	The law was enacted in 2006 to conserve and protect water resources and river systems for the beneficial use of the public. It also aims to protect the environment against abusive use and exploitation of water resources. The law strictly prohibits disposal of engine oil, chemical, poisonous material, and other materials which that may cause environmental damage.

3.6 International Environmental Conventions and Agreements

70. Myanmar is signatory to international agreements and protocols on environment, social, safety and occupational issues. The list of these international agreements is presented in Table 8.

Table 8 Myanmar's International Agreements on Environmental Management

International Convention	Cabinet Approval
United Nations Framework Convention on Climate Change, New York, 1992 (UNFCCC)	No. 41/94 (09/11/1994)
Convention on Biological Diversity, Rio de Janeiro, 1992	No. 41/94 (09/11/1994)
International Tropical Timber Agreement (ITTA), Geneva, 1994	-
Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985	No. 46/93
Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987	No. 46/93

International Convention	Cabinet Approval
London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990	No. 46/93
The Convention for the Protection of the World Culture and Natural Heritage, Paris, 1972	No. 6/94
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and / or Desertification, Particularly in Africa, Paris, 1994 (UNCCD)	No. 40/96 (4-12-96)
Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, D.C., 1973; and this convention as amended in Bonn, Germany,1979 (CITES)	No. 17/97 (30-4-97)
ASEAN Agreement on the Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	-
Cartagena Protocol on Biosafety, Cartagena, 2000	No. 13/2001 (22-03-2001)
ASEAN Agreement on Transboundary Haze Pollution	No. 7/2003 (27-02-2003)
Kyoto Protocol to the Convention on Climate Change, Kyoto, 1997	No. 26/2003 (16-07-2003)
Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	No. 14/2004 (01-04-2004)

3.7 ADB Safeguard Policy Statement

71. In 2005, the ADB initiated a review process of its three safeguard policies on environment, involuntary resettlement and indigenous peoples. Following a four-year review process, the 2009 Safeguard Policy Statement (SPS) was issued in July 2009 and which became effective in January 2010. The 2009 SPS replaces the previous separate policies, namely, Policy on Indigenous People (1998), Involuntary Resettlement Policy (1995), and the Environment Policy (2002).

72. The Environmental Safeguard Requirements 1 (SR1) of the SPS outlines the requirements that borrowers/clients have to meet. These requirements include assessing impacts, planning and managing impact mitigations, preparing environmental assessment reports, disclosing information and undertaking stakeholder consultations, establishing a grievance redress mechanism, and monitoring and reporting. It also includes specific environmental safeguard requirements pertaining to biodiversity conservation and sustainable management of natural resources, pollution prevention and abatement, occupational and community health and safety, and conservation of physical cultural resources.

3.7.1 Project screening and classification

73. The ADB SPS (para. 50) stipulates that the ADB will undertake project screening as early as possible to i) determine the significance of adverse impacts; ii) identify the level of assessment and institutional resources required; and iii) determine disclosure requirements.

74. The category of the proposed project is determined by screening using the ADB's sector-specific Rapid Environmental Assessment (REA) checklist. ADB assigns a proposed project to one of the following categories:

i. Category A – if a proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) including an environmental management plan (EMP) is required.

ii. Category B – if a proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP is required.

iii. Category C – if a proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.

iv. Category FI – is assigned to projects that involve investment of ADB funds to or through a financial intermediary.

3.7.2 Environmental Assessment

75. An environmental assessment is required by ADB for a project to identify potential direct, indirect, cumulative and induced impacts and risks to physical, biological, socio-economic (including impacts on livelihood, health and safety, vulnerable groups and gender issues) and physical cultural resources. Included in the environmental assessment is the examination of alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and the development of environmental management plan (EMP) and environmental monitoring plan (EMoP) in accordance to ADB SPS Principles 3 and 4 (environment).

3.7.3 Public Consultation and Information Disclosure

76. In line with the ADB's Public Communications Policy, ADB also requires public disclosure for Category A and B projects. For Category A, there should be at least two consultations, once during the early stages of the EIA and once when the draft EIA is available prior to ADB loan appraisal. For Category B, the draft IEE report should be available to interested stakeholders before project approval and should be posted on the ADB's website upon Board approval of a project.

3.7.4 Grievance Redress Mechanism

77. The ADB SPS requires the borrower/client to set up and maintain a grievance redress mechanism (GRM) at project level (para 59). The GRM is intended to establish a system of receiving and resolving grievances or complaints at the local level. Affected people can also take complaints to the ADB's Accountability Mechanism.

3.7.5 Monitoring and Reporting

78. The monitoring obligations are required to be "commensurate with the project's risks and impacts". For highly complex and sensitive projects, the ADB requires the borrower/client to "engage an independent advisory panel" (SPS, para. 57). The minimum requirements are semi-annual reports during construction for Category B projects, and quarterly monitoring reports during construction for Category A projects. For pro-

jects with likely ongoing impacts during operation, annual monitoring is required. Monitoring reports must be posted in a location accessible to the public (SPS, Appendix 1, paras. 21 & 22).

3.8 Comparison of Government of Myanmar Laws and Regulations with ADB Safeguard Policies

79. Based on the preceding sections, there are some differences between existing laws and government practices and ADB's policies relative to addressing environmental impacts. The differences lie mainly on the fact that the implementation of existing national laws and government practices are relatively new or are still lacking. Some of the rules are still being drafted by the Government.

80. Table 9 highlights the key areas of environmental management where major gaps exist between national laws and practices of Myanmar, on one hand, and the ADB policies, on the other hand.

Table 9 Gap Matrix on Environment Safeguards

ADB Policy Principle	GOM National Laws & Regulations	Project Policy
Principle 1: Project screening and classification	Chapter III of the EIA Procedure outlines the screening process of a project. The list of projects is presented in Annex 1 – Categorization of Economic Activities for Assessment Purposes of the EIA Procedure.	The Project has undergone screening by ECD in compliance with the EIA Rules. The Distribution Component is being required by ECD to submit site specific EMP of the distribution systems.
Principle 2: Environmental assessment	Section 21 of the ECL and Articles 52, 53, and 55 of the ECL Rules prescribe the conduct of environmental assessments for projects which may cause impact on environmental quality by undertaking an IEE or EIA or developing an EMP and obtaining an ECC in accordance with the EIA Procedures.	The MOEE proposed to ECD the preparation and submission of an IEE. Despite ECD's decision to require an EMP only for the Distribution Component, MOEE recognizes the need to conduct an assessment of the environmental impacts through an IEE.
Principle 3: Examination of alternatives	Analysis of project alternatives and determination of appropriate measures are included in the requirements of the EIA Procedure. The analysis includes a comparison of adverse impacts, required mitigation, and residual impacts of the alternatives.	Alternatives were examined to consider subproject viability based on technical, environmental and social due diligence. Issues raised by stakeholders were also considered.
Principle 4: Develop EMP and EMoP	An EMP and monitoring plans by project phase are required by the MONREC for all types of projects under the EIA Procedure.	The EMP outlines a summary of impacts and proposed mitigation measures. An environmental monitoring plan is also included in the IEE.

ADB Policy Principle	GOM National Laws & Regulations	Project Policy
Principle 5: Public consultation and grievance redress mechanism	Articles 34, 50, and 61 of the ECL Rules require the conduct of public consultations. The EIA Procedures require consultations for EIA-type and IEE-type projects. Public consultations are not required for EMP-type projects. The establishment of GRM is not in the ECL Rules and EIA Procedure but states the right of any person to appeal the decision to reject or approve an EIA report.	Public consultations and key informant interviews were conducted to gather views of the community about the project. A grievance redress mechanism is also designed to address complaints that may be raised by the public during project implementation.
Principle 6: Disclosure of environmental assessment and EMP	The disclosure of the EIA/IEE is required by Articles 34, 50, and 61 of the ECL Rules. There is no requirement for disclosure of EMP-type projects.	The IEE will be disclosed at ADB website and at MOEE website.
Principle 7: Implementation and monitoring EMP	Chapter IX of the EIA Procedure requires the continuous, proactive and comprehensive self-monitoring of the project and activities include the ECC and the EMP. Monitoring reports are to be submitted every six months to the ECD, or periodically as prescribed by the Ministry.	The EMP will be monitored during project implementation. An EMoP has been designed for the Distribution Component.
Principle 8: Avoid activities in critical habitats	The GOM's policy on protection of wildlife and wild plants and conservation of natural areas are embodied in the 1994 Protection of Wildlife Law as well as in the National Forest Policy (1995). The EIA Procedure also provides stringent requirements for projects/activities with adverse effects on protected and conservation areas.	MOEE adopts the precautionary approach when identifying locations of project components. The works for the distribution component are located in semi-urban/rural areas which are near settlement areas to be electrified. These areas are not critical habitats or environmentally sensitive areas.
Principle 9: Pollution prevention and control	Section 11 of the ECL (2012), the ECL Rules and the EIA Procedure apply the principles of pollution prevention and control and the adoption of international good practices. Environmental standards for emissions, effluents, and noise are prescribed in NEQG (2016). However, there are still no GOM standards for solid waste and hazardous waste management.	Existing substations are not provided with oil pits in transformer areas. In recognition of the potential for oil spill, the transformer pads will be provided with oil pits in the new substations.
Principle 10: Occupational and community health and safety	Thematic sub-plans that address occupational and community health and safety are required under the EIA Procedure. Safety clearances of transmission lines are prescribed in the Electricity Rules (1985).	MOEE/ESE shall comply with the safety clearance to ensure community safety. MOEE/ESE staff participates in regular safety training. The communities are also made aware of hazards of transmission lines through leaflets that are provided to

ADB Policy Principle	GOM National Laws & Regulations	Project Policy
		customers during line connection. Contractors will also be required to implement health and safety guidelines during project construction.
Principle 11: Conservation of physical cultural resources	Chapter II of the Protection and Preservation of Cultural Heritage Regions Law (1998) prescribes the policy for the protection of cultural heritage. This is further reiterated in Articles 48 and 49 of the ECL Rules (2014).	During identification of pole locations, physical cultural resources such as temples, pagodas, mosques and other similar heritage sites will be avoided. A chance find procedure of archaeological artifacts will be developed and coordinated with the Department of Archaeology.

4 Project Description

81. Myanmar has the lowest electrification rate in Southeast Asia,[8] despite ample energy resources in the country. Just over one third of households in the country are connected to the national grid. It is also the country with the lowest per capita electricity consumption in Southeast Asia. The domestic electricity supply has suffered from inadequate investment, with an outdated energy generation and transmission infrastructure, and an incomplete national grid.

82. The distribution component includes the upgrade, design, supply, installation and commissioning of 66/33 kV, 66/11 kV, and 33/11 kV substations and the installation of related transmission lines in five states and regions which are prioritized as areas in dire need of rehabilitation and upgrading of distribution systems. The following are the target areas of the power network distribution system (Figure 1):

i. Ayeyarwaddy Region: 10 townships consisting of (i) Nga Yoke Kaung, (ii) Laymyatnar, (iii) Ingapu (Htoo Kyi), (iv) Myanaung (Innpin), (v) Dedaye, (vi) Maubin, (vii) Pyarpon (2 subprojects), (viii) Bogale (2 subprojects), (ix) Zalun, and (x) Danubyu.

ii. Bago Region: 12 townships in Bago Region consisting of 6 townships in Bago (East): (i) Ngaunglebin (Pyontazar), (ii) Kyauktaga (Taw Kywe Inn), (iii) Phyu (Kanyuktwin), (iv) Oktwin, (v) Yedashe (Swar), and (vi) Kawa and 6 townships in Bago (West): (i) Thegon, (ii) Pateegon, (iii) Paungde, (iv) Monyo, (v) Innma, and (vi) Hmattaing.

iii. Mon State: 5 townships consisting of (i) Thanbyuzayat, (ii) Bilin (2 subprojects), (iii) Kyaikhto, (iv) Paung, and (v) Mawlamyine.

iv. Kayin State: 7 townships consisting of (i) Hpa-An (3 subprojects), (ii) Paingkyon, (iii) Hpapon, (iv) Zarthapyin, (v) Kyainsekgyi, (vi) Kan Ma Maung, and (vii) Kataingti.

v. Rakhine State[9]: 7 townships consisting of (i) Gwa, (ii) Kyauk Taw, (iii) Thandwe (2 subprojects), (iv) Ponnagyun, (v) Ramree (2 subprojects), (vi) Minpya, and (vii) Mrauk U.

83. There will be 48 subprojects which are located in 41 townships that will be upgraded and/or expanded. The scope of the distribution component includes:

i. Upgrading of existing 66/11kV and 33/11kV substations through extension of existing substations and installation of additional new equipment in six substations

ii. Construction of new 66/11kV and 33/11kV substations in 42 locations

iii. Extension of 33kV and 66kV transmission lines with a total length of 843.6 kilometers

iv. Installation of switchbays within substation areas.

84. Details are outlined in Table 10.

[8] Myanmar Energy Master Plan. Government of Myanmar. 2016 Naypyitaw

[9] Due to ongoing conflict in certain areas in Rakhine State, the technical assessment and due diligence were only carried out in the zones considered safe to access by the authorities. Due diligence was undertaken in subprojects in Gwa, Ponnagyun, Ramree, and Thandwe.

Table 10 Scope of Distribution Component

Region / State Township	Scope of Work
Ayeyarwaddy Region 1. Nga Yoke Kaung 2. Laymyatnar 3. Ingapu (Htoo Kyi) 4. Myanaung (Ingpin) 5. Dedaye 6. Maubin 7. Pyarpon 8. Bogale 9. Zalun 10. Danubyu	1.1 New construction of 33/11 kV 10 MVA substation at Nga Yoke Kaung 66/33/11kV 10 MVA substation 1.2 New construction of 66 kV Transmission line 15 miles single circuit from Hinthada 66 kV substation to Laymyatnar Township and 66/11 kV 5 MVA new substation at Laymyatnar Township 1.3 New construction of 66 kV Transmission line 0.5 miles double circuit from Myanaung - Hinthada 66 kV line to HtooKyi (Ingapu) and 66/11 kV 5 MVA new substation at HtooKyi (Ingapu) 1.4 New construction of 66 kV Transmission line 0.1 miles double circuit from Myanaung - Hinthada 66 kV line to Inpin village (Myanaung) and 66/11 kV 5 MVA new substation at Inpin village (Myanaung) 1.5 New construction of 66 kV Transmission line 15 miles single circuit from Kyaiklat 230 kV substation to Dedaye and 66/11 kV 10 MVA substation at Dedaye Township 1.6 New construction of 33 kV Transmission line 9 miles single circuit from Maubin 33/11 kV substation to Yelwe village, 33/11 kV 5 MVA new substation at Yelwe (Maubin) and 2 sets of 33kV outgoing switch bays at Maubin substation 1.7 New construction of 66/33 kV 10 MVA substation at Pyarpon Township 1.8 New construction of 66/33 kV 10 MVA substation at Bogale Township 1.9 New construction of 66 kV Transmission line 15 miles single circuit from Kyaiklat 230 kV Main substation to Pyarpon and 66/11 kV 20 MVA new substation at Pyarpon Township 1.10 New construction of 66 kV Transmission line 21 miles single circuit from Pyarpon 66/11 kV substation to Bogale Township and 66/11 kV 10 MVA new substation at Bogale Township 1.11 New construction of 66 kV Transmission line 13.5 miles single circuit from Yekyi - Hinthadaline line to Zalun Township and 66/11 kV 5 MVA new substation at Nyaungpin market (Zalun) 1.12 New construction of 66 kV Transmission line 16 miles single circuit from Zulun substation to Danubyu and 66/11 kV 10 MVA new substation at Danubyu
Bago Region (East) 1. Ngayunglebin (Pyontazar) 2. Kyauktaga (Taw Kywe Inn) 3. Phyu (Kanyutkwin) 4. Oktwin 5. Yedashe (Swar) 6. Kawa	2.1 New construction of 33 kV Transmission line 2 miles double circuit from from existing Nyaunglaypin - Daik U 33 kV line to Pyontazar, 33/11 kV 10 MVA new substation at Pyontazar 2.2 New construction of 33 kV Transmission line 5.1 miles single circuit from Penewgone - Kannyutkwin 33 kV line to Taw Kywe Inn, 33/11 kV 10 MVA new substation at Taw Kywe Inn (Kyauk Ta Khar) 2.3 Upgrading 33/11 kV 5 MVA Present substation to 33/11 kV 10 MVA substation at Kanyutkwin 2.4 Upgrading 33/11 kV 3 MVA Present substation to 33/11 kV 10 MVA substation at Oktwin

Region/State Township	Scope of Work
	2.5 New construction of 33 kV Transmission line 3.9 miles single circuit from Thargaya substation to Swar Township (near graveyard),33 kV line 0.55 miles double circuit from near graveyard to Swar township office, 33/11 kV 10 MVA new substation at Swar township office and 2 sets of 33 kV outgoing switch bays at Thargaya substation 2.6 Upgrading 33/11 kV 3 MVA Present substation to 33/11 kV 10 MVA substation at Kawa
Bago Region (West) 1. Thegon 2. Pateegon 3. Paungde 4. Monyo (Hteintaw) 5. Innma 6. Hmattaing	3.1 Upgrading 33/11 kV 3 MVA Present substation to 33/11 kV 10 MVA substation at Thegon and new construction of 33 kV Transmission line 0.5 miles double circuit from Pyay-Paungde line 3.2 Upgrading 33/11 kV 1.25x2 MVA Present substation to 33/11 kV 10 MVA substation at Pateegon and new construction of 33kV Transmission line 0.8 miles double circuit from Pyay-Paungde 33 kV line 3.3 New construction of 66 kV Transmission line 30 miles single circuit from 230/66 kV Shwedaung Gas Turbine to existing 33/11 kV Paungde substation and 66/33 kV 20 MVA new substation at Paungde substation 3.4 New construction of 33 kV Transmission line 15 miles single circuit from Monyo 33/11 kV substation to Hteintaw (Monyo), 33/11 kV 10 MVA new substation at Hteintaw (Monyo) and 2 sets of 33kV switch bays at Monyo substation 3.5 New construction of 33 kV Transmission line 12 miles single circuit from Paungde substation to Innma and 33/11 kV 10 MVA new substation at Innma Township 3.6 New construction of 33 kV Transmission line 8 miles single circuit from Paungde substation to Hmattaing township office and 33/11 kV 10 MVA new substation at Hmattaing (Paungde)
Mon State 1. Thanbyuzayat (Wekame) 2. Bilin 3. Bilin 4. Kyaikhto 5. Paung 6. Mawlamyine	4.1 New construction of 33 kV Transmission line 19 miles single circuit from Thanbyuzayat 66/33 kV substation to Wekame village and 33/11 kV 10 MVA new substation at Wekame (Thanbyuzayat) 4.2 New construction of 66 kV Transmission line 40 miles single circuit from 230 kV Thahton substation to Bilin and 66/33 kV 20 MVA new substation at Bilin 4.3 New construction of 33 kV Transmission line 12.5 miles single circuit from Bilin 33/11 kV Office substation to Melan village, 33/11 kV 5 MVA new substation at Melan (Bilin) and 2 sets of 33 kV outgoing switch bay at Bilin township office substation 4.4 New construction of 33 kV Transmission line 6 miles single circuit from Kyaikhto (Saungnainggyi) 33/11 kV substation to Kim Pun Sakham and 33/11 kV 10 MVA new substation at Kyaikhto Township 4.5 New construction of 33 kV Transmission line 0.14 miles double circuit from existing Thahton - Paung 33kV line to Pankone village, 33/11 kV 10 MVA new substation at Pankone (Paung) 4.6 Upgrading Nantay 66/11 kV 10 MVA Present substation to 66/11 kV 20 MVA substation at Nantay (Mawlamyine)
Kayin State 1. Hpa-An	5.1 New construction of 66 kV Transmission line 0.5 miles double circuit from Thaton – Warboetaw -

Region / State Township	Scope of Work
2. Hpa-An 3. Paingkyon 4. Hpapon 5. Hpa-An 6. Zarthapyin 7. Kyainseikgyi 8. Kan Ma Maung 9. Kataingti	Kanmamaung 66 kV line to Nyaung Gone and 66/11 kV 10 MVA new substation at Nyaung Gone (Hpa-An) 5.2 New construction of 66 kV Transmissionlline 0.5 miles double circuit from Thaton - Warboetaw - Kanmamaung 66 kV line to Warboetaw (Hpa-An) and 66/11 kV 5 MVA new substation at Warboetaw (Hpa-An) 5.3 New construction of 33 kV Transmission line 11 miles single circuit from Paingkyon 33/11kV substation to Paung village and 33/11 kV 5 MVA new substation at Paung village (Paingkyon) 5.4 New construction of 33 kV Transmission 34 miles single circuit from Kataingti 66/33kV substation to Hpapon and 33/11 kV 10 MVA new substation at Hpapon township 5.5 New construction of 66 kV Transmission line 12 miles single circuit from Hpa-An (Hpa Yar Kone substation) to Eaindu, 66/11 kV 5 MVA new substation at Eaindu (Hpa-An) and 1 set of 66kV outgoing switch bays at Hpa Yar Kone substation 5.6 New construction of 66 kV Transmission line 0.3 miles double circuit from Mawlamyine - Payargoneline 66 kV line to Zarthapyin and 66/11 kV 5 MVA new substation at Zarthapyin 5.7 New construction of 66 kV Transmission line 41 miles single circuit from Mudon substation to Kyainseikgyi and 66/11 kV 10 MVA new substation at Kyainseikgyi 5.8 New construction of 66 kV Transmission line 35 miles single circuit from Thaton GT Factory to Warboetaw - Kanmamaung 66 kV line and 66/11 kV 5 MVA new substation at Kanmamaung 5.9 New construction of 66 kV Transmission line 23 miles single circuit from Kanmamaung to Kataingti and 66/33 kV 10 MVA new substation at Kataingti (Kanmamaung)
Rakhine State 1. Gwa (Kyain Ta Li) 2. Kyauk Taw (Apauk We) 3. Thandwe (Shew Hlay and Thanbyugyaing) 4. Ponnagyun (Yoetayoak) 5. Ramree (Kyauk Ni Maw and Aung Hla Pyin) 6. Minpya (Kyauk Khoke) 7. Mrauk U (Teinnyo)	6.1 New construction of 66 kV Transmission line 42.8 miles single circuit from Thandwe to Kyein Ta Li and 66/11 kV 5 MVA new substation at Kyain Ta Li (Gwa) 6.2 New construction of 66 kV Transmission line 0.5 miles double circuit from Ponnagyun - Kyauk Taw 66 kV line to ApaukWavillage, 66/11 kV 5 MVA new substation at ApaukWa (Kyauk Taw) and 1 set of 66kV outgoing switch bays at Ponnagyun substation 6.3 New construction of 66 kV Transmission line 1.2 miles double circuit from Taungkote - Thandwe 66 kV line to ShewHlay village and 66/11 kV 5 MVA new substation at ShewHlay (Thandwe) 6.4 New construction of 66 kV Transmission line 0.7 miles double circuit from Ponnagyun - Kyauktaw 66 kV line to Yoetayoak village and 66/11 kV 5 MVA new substation at Yoetayoak (Ponnagyun) 6.5 New construction of 66 kV Transmission line 25.2 miles single circuit from Ramree 66kV substation to Kyauk Ni Maw village, 66/11 kV 5 MVA new substation at Kyauk Ni Maw (Ramree) and 1 set of 66kV outgoing switch bays at Ramree substation 6.6 New construction of 66 kV Transmission line 13.2 miles single circuit from Ramree substation to Aunghlapyin

Region/State Township	Scope of Work
	village, 66/11 kV 5 MVA new substation at Aunghlapyin (Ramree) and 1 set of 66kV outgoing switch bays at Ramree substation 6.7 New construction of 33 kV Transmission line 0.5 miles double circuit from Minpya - Myaypone 33 kV line to Kyauk Khoke village and 33/11 kV 5 MVA new substation at Kyauk Khoke (Minpya) 6.8 New construction of 66 kV Transmission line 12 miles single circuit from Mrauk U substation to Teinnyo village, 66/11 kV 5 MVA new substation at Teinnyo (Mrauk U) and 1 set of 66kV outgoing switch bays at Mrauk U substation 6.9 New construction of 66 kV Transmission line 10 miles single circuit from Kyaukgyi substation to Thabyuchaing village, 66/11 kV 5 MVA new substation at Thabyuchaing (Thandwe) and 1 set of 66 kV outgoing switch bays at Kyaukgyi substation

Source: ESE

Table 11 Length of the Transmission Lines per Region/State

Region/State	Total Length (km)	66 kV circuit (km)		33 kV circuit (km)	
		Single	Double	Single	Double
Ayeyarwady Region	169.2	153.73	0.97	14.5	-
Bago Region					
- Bago East	18.6	-	-	14.5	4.10
- Bago West	106.7	48.3	-	56.31	2.09
Mon State	125.0	64.4	-	60.38	0.23
Kayin State	253.3	180.8	1.29	71.21	-
Rakhine State	170.8	166.14	3.86	-	0.8
Total Length	843.6	613.73	6.12	216.9	7.22

Source: ESE

Table 12 Summary of Substation Works per Region/State

Region/ State	New Construction of substation[(a)]			Upgrade of existing substation[(b)]		Additional switchbays[(c)]	
	66/ 33kV	66/ 11kV	33/ 11kV	66/ 11kV	33/ 11kV	66 kV	33 kV
Ayeyarwady Region	2	8	2	-	-	1	2
Bago Region							

Region / State	New Construction of substation[a]			Upgrade of existing substation[b]		Additional switchbays[c]	
	66/ 33kV	66/ 11kV	33/ 11kV	66/ 11kV	33/ 11kV	66 kV	33 kV
- Bago East	-	-	3	-	3	-	6
- Bago West	1	-	3	-	2	-	2
Mon State	1	-	4	1	-	1	4
Kayin State	1	6	2	-	-	1	-
Rakhine State	-	8	1	-	-	5	-
Total	5	22	15	1	5	8	14

Note: [a] involves the construction of new substation and installation of new additional equipment

[b] involves the installation of new equipment in existing substation

[c] involves the installation of switchbays as component of the substation and distribution system

4.1 Impact Footprints

85. The substations and transmission lines will be built in rural areas and near town centers. In general, the sites of the substations and transmission lines are rural/semi-urban environments that are in proximity to settlement areas to be served with electricity.

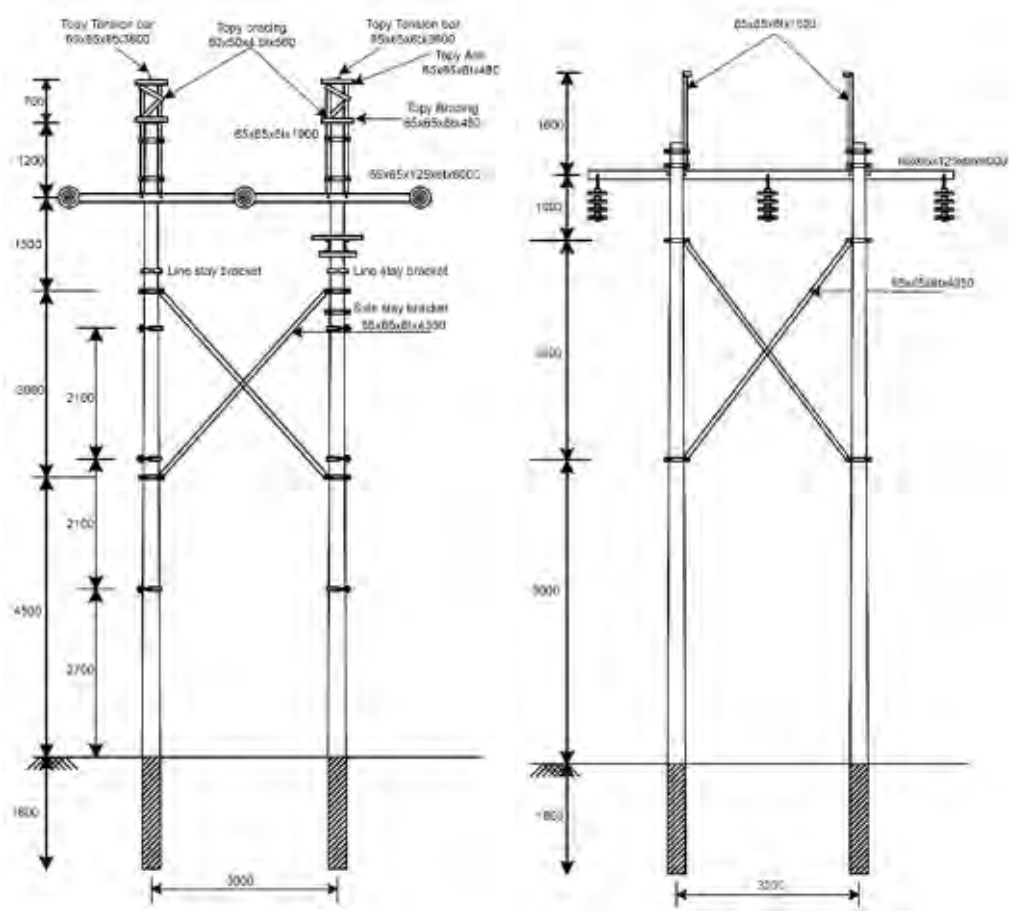
4.1.1 Substations

86. The substations will be either built within or adjacent to existing substation compound, in properties owned by the Government, or in privately-owned land. The area required for the substations ranges from 0.2 − 0.4 hectares but for future extension of the substation, land requirement is approximately 0.6 hectare.

4.1.2 Transmission Lines

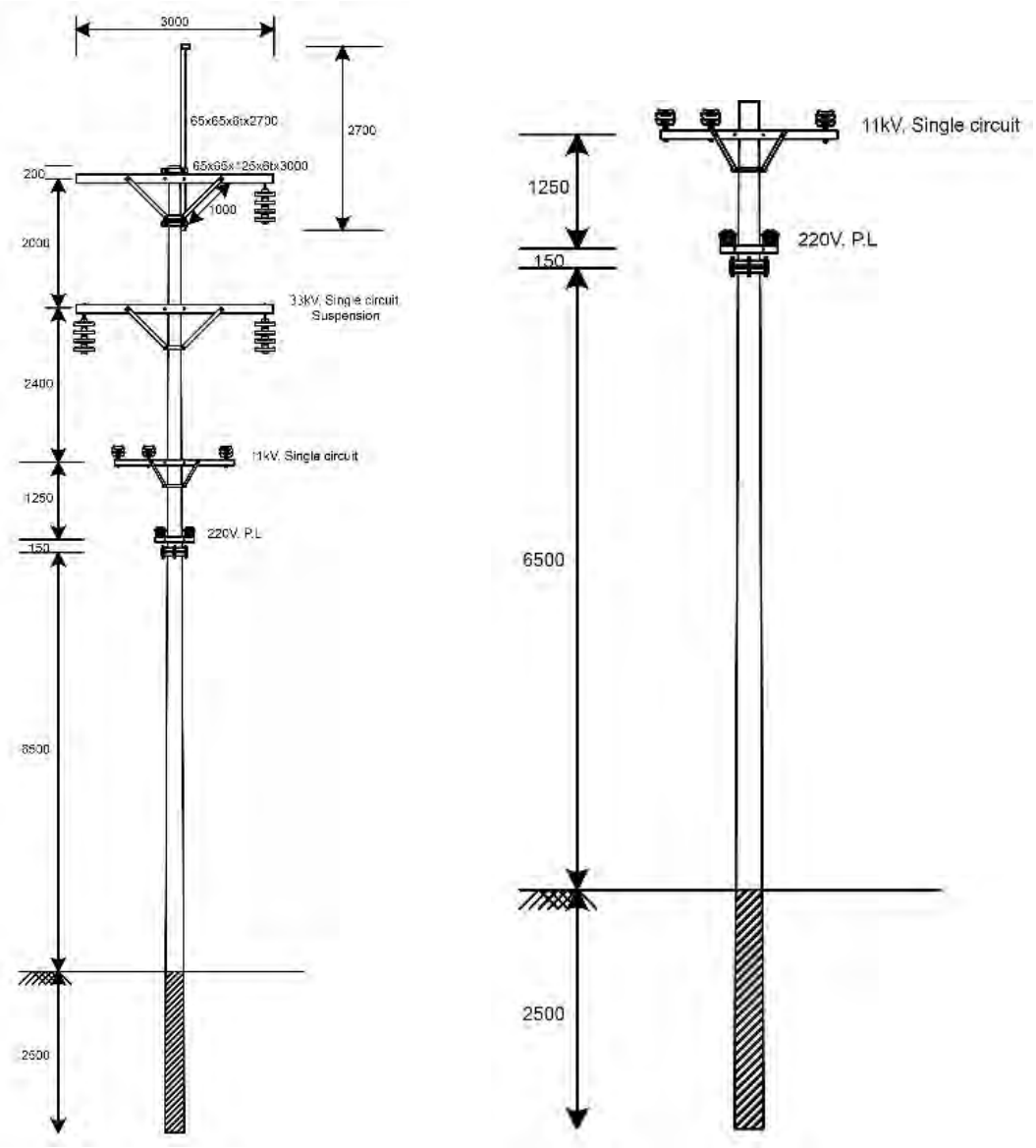
87. Two parallel distribution poles (H-pole design) that are 3-meter apart will be installed to support the transmission lines. The H-poles will be positioned about 200 feet apart from the next H-pole set-up. Each pole will have a height of about 12 to 15 meters and will occupy a borehole diameter of about 18 inches (0.5 meter), placed at a depth of approximately 1.8 to 2.5 meters below ground surface. During pole installation, a minimum of distance of 4-meter radius from the pole location will be temporarily disturbed. Figure 2 presents the schematic drawing of the disturbed area during pole installation. Aside from the location of the H-poles, other impact areas are the temporary access paths to be used to deliver the poles and other equipment to the pole sites which primarily comprises of paddy fields.

Figure 2 Typical 66kV single circuit tension and suspension tower



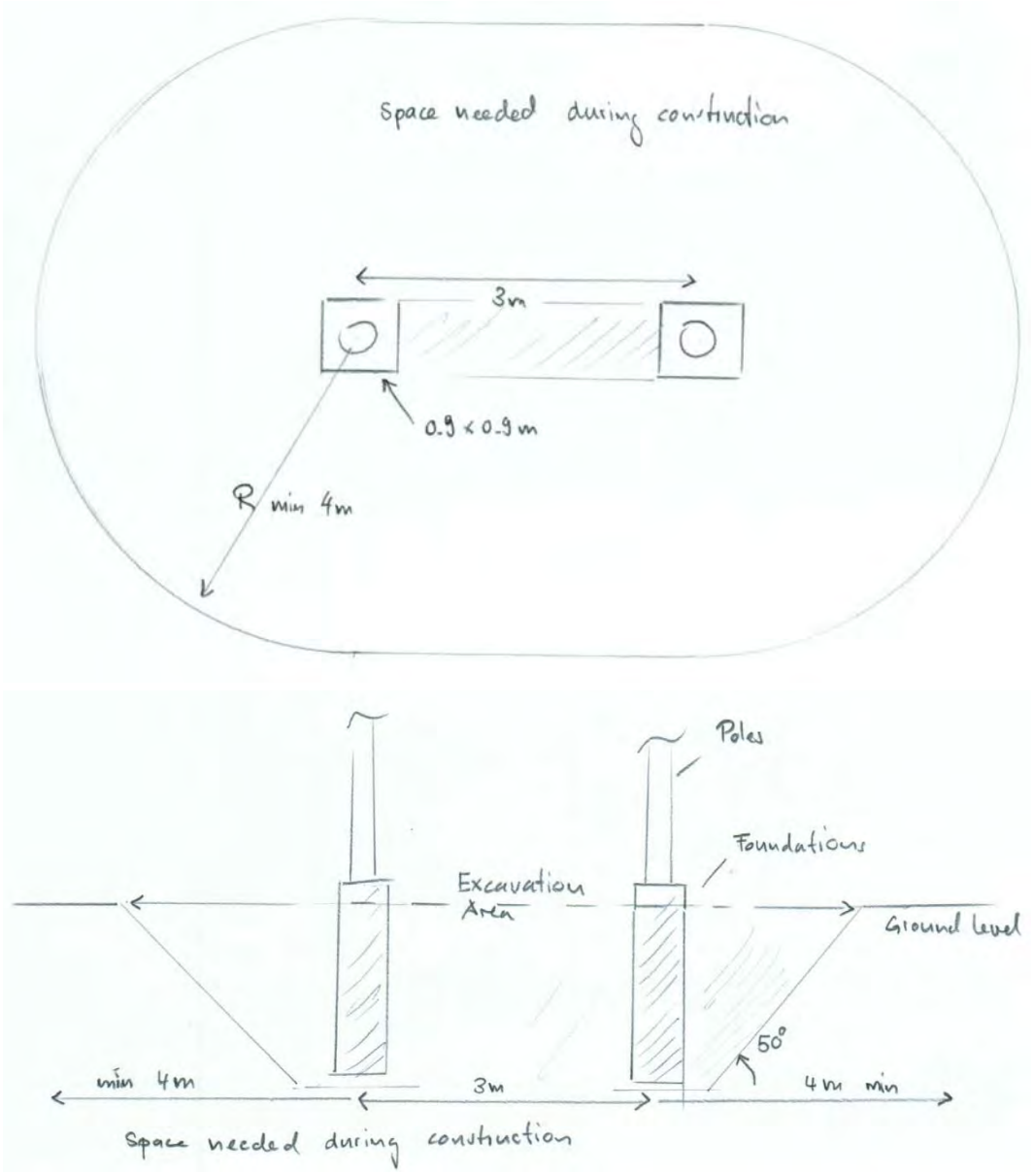
Source: Feasibility Study TA 9179-MYA: Power Network Development Project PPTA Consultant, November 2017

Figure 3 Typical 33kV towers (with 11kV and 400kV) and 11kV transmission tower



Source: Feasibility Study TA 9179-MYA: Power Network Development Project PPTA Consultant, November 2017

Figure 4 Disturbed Areas during Pole Installation



Sources: Damian Aegerter, PPTA Team, AFConsult

4.2 Project Implementation Phases

88. The activities to be implemented during the construction of substations and installation of the transmission lines involve the completion of the detailed design, bidding, evaluation and approval of contract packages, procurement, and the installation of equipment, testing and commissioning.

4.2.1 Construction of Substations

89. After the design of the substation has been finalized, the site will be cleared of obstructions such as vegetation. Some substations will require backfilling to elevate the site.

90. 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 ESE regional/state warehouse. 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. The main structures required for 66 or 33kV substations are (i) incoming and outgoing gantries, support structures for breaker, isolators, fuses, insulators, power transformers, and bus bars.

91. Civil works for one substation can be completed within a period 6 months while installation of equipment at the substation can be done in 1 − 2 months.

4.2.2 Pole Installation

92. The installation of poles will involve the following activities:

i. survey and verification of alignment and pole location
ii. notification of affected landowners and farmers in coordination with local authorities
iii. delivery of poles to the site
iv. pole installation
v. line installation and line stringing
vi. installation of accessories
vii. testing and commissioning.

93. Prior to installation of the transmission lines, the ESE through the ESE region/state offices and township officers will survey the line alignment and the proposed location of poles. This will be done in coordination with the township and village General Administration Department (GAD) to identify owners of land that will be affected by the line. Notices to affected landowners and farmers and the local authorities will be given and discussion will commence regarding any compensation for affected land and crops. For line alignment along roads, the Forest Department will be advised to conduct survey of trees to identify regulated trees and to determine the compensation in accordance with the rules of the Forestry Law.

94. Once the alignment and pole locations are finalized, the construction activities will begin with the excavation of the pole foundations and delivery of materials such as cement, sand, stone and equipment parts of the concrete poles, insulators and conductors. The concrete poles will be transported through trucks and unloaded near the sites through wheel borrows pulled by animals (usually buffalos/cows) or by workers manually pushing the wheel borrows. There are also instances wherein workers manually lift each pole to deliver to the pole site.

95. Foundations of the pole will be done through manual digging up to a depth ranging from 1.8 to 2.5 meters and an area of 0.9 x 0.9 meters. All excavated soil will be retained and used for backfilling of the pole foundation. The pole foundation will be reinforced with cement at the base to ensure pole stability. Construction activities at the pole site may require a disturbed area of about 4-meter radius around the pole site. In addition, access paths for the wheel borrows and workers from the existing road to the pole locations will be disturbed temporarily during construction.

96. Line installation and stringing will also be done manually. Cranes can be utilized during tower installation and line stringing to maximize the number of poles that can be installed in a day, depending on the conditions at the site. However, manual installation of poles and lines is the usual practice in Myanmar. For narrow roads, the contractor will be required to use small vehicles to avoid significant disturbance to traffic flow.

97. 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 accidents and damage to facilities and properties. The line shall be tested and adjusted prior to full commissioning.

4.2.3 Operational Phase

98. The activities that will be implemented during the operational phase of the distribution component include the routine monitoring and inspection to check if the required clearances of trees and houses are maintained. Regular maintenance and trimming of vegetation within the ROW is necessary to prevent damage to overhead transmission lines. The clearing of vegetation shall be undertaken manually, without the use of herbicides.

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

4.3 Project Proponent

100. The executing agency (EA) will be the Ministry of Electricity and Energy (MOEE) while the Electricity Supply Enterprise (ESE) will be responsible for overall project implementation and management of the distribution component.

101. MOEE/ESE 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 are followed with full coordination with project implementation units (PIUs) of the five regions/states. The PMU will be supported by the Project Implementation Consultant (PIC) in the review of design, supervision, management and monitoring, and capacitiy building for MOEE, ESE and ESE regions/states. The institutional arrangements and responsibilities in terms of environmental management are presented in Section 10.2.

5 Description of Environmental Condition

102. Baseline information on the relevant physical, biological, and socio-economic conditions of the existing environment at the subproject areas is described in this section. Aspects on various environmental parameters, which are likely to be directly or indirectly affected by the proposed project, are discussed.

5.1 Physical Resources

5.1.1 Geography

103. The Republic of the Union of Myanmar has a total land area of 676,578 km^2. It is geographically located between 09°58′ to 28°31′N and 09°29′ to 10°10′E latitudes and 92°10′E and 101°11′E longitudes[10]. Myanmar is bounded on the north by the Tibet Autonomous Region of China; on the east by China, Laos, and Thailand; on the south by the Andaman Sea and the Bay of Bengal; and on the west by the Bay of Bengal, Bangladesh, and India.

104. The country is divided into seven states and seven regions named in the 2008 Constitution, six self-administered zones or divisions and one union territory containing the capital Naypyitaw. The smallest formal administrative unit is the village, with several grouped together into village tracts. Urban wards, towns, and village tracts are grouped into townships, where the lowest levels of government offices are generally located. There are 325 townships and 67 districts in Myanmar's states and regions.[11]

105. The project sites are located within the region/states of Ayeyarwaddy, Bago, Mon, Kayin and Rakhine. Table 13 presents the number of districts and townships and land areas of these states/regions. The geographic profile of each project region/state is discussed in the succeeding sections.

Table 13 Administrative Units and Land Area of Project States/Regions

States and Regions	No. of Districts	No. of Townships	Land Area (sq.km.)
a) Ayeyarwaddy Region	6	26	35,138
b) Bago Region	4	28	39,404
c) Kayin State	3	7	30,381
d) Mon State	2	10	12,297
e) Rakhine State	4	17	36,778

Source: State and Region Governments in Myanmar, The Asia Foundation; The Myanmar Information Unit (MIMU)

5.1.1.1 Ayeyarwaddy Region

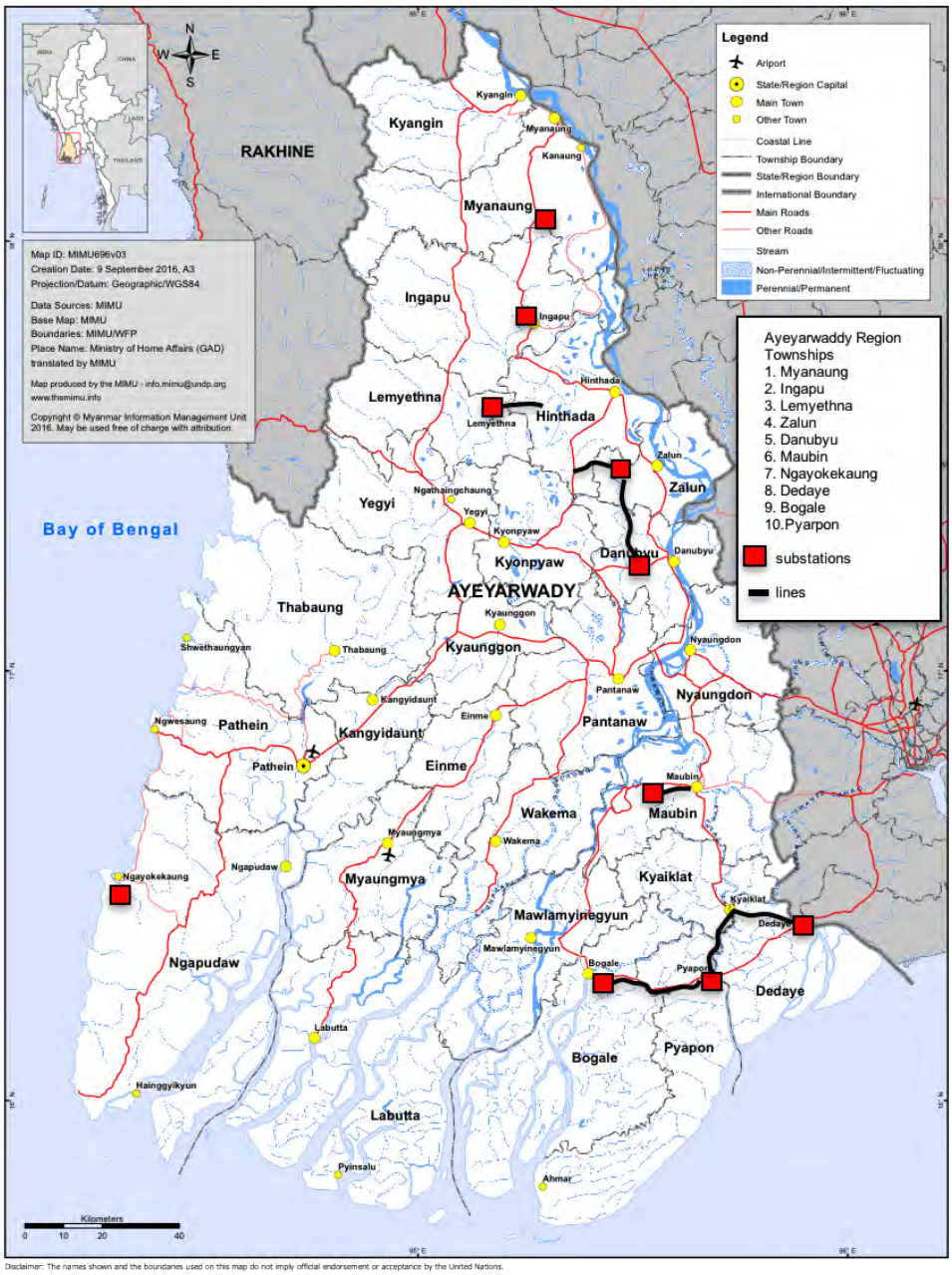
106. Ayeyarwaddy Region is located in southern Myanmar and is bordered by Rakhine State and Bago Region to the north; Yangon Region to the east; and the Andaman Sea and Bay of Bengal to the south and west. The region has a total 26 townships and 1,919

[10] Country Profile, Health in Myanmar, 2013
[11] State and Region Governments in Myanmar. The Asia Foundation. September 2013. www.asiafoundation.org

village tracts. In terms of territory, it has an area of 35,138 km^2 and ranks as the 10th largest among Myanmar's 14 states and regions.

107. The proposed substations and transmission lines in Ayeyarwaddy Region will be in 10 townships comprising of (i) Ngayokekaung, (ii) Lemyethnar, (iii) Ingapu, (iv) Myanaung, (v) Dedaye, (vi) Maubin, (vii) Pyapon, (viii) Bogale, (ix) Zalun, and (x) Danubyu. The areas are mostly in the eastern section of the region where majority of community areas are situated. One substation located in Ngayoke kaung is in the southwestern area of Ayeyarwaddy Region. The map showing the location of these subproject areas in Ayeyarwaddy Region is shown in Figure 5.

Figure 5 Location of Project Components in Ayeyarwaddy Region



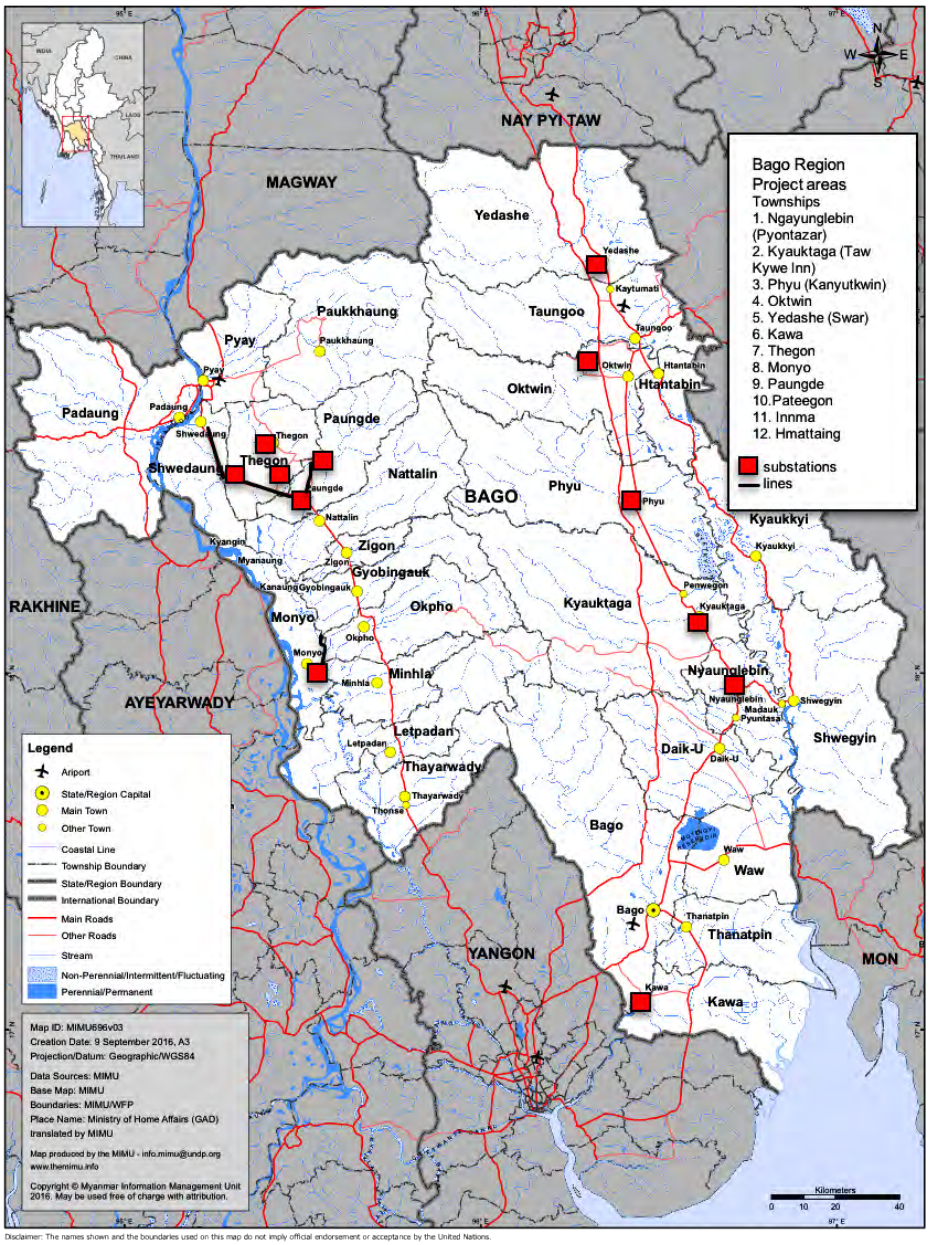
Base Map: MIMU

5.1.1.2 Bago Region

108. Bago Region has an area of 39,405 km^2 and is located in the southern central Myanmar. It is bordered by Mandalay and Magway Regions and the Union Territory of Naypyitaw to the north; Mon and Kayin States and the Andaman Sea to the east; Yangon Region to the south; and Ayeyarwaddy Region and Rakhine Region to the west. Bago region is split into two distinct regions – Bago East and Bago West. Bago Region consists of 28 townships, with 83% of the population living in the rural areas.

109. The proposed project in Bago Region will be in 12 townships (6 in Bago East and 6 in Bago West). The map showing the location of the project areas in Bago Region is shown in Figure 6.

Figure 6 Location of Project Components in Bago Region



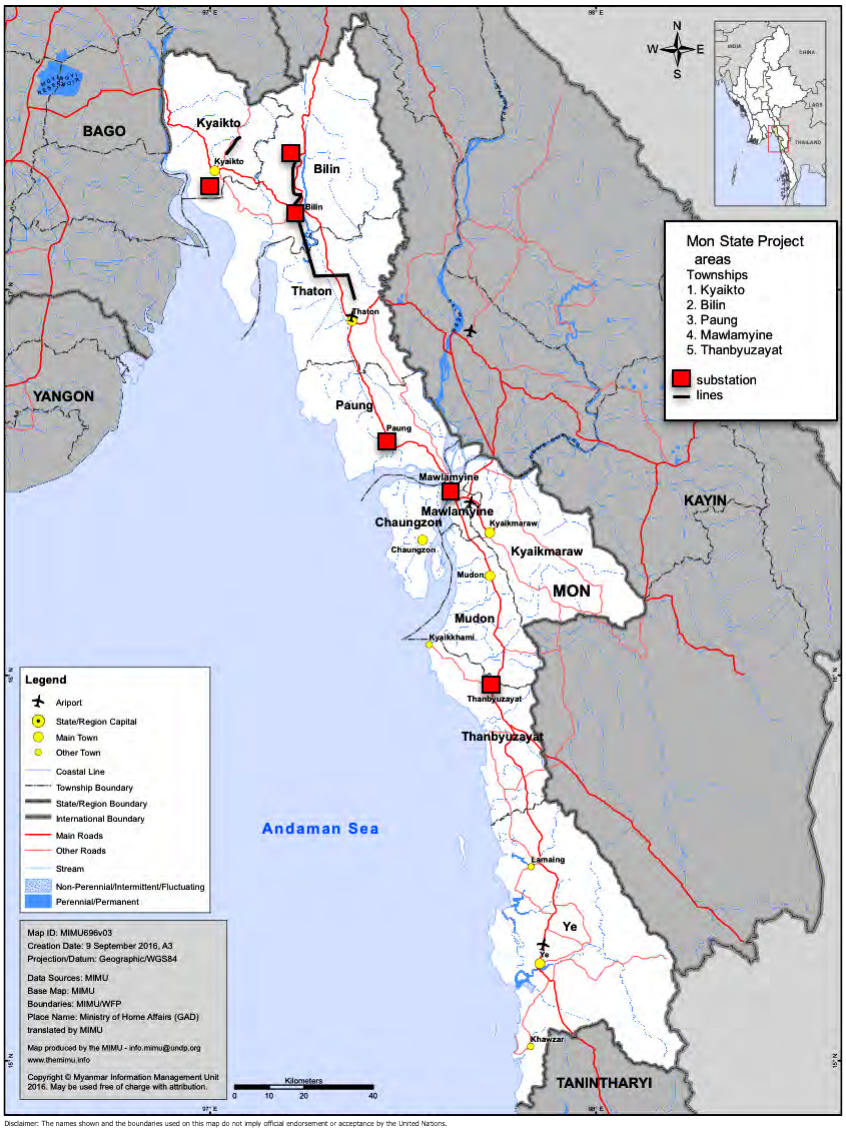
Base Map: MIMU 2015

5.1.1.3 Mon State

110. Mon State is located in southeastern Myanmar. It is bordered by Bago Region to the north; Tanintharyi Region to the south; and Kayin State to the east. It has a short border with Thailand on its east and is flanked almost entirely by the Andaman Sea on the west. Mon State covers 12,296 km^2 and consists of ten townships, spread across two districts, i.e. Mawlamyine and Thaton. Ye township in southeastern Mon State also has two sub-townships, Khaw Zar and La Mine. Under Mawlamyine district are the following townships: (i) Mawlamyine, (ii) Kyaikmaraw, (iii) Chaungzon, (iv) Thanbyuzayat, (v) Mudon, and (vi) Ye. Under Thaton district are the following townships: (i) Thaton, (ii) Paung, (iii) Kyaikto, and (iv) Bilin. Mawlamyine is the capital of Mon State and is one of the largest cities in Myanmar.

111. The proposed subprojects in Mon State will be in 6 townships. The project targets to provide electricity to 122 villages and 42,757 additional households. The map showing the subproject locations is shown in Figure 7.

Figure 7 Location of Project Components in Mon State



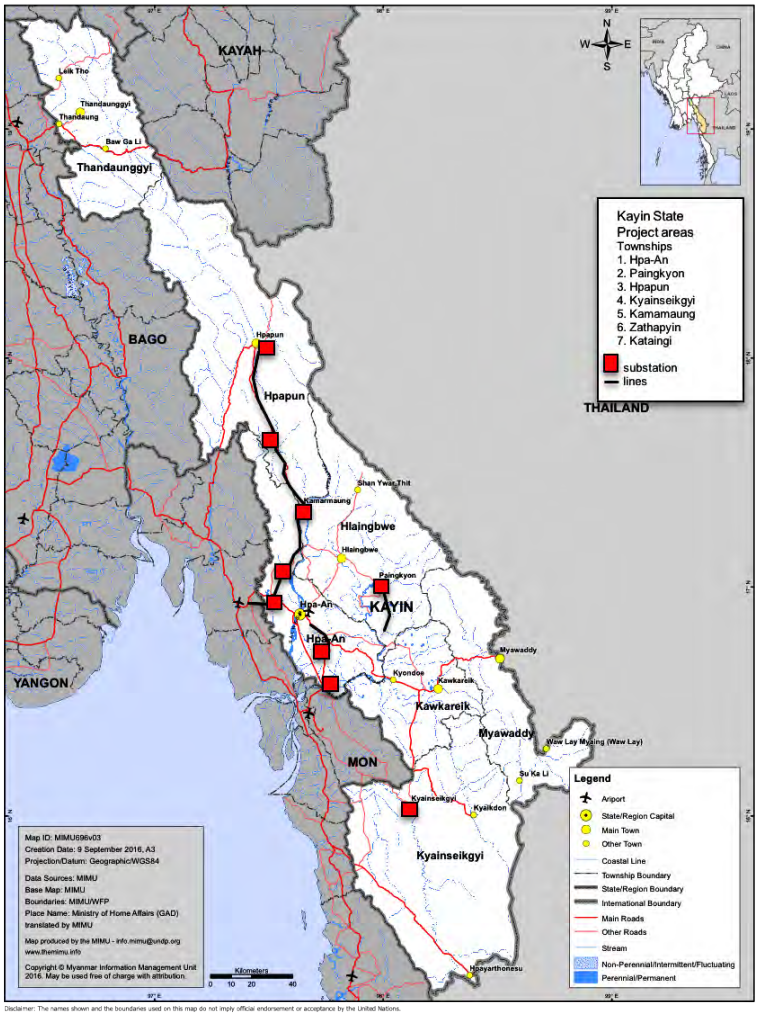
Base Map: MIMU 2015

5.1.1.4 Kayin State

112. Kayin State is located in southeastern Myanmar. It is bounded by Mandalay Region and Shan State to the north; Kayah State to the northeast; Mon State and Bago Region to the west; and Thailand to the east. Kayin State was previously known as Karen State because primarily the Karen people inhabit it. Kayin State covers an area of 30,385 km^2 and is composed of four districts: (i) Hpa-An, (ii) Myawaddy, (iii) Hpa-pun, and (iv) Kawkareik. There are seven townships in Kayin State, 454 wards and an estimated 4,092 villages. The state capital is Hpa-An, which is located about one hour drive from Mawlamyine. The townships under Hpa-An district include (i) Hpa-An, (ii) Hlaingbwe, (iii) Hpapun, and (iv) Thandaunggyi. Kawkareik District has two townships, namely, (i) Kawkareik and (ii) Kyainseikgyi. The districts of Myawaddy and Hpapun have only one township each.

113. The proposed project in Kayin State will be in 5 townships, of which 4 subprojects will be in the Hpa-An township, 1 in Paingkyon township, 1 in Hpapun township, 1 in Kyainseikgyi, and 1 in Kamamaung township. The project targets to provide electricity to 205 villages and 27,820 additional households. The map showing the location of these project service areas is shown in Figure 8.

Figure 8 Location of Project Components in Kayin State



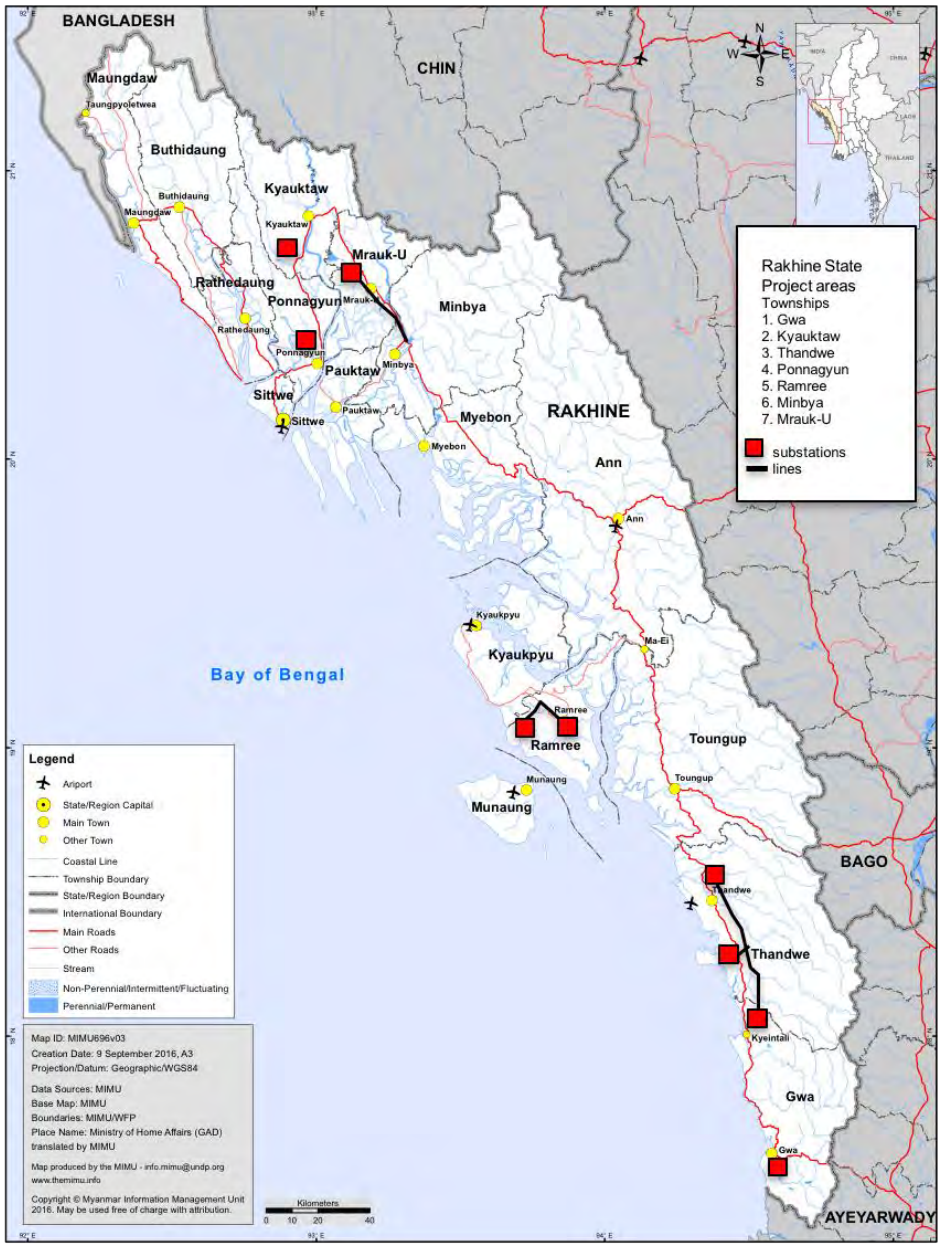
Base Map: MIMU, 2015

5.1.1.5 Rakhine State

114. Rakhine State is located in the west of Myanmar. It shares an international border with Bangladesh and with the national states of Chin, Magway, Bago and Ayeyarwaddy. Rakhine State covers an area of 36,778 km^2 and consists of 17 townships, with Sittwe as the capital city of Rakhine.

115. The proposed project in Rakhine State will be in 7 townships, of which one subproject each in Gwa, Kyauk Taw, Ponnagyun, Minpya, and Mrauk U and two subprojects each in Thandwe and in Ramree. The project targets to provide electricity to 265 villages and 36,694 additional households. The map showing the location of these project service areas is shown in Figure 9.

Figure 9 Location of Project Components in Rakhine State

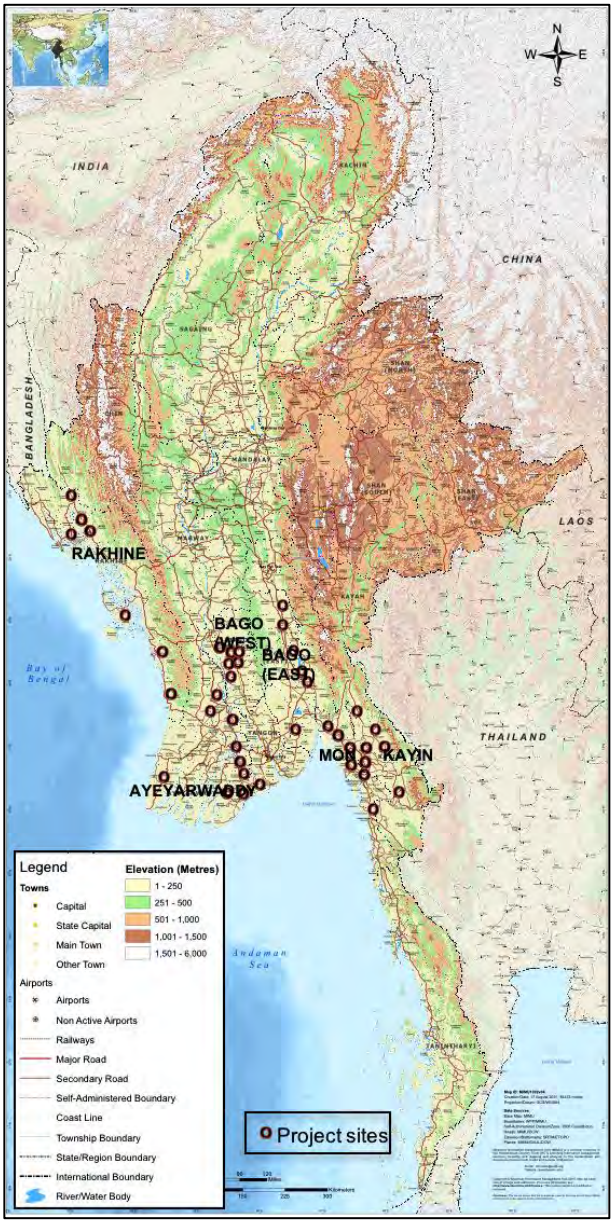


Base Map: MIMU, 2015

5.1.2 Topography

116. The topography of Myanmar can be roughly divided into three parts: (i) Western Hills Region, (ii) Central Valley Region, and (iii) Eastern Hill Region. The proposed project components in Ayeyarwaddy and Bago are mostly located within the Central Valley Region where majority of the country's population lives. The central valley is situated between the mountain ranges of Rakhine Yoma and the Shan Plateau. This region consists of the broadest valley of the Ayeyarwaddy River which originates from the first part of the river to Mandalay; the second part continues from Mandalay to Pyay; and the third part from Pyay to the mouth of the river. The Central Valley Region is divided by the Bago Mountains, forming the Sittaung Valley and the Chindwin Valley.

Figure 10 Topographic map of Myanmar showing location of project components



Base Map Source: MIMU 2016

117. A major portion of the area is covered with low-lying lands just three meters above sea level. The southern area of the delta is completely flat with no local relief. The topographic configuration in Ayeyarwaddy and Bago makes it an excellent environment for agriculture, especially rice production.

118. The project components in Kayin State are located in moderately sloping topography. Kayin State is also characterized by fertile lowlands along the lower Thanlwin (Salween) River but with inaccessible and forested hill areas along the Thailand-Myanmar border. The State capital of Hpa-An can be accessed by travelling either through Bago Region or Kayah State. The project components in Rakhine State are in the western coastal area while the project components in Mon State are in the eastern coastal area. The coastal area in Rakhine State is fringed with numerous islands of varying sizes.

5.2 Land Use

119. The substations are located either within existing substation compound as an extension of the facility or at another site in the township. New substation sites are in agricultural land (primarily paddy field) or in open areas near a road. The new transmission lines will be either parallel to a road and/or will traverse paddy fields. These areas are in rural/semi-urban communities. The prevailing land uses at the sites and vicinity of the substations and transmission lines in each region/state are described in the succeeding sections.

5.2.1 Ayeyarwaddy Region

120. The project components in Ayeyarwaddy Region will be located in sparsely populated areas. Major land use at the project affected sites is agricultural, primarily used as rice paddy or open grassland area for grazing of animals. Components requiring upgrades of existing substations such as in Nga Yoke Kaung, Dedaye, and Pyarpon will be located inside or adjacent to the substations. The surrounding areas of these existing substations are also characterized as paddy fields.

Figure 11 Typical land use at project sites in Ayeyarwaddy Region

Maubin

Pyarpon

Laymyatnar

Zalun

5.2.2 Bago Region

121. The project locations in Bago Region will be in areas which are characterized as paddy fields, grazing land, and sparsely populated residential/community areas.

Figure 12 Paddy fields adjacent to existing substations in Bago Region

Kanyuktwin substation

Oktwin substation

5.2.3 Mon State

122. Land uses at locations of project components in Mon State consist of rubber tree plantation, secondary growth forest, shrub land, and rice paddy. New substation sites are mostly adjacent to existing roads. Project components involving upgrades of existing substations will be in areas where current land use is also agricultural.

123. The Thanbyuzayat substation will affect a rubber plantation and the Bilin substation will be in a hilly area with secondary forest. The site of the Bilin substation is adjacent to a road and about 14 miles from the village settlement area. At the site of the proposed Paung substation in Pan Kone village, Thaton District, the area is being

used as dumping area of risk husk. The site is surrounded by grazing land and paddy field.

Figure 13 Land uses at project sites in Mon State

Rubber plantation at site of proposed Thanbyuzayat substation.

Hilly shrub land area at site of proposed Bilin substation

Proposed site of Paung substation which is being used as disposal site of rice husk. The area is surrounded by paddy field and grazing land.

Residential area adjacent to existing Kyaikhto substation.

5.2.4 Kayin State

124. Land uses of project sites in Kayin State consist of cashew plantation, grazing land, teak plantation, shrub land, and paddy field. The proposed Hpa-An (Nyaung Gone) substation will be located close to a narrow road junction and a cashew plantation. The site is on a hilly terrain. Project locations with teak trees are in Warboetaw and Hpapun. The Warboetaw area used to be a teak plantation area and the existing trees at the site are considered as regenerated teak trees with grasses and shrubs.

125. In Zarthapyin and Kan Ma Maung, the sites of the proposed substation and immediate vicinity is characterized as grassland. The Kyainseikgyi site is adjacent to a road but is being used as an open dump and truck parking area.

126. Typical land uses to be traversed by the transmission lines consist of grassland, shrubland, and rice paddies.

Figure 14 Typical land uses at project locations in Kayin State

Site of proposed Hpapun substation with teak trees

Grazing land at site of proposed Hpa-Ann (Eindu) substation

Grazing land at site of proposed Zarthapyin substation

Site of proposed Kyainseikgyi substation which is being used as open dump

5.2.5 Rakhine State

127. The project locations in Rakhine state are characterized as paddy field, grazing land, shrub land, and cashew plantation. Areas that are considered as shrubland and

grazing land are the sites in Thandwe township. The project components located in Yangbye are either used as rice paddy or cashew plantation.

Figure 15 Land use setting in Rakhine State

Grassland in Yangbye

Cashew plantation in Yangbye (Aunghlapyin)

Table 14 Land Uses in Project Regions/States

Land Use	Ayeyarwaddy Region	Bago Region	Mon State	Kayin State	Rakhine State
Agriculture	50.00%	40.12%	31.52%	16.40%	21.15%
Decidous	1.91%	17.34%	0.26%	0.33%	8.88%
Evergreen	4.31%	11.62%	8.55%	34.12%	40.00%
Forest	0	0	0	0	0
Mangrove	4.81%	0	0.12%	0	0
Shrubland	4.47%	0.48%	10.90%	0.74%	8.50%
Waterbody	34.50%	30.38%	48.60%	48.40%	21.47%
No data	0	0.06%	0.05%	0	0

Sources: Socio-economic report, PPTA 9179-MYA: Power Network Development Project; land uses in project townships from MIMU 2013

5.3 Climate

128. 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.

129. The average highest temperature in Central Myanmar during the summer months of March and April is above 43.4 ºC while in the Northern Myanmar is about 36.1ºC.

5.3.1 Climate Change

130. Myanmar is exposed to several natural weather events which have increased in intensity and frequency over the last 6 years. Many parts of Myanmar experience heavy rain-induced floods being in the center of Southeast Asia's southwest monsoon area and due to large river systems that end in vast delta. The coast also faces the eastern side of the Bay of Bengal and the Andaman sea which makes it also prone to cyclones and associated strong winds, heavy rains and storm surges. In central Myanmar, droughts are also frequent.

131. The project sites in Ayeyarwaddy Region and Bago Region are located in the delta area. This area is most exposed to recurring tropical storms, cyclones, and floods.

132. Information from the Department of Meteorology and Hydrology (DMH) showed that there are observable trends over the last six decades:[12]

a. Mean temperature has risen by around 0.08ºC each decade;

b. Overall rainfall has mainly risen throughout the country; although it has fallen in some areas;

c. There is late onset and early termination of southwest monsoon;

d. There are more extreme weather events; and

e. Sea levels are rising.

133. The shorter monsoon period brings with it more intense rainfall events and destructive cyclones make landfall on Myanmar's coastline annually, compared to once in every three years in the 20th century. (MCCSAP, 2017; NAPA 2013). Other observed extreme events that were reported by DMH are:

a. Increased prevalence of drought events. Drought years were frequent in the late 1980s and 1990s and also severe drought was experienced in 2010.

b. Higher intensity and frequency of cyclones and strong winds, such as cyclone Mala in 2006, Nargis in 2008, and Giri in 2010.

c. Rainfall has become more variable, including erratic and record-breaking intense rainfall events. The project sites in Ayeyarwaddy and Bago Regions, Mon and Rakhine States experienced heavy rain and flooding from July to October in 2011.

d. Increased occurrence of flooding in recent years. In July and August 2015, flooding and landslides displaced 1.6 million people and caused 132 deaths.

e. There are more extreme high temperatures. In summer of 2010, 1,482 cases of heat-related disorders and 260 heat-related deaths were reported across Myanmar.

f. The late onset and early withdrawal of monsoon has decreased the normal average duration from 144 days in 1961-1990 to 121 days in 1981-2010.

134. Table 15 presents the climate change projections for the project regions/states based on information from the DMH. The DMH reported that Ayeyarwaddy delta region

[12] Myanmar Climate Change Strategy and Action Plan 2016-2030. Final draft. May 2017

will be exposed to increased inundation, increased salinity, and coastal erosion. The delta region will respond more rapidly to both natural and anthropogenic climate and sea-level change. Climate change impacts at the project regions/states are as follows:

a. Ayeyarwaddy Region
    i. damage to crop, land, infrastructure and ecosystem services from cyclone/strong winds
    ii. intense surface runoff and soil erosion and flash floods from intense rains
    iii. severe inundation of land in low-lying areas along major river systems
    iv. sea level rise in coastal areas
    v. coastal erosion and salt water intrusion

b. Bago Region
    i. Flooding and inundation of land in low lying areas along major river systems

c. Mon State
    i. Damage to crops, land, infrastructure and ecosystem services from cyclone/strong winds
    ii. Flash floods, intense surface runoff and soil erosion in mountainous and hilly areas
    iii. Damage to coastal ecosystem

d. Kayin State
    i. Flash floods, intense surface runoff and soil erosion from intense rains

e. Rakhine State
    i. Damage to crops, land, infrastructure and ecosystem services from cyclone/strong winds
    ii. Loss of land, infrastructure and coastal habitats from sea level rise
    iii. Salt water intrusion and coastal erosion

Table 15 Climate Change Projections for Project Regions/States, 2021-2040

State/Region	Annual Maximum Temperature Increases (ºC)	Annual Minimum Temperature Increases (ºC)	Rainfall Change (%)
Ayeyarwaddy	0.8 – 1.1	0.7 – 1.2	3 to 14
Bago	0.8 – 1.3	0.8 – 1.2	3 to 14
Kayin	0.7 – 1.2	0.8 – 1.2	-2 to 10
Mon	0.7 – 1.1	0.7 – 1.1	-2 to 10
Rakhine	0.7 – 1.1	1.0 – 1.3	3 to 14

Note: Climate change projections were based on Representative Concentration Pathways (RCPs) adopted by the IPCC for the 5th Assessment Report in 2014. The above table presents the RCP 4.5 for the medium-low emission scenario.
Source: Myanmar Climate Change Strategy and Action Plan 2016-2030. Final draft. May 2017

5.4 Hydrology

5.4.1 Surface Water

135. Myanmar has abundant water resources and monthly distribution of river flows closely follows the pattern of rainfall. About 80 percent flows during the monsoon season (May-October) and 20 percent in the dry season (November-April).[13] There are six major rivers in Myanmar, of which two are international rivers. The six river basins are:

a) Ayeyarwaddy – Chindwin River Basin which is almost entirely located in Myanmar and drains 58 percent of the territory. It is divided into three sub-basins: Upper Ayeyarwaddy, Lower Ayeyarwaddy, and Chindwin.

b) Sittaung River Basin, which is also entirely located in Myanmar to the east of the downstream part of the Ayeyarwaddy. The river drains 5.4 percent of the territory.

c) Thanlwin River Basin (also called Salween in Thailand and Nu in China), which drains 18.4 percent of the territory, mainly the Shan plateau in the east. The source of the river is in China and after entering Myanmar, forms the border with Thailand for about 110 km.

d) Mekong River Basin (Lankang in China), which drains 4.2 percent of the territory in the far east and forms the border with Lao People's Democratic Republic.

e) Rakhine (Arakan) coastal basin in the west which drains into the Bay of Bengal.

f) Tanintharyi (Tenasserim) coastal basin in the south which drains into the Andaman Sea.

136. The mountain ranges of Rakhine Yoma, Bago Yoma, and the Shan Plateau divide Myanmar's three main river systems which are the Ayeyarwaddy, the Thanlwin, and the Sittaung rivers.

137. During the reconnaissance survey, surface water bodies in the project areas were identified to determine possible environmental issues particularly during the construction of substations and installation of transmission lines.

138. The alignment of the transmission lines will traverse creeks, river tributaries, and irrigation canals. Most of the substation sites will drain into paddy canals and/or to drainage canals that lead to creeks and rivers. Discussed in the succeeding sections are the identified water bodies that may be affected by the project.

Ayeyarwaddy Region

139. The project components in Ayeyarwaddy Region drains into the Ayeyarwaddy River through a number of creeks, drainage and irrigation canals. The Ayeyarwaddy River is nearly 2,170 km long. 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 Regions. Identified water bodies that may be affected by the project components in Ayeyarwaddy Region are the following:

[13] Source: http://www.fao.org/nr/water/aquastat/countries_regions/MMR/

a) Mayin creek and Yele Nyaung creek in Aing Thabyu village, Laymyantnar township
b) Khwe Phyu Kya creek in Myanaung township
c) Chaung Phyar creek in Dedaye
d) Ye Lae creek and Yarsu Taing river in Maubin
e) Pyarpon River in Pyarpon township
f) Nay Chaung creek in Bogale township
g) Pyinma Kone creek in Zalun
h) Irrigation canals near paddy fields
i) Bay of Bengal in Ngayokekaung.

Bago Region

140. There are eight creeks that may be affected by the proposed project in Bago Region, particularly during the construction of the substations and installation of the lines. The identified surface waters are:

a) Thakhote Kone creek in Pyontazar
b) Phyu Lone creek in Taw Kywe Inn
c) Nga Nu San creek in Kanyuktwin
d) Nga Zin creek in Oktwin
e) Sin Thae creek in Thegon
f) Ayeyarwaddy River in Pateegon
g) Nga Byae Ma creek in Monyo leading to Ayeyarwaddy River
h) Myit Makha creek in Innma leading to Ayeyarwaddy River
i) Bago River in Kawa
j) Irrigation canals near paddy fields.

Mon State

141. The identified surface waters in Mon State that are traversed by the distribution component are:

a) Bilin creek leading to Bilin River in Bilin township
b) Kadet creek which flows into the Sittaung River in Kyaikhto
c) Uttaran River in Mawlamyine leading to Andaman Sea.

142. Mon State drains into the Andaman Sea which is located in the southeastern section of Myanmar.

Kayin State

143. In Kayin State, the identified surface waters in the vicinity of the distribution component are:

a) Yone Salin creek in Hpa-An
b) Paung creek in Paingkyon
c) Kyone Phe creek in Zarthapyin
d) Zali River in Kyainseikgyi
e) Thanlwin River in Kan Ma Maung.

Rakhine State

144. The project components in Rakhine State are located in the coastal basin which drains into the Bay of Bengal.

5.4.2 Flooding

145. In general, the catchment areas of major rivers in the north and central zone are prone to flooding caused by swollen rivers. Ayeyarwaddy region was severely impacted by Cyclone Nargis on May 2, 2008. About 138,000 lives were lost and serious

damage was inflicted.[14] The southern delta in Yangon experience flood tide and high river water flow but these areas are protected with earthen dikes. There are also localized flooding which occurs in low-lying areas and those near rivers.

146. Riverine floods are common when the monsoon troughs or low pressure waves superimpose on the general monsoon pattern resulting in intense rainfall over strategic areas of the river catchments. In Ayeryarwaddy and Chindwin rivers, the flooding occurs when intense rain persists for at least 3 days over northern Myanmar. Most of the flooding in the lower Ayeyarwaddy and the delta is by Chindwin when its flood coincides with the upper Ayeyarwaddy floods.

147. In Sittaung and Thanlwin rivers, flooding is caused by rainfall associated with low pressure waves which are remnants of typhoons and tropical storms from the South China Sea moving from east to west across the country. Aside from these rivers, the Bago and Dokethawady rivers (tributary of Ayeyarwaddy) also cause major floods in the area.

148. The project areas in Ayeyarwaddy Region and Bago Region are prone to flooding while the hilly areas in Kayin State and Mon State are threatened by flash floods. The flash floods occur at the beginning of summer. Along the coastal region in Rakhine State, the floods are secondary hazard generated by cyclones.

149. Of the project areas, the following townships are considered as flood-prone areas and have experienced major flood events based on records from 1997 to 2007.

Table 16 Project Areas Affected by Major Floods (1997-2007)

Location	Date	No. of Affected Village Tracts and Villages	No. of Affected Families	Affected Population
Bago Region	7/7/97	All villages in 6 townships	6,629	33,768
Kayin State	1/8/97	All villages in 5 townships	18,855	109,840
Hpa-an, Kayin State	13/8/91	6 villages	2,669	14,488
Kyauktaw, Rakhine State	10/7/97	-	1,030	5,983

Source: Hazard Profile of Myanmar, July 2009

5.4.3 Water Quality

150. Considering the short-term water quality impacts of construction of substations and transmission lines and the limited time to undertake the environmental due diligence, baseline water quality sampling was not undertaken in the identified creeks and rivers. Secondary water quality data was gathered from the Pollution Control Division (PCD) of MONREC. The agency is currently conducting water quality and ambient air quality monitoring through the Myanmar Environment Institute (MEI) as part of the initiative to develop environmental quality standards.

151. The MEI conducted water quality monitoring in Bago City, Bago Region and in Pathein City, Ayeyarwaddy Region in May 2016 at the Nga Wun River in Thabaung township, Daga River, Pathein River, Bago River, and Kan Daw Gyi Lake. The nearest water

[14] Local Governance Mapping. The State of Local Governance: Trends in Ayeyarwady. UNDP. December 2014. www.mm.undp.org

quality monitoring station to one of the project component site is the Bago River in Kawa. The results of the surface water quality monitoring are summarized in Table 17.

Table 17 MEI Water Quality Monitoring in Bago Region and Ayeyarwaddy Region

Parameter	Nga Wun River Thabaung Township	Daga River	Downstream of Pathein River	Bago River	Kan Daw Gyi Lake
Temperature (ºC)	28.84	30.09	28.51	31.99	30.77
pH	7.68	7.63	7.4	7.05	7.79
DO (mg/l)	6.98	7.11	6.05	5.92	6.19
Total dissolved solids (mg/l)	162.41	151.05	1856.1	107.77	15.5
Turbidity (FNU)	34.0	55.0	105.0	3.5	2.8
Total suspended solids (mg/l	77	122	320	72	83.67
BOD (mg/l)	7	8	11	6	5
Total nitrogen (mg/l)	<1	<1	<1	<1	<1
Total phosphorus (mg/l)	<0.01	<0.01	<0.01	0.01	<0.01
Oil & grease (mg/l)	<5	<5	<5	<5	<5
Mercury (mg/l)	0	0	0	0	0
Lead (mg/l)	0	0	0	0	0
Cyanide (mg/l)	nil	nil	nil	nil	nil
Total coliform (MPN/100ml)	>16	>16	>16	>16	>16
COD (mg/l)	4.5	3.4	<0.150	<1	<1
Iron (mg/l)	<0.02	<0.06	<0.03	0.126	<0.1
Arsenic (mg/l)	0	0	0	0	0

Source: Myanmar Environment Institute
Notes: DO-dissolved oxygen; BOD-biochemical oxygen demand; COD-chemical oxygen demand, oC-degree Celsius; FNU-formazin nepheolometric unit; mg/l-milligrams per liter; MPN-most probable number; ml-milliliter

152. The water quality monitoring results indicate that water quality in the sampled rivers are still relatively good in terms of dissolved oxygen (DO), total suspended solids (TSS), and total dissolved solids (TDS). The DO levels are still high while the total suspended solids (TSS) and total dissolved solids (TDS) are low. There were no detected heavy metals in the surface water. Total coliform was measured but at low levels. Coliform is expected since the water bodies receive the discharges from the surrounding community.

5.5 Air Quality

153. The quality of ambient air in the subproject areas is typical of rural areas in Myanmar. There are no major industrial activities that contribute to air quality changes. One substation site in Ye Lae Kalay village in Maubin in Ayeyarwaddy is in an industrial zone but the operating industries are mostly engaged in agro-industrial activities such as rice milling.

154. In general, the main sources of air pollutants in the project areas are dusts from unpaved roads, burning of agricultural wastes, and vehicle emissions. Based on this, the air quality condition at the project areas is considered to be generally good.

155. Ambient air quality sampling was not conducted at the project locations because of limited time to conduct the environmental due diligence and the short-term environmental impacts on air quality of the construction of substations and transmission lines.

5.6 Noise

156. As observed during the site visits, noise quality is typical of rural areas in Myanmar. There are no major industrial activities that contribute to noise that will disrupt the normal balance in the daily lives of local people. The main sources of noise are movement of vehicles for areas near project roads. Noise data was not available for the five regions/states. Noise sampling was not conducted during the site visits because of the short-term environmental impacts on noise during the construction of the substations and transmission lines.

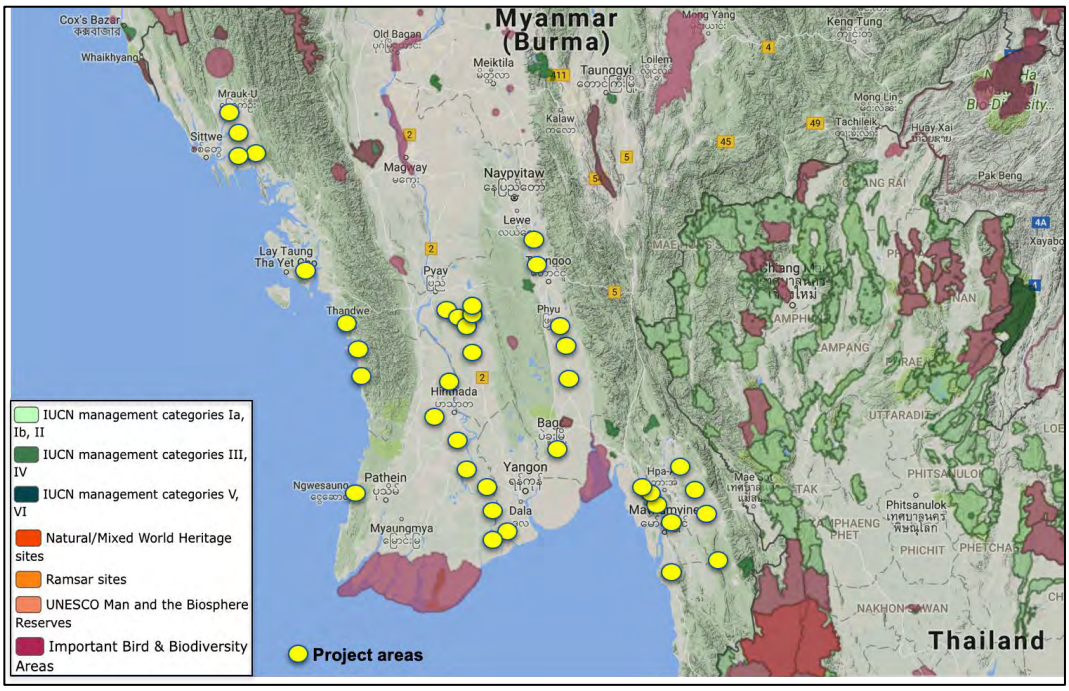
5.7 Biological Resources

157. The project sites will not be located in any declared protected area, Ramsar site, World Heritage site, UNESCO's Man and biosphere reserve area, and mangrove areas. The sites are located in areas where the land has been disturbed by human activities. Typical terrestrial vegetation along the transmission line ROW consists of the rice, bamboo, fruit trees, rice, and other shrubs. Transmission line alignments along roads also

has trees which could be avoided or removed to maintain conductor clearance and for safety and line integrity purposes.

158. At the sites of substations and switchbays, typical vegetation are shrubs and rice paddies. There are some substation areas with trees in the property which needs to be removed.

Figure 16 Map of protected areas and key biodiversity areas showing the project areas



Base map: https://www.ibatforbusiness.org/mapviewerol213

5.8 Social and Cultural Resources

5.8.1 Sensitive Receptors

159. The presence of sensitive receptors such as residential households, temples, monasteries, mosques, and hospitals/health clinics within 50 - 100 meters surrounding the substations and at 50 - 100 meters on both sides of the proposed alignment of the transmission lines were identified during the survey. These sensitive receptors are anticipated to experience adverse impacts of dust, noise and traffic during the construction period, and exposure to electrical equipment during the operational phase.

160. In Ayeyarwaddy Region, the sensitive receptors comprise of houses near substations and along lines in Danubyu, Dedaye, and in Zalun. The Mayathiwa temple is located about 1 km away from the Ingapu (Htoo Kyi substation) but the entrance gate to the temple is adjacent to the site of the proposed substation. Along the line alignment in Zalun, there is a hospital in Nyaungbin Zay ward, a school, and a dispensary in Maung Htaung village. The transmission line from Pyarpon substation to Pyarpon township will be along the Kyaiklat-Pyarpon road and will affect mostly paddy fields at the Thar Lake Lyi village and Kyonetar village. The line from Zalun substation to Danubyu substation

will affect paddy fields and village areas in Kyone Sha, Thabaw Thapyu, and Yae Twin Kone.

161. In Bago East, the sensitive receptors consist of houses and village areas near substations in Pyontazar, Kanyuktwin, Kawa, Oktwin, Swar, and Taw Kywe Inn. There is also a General Administration Office near the Taw Kywe Inn substation while the sensitive receptors at the line alignment along the road consists of residential houses and shops, a monastery, and a Baptist church. The substation and transmission line in Pyontazar will affect the settements in Aye village and village streets/lanes.

162. In Bago West, the sensitive receptors mostly comprise of village areas and houses near substations and along the lines. Houses and villages near the sites can be found at Innma, Htein taw, Pateegon, and Thegon. In Thegon, there is a monastery located about 30 meters away from the substation. There is a safe clearance area of about 100 ft. between the switchyard and the nearest house, but only wires and wooden poles serve as fence of the substation. Notably, the substation area in Thegon is within the town center but the houses and other establishments are not closely located.

163. The new 10MVA Hmattaing substation in Paungde will be constructed at the back of the Hmattaing township office, near an existing transformer. Access to the new substation site will be through the entrance of the township office compound from Paungde-Hmattaing Road. The proposed substation site is within the town center while the proposed transmission line will run parallel to the Yangon-Pyay Road and will mostly traverse paddy fields and some village areas. The nearest house to the substation is about 50 meters away. There is a school located about 25 meters away and a health center about 30 meters from the substation site. The Paungde Buddha Tooth relic pagoda was identified about 400 meters away from the substation in Paungde.

164. Sensitive receptors in Mon State consist of village/ward areas in Mawlamyine, Kyaiktho, and Paung. The Melan Yan Monastery with Buddha relics was also identified in Bilin while a clinic was identified in Kyaiktho in Kin Pon Sakhan village within 100 meters from the site. The site of the Thanbyuzayat substation has a house and two temporary shops inside the property. The transmission line (19 miles) will be along the Thanbyuzayat-Ye Road and will traverse village areas.

165. In Kayin State, there were no sensitive receptors that were identified near the substations. Along the alignment of the transmission lines are village areas such as the Kyauk village and Eindu town and a Muslim mosque near the road going to the substation in Kataingi. In Kyainsekgyi, the identified sensitive receptors along the line alignment include eight monasteries, two churches, one Muslim mosque, a township hospital, and a clinic. The line alignment in Paingkyon identified a school (0.25 miles from Paingkyon substation), Paung village area, and the Paung shrine.

166. In Rakhine State, the alignment in Aunghlapyin will affect a school (1 mile away from the substation), a monastery, and the Seik Nar Pyin Pagoda which is about 0.25 miles from the substation. The line alignment in Kyain Ta Li in Gwa will be along the road and will affect a school (45 meters away from the Kyain Ta Li substation). The monastery was identified 270 meters away while the hospital is 4 km away. There are also some houses along the line. The identified sensitive receptors along the line from Youngpye to Kyauk Ni Maw village are the Min Thar Su village, Htaing Ching village, a school, monastery and temple located about 1 mile from the Youngpye substation and a hospital 2 miles away from the substation. The alignment from Kyaukgyi substation to Thaphuchine village identified a primary school, a high school, moastery, clinic, a village temple, and the Sin Din Gyi village area.

167. The sensitive receptors were identified based on the initial alignment provided by ESE township engineers. These sensitive receptors will be confirmed during detailed

design of the transmission line alignment. Mitigation measures to ensure community health and safety will be necessary for works near these sensitive receptor areas.

5.8.2 Demographic Profile

168. Based on the 2014 Myanmar Population and Housing Census (MPHC), the country has a reported total population of 51,486,253 persons as of March 2014. Of these, 24,824,586 were males and 26,661,667 were females. The population size represents an increase of 46 percent compared with the 1983 census.[15] The population increased at a rate of 0.89 percent per annum between 2003 and 2014. The census results showed that Yangon Region had the largest population (7.36 million), followed by Ayeyarwaddy (6.18 million), Mandalay (6.16 million), Shan (5.82 million), and Sagaing (5.32 million). The least populated states and regions are Kayah (286,000), Chin (478,000), Naypyitaw (1.16 million), Tanintharyi (1.40 million), and Kayin (1.57 million).

169. The project regions and states account for almost 35 percent of the total population of the country. The distribution of population in the project states and regions is presented in Table 18.

Table 18 Population Size, Proportion of Total Population and Density in the Five Project States and Regions (2014)

Region/State	Population	Proportion of Total Population	Population Density (persons per square km)
Union	51,486,253	100	76
Ayeyarwaddy Region	6,184,829	12.0	177
Bago Region	4,867,373	9.5	124
Mon State	2,054,393	4.0	167
Kayin State	1,574,079	3.1	52
Rakhine State	3,188,807	6.2	87

Source: 2014 Myanmar Population and Housing Census. Department of Population. Ministry of Immigration and Population. May 2015

170. Myanmar had a population density of 76.1 persons per square kilometer in March 2014. The population density increased by 81 percent from 43 persons per square kilometer in 1973 and 46 percent from 52 persons per square kilometer in 1983. Yangon is the most densely populated with 716 persons per square kilometer. This was followed by Mandalay (200 per km^2), Ayeyarwaddy (177 per km^2), Mon (167 per km^2), Naypyitaw (164 per km^2), and Bago (124 per km^2). As compared to most other Asian countries, the population density of Myanmar is lower.

171. The 2014 census showed that there is a high proportion of persons in the rural areas as compared to those living in urban areas. For every 100 persons in Myanmar, 70 persons live in the rural areas and 30 persons live in urban areas (2014 MPHC). Yangon Region had the highest proportion of people living in areas classified as urban by the General Administration Department (GAD) at 70 percent, followed by Kachin at 36 percent and Mandalay at 35 percent.

[15] 2014 Myanmar Population and Housing Census. Department of Population. Ministry of Immigration and Population. May 2015

172. Ayeyarwaddy had the largest proportion of rural population at 86 percent, followed by Magway (85 percent) and Sagaing and Rakhine (83 percent). Table 19 presents the proportion of population by urban and rural areas in the project regions and states.

Table 19 Proportion of Population by Urban and Rural Areas in the Project Regions and States

State/Region	Urban Population	Percent Urban Population	Rural Population	Percent Rural Population
Union	14,877,943	30	35,401,957	70
Ayeyarwaddy Region	872,600	14	5,312,229	86
Bago Region	1,072,336	22	3,795,037	78
Mon State	572,189	28	1,482,204	72
Kayin State	329,166	22	1,175,160	78
Rakhine State	354,288	17	1,744,519	83

Source: 2014 Myanmar Population and Housing Census. Department of Population. Ministry of Immigration and Population. May 2015

173. 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[16]. The main religions are Buddhism (89.2%), Christianity (5.0%), Islam (3.8%), Hinduism (0.5%), Spiritualism (1.2%) and others (0.2%).

174. 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.

5.8.3 Economy

175. About 70% of Myanmar's population are dependent on agriculture for their livelihood[17]. Moreover, about 36% of the rural population, many of whom are landless laborers, living below the poverty line.

176. Ayeyarwaddy Region has been the center of Myanmar's fisheries, rice and grain production for over a century. In recent decades, there has been low yields and an underdeveloped transport and storage infrastructure that causes a relative decline of Ayeyarwaddy's position. Thirty-two percent (32%) of the region's population live below the poverty line.[18]

177. Bago Region is endowed with significant reserves of natural resources (teak and petroleum) and highly favorable conditions for rice cultivation which make it the second largest producer of rice among all states/regions in the country.

[16] Source: Ministry of Foreign Affairs, www.mofa.gov.mm
[17] Source: Country Profile, Health in Myanmar, 2013
[18] Local Governance Mapping in Ayeyarwaddy Region. Highlights. UNDP. December 2014

178. Mon State has more established local economy and markets and variety of industries. Overall, the state capital Mawlamyine is established as the trading and shipping hub for southeast Myanmar. Traditionally, the people of Mon State have relied extensively on agriculture for livelihoods, with large areas of arable flat land throughout the area. Majority of land area is used for rice paddies. Other major crops in Mon State include corn, groundnut, sunflower, cashew nuts, sugarcane, coconut, palm oil, cocoa, and various type of fruits like mangosteen and pomelo. Fishing along the western coast also supplement incomes for wholesale markets as well as for the processing of dried fish and algae for production of fish sauce, paste, spices, and agar-agar. Another emerging industry in Mon State is mining of minerals such as antimony, granite, and gold. There are also several state-owned enterprises in Mon State which are involved in rubber manufacturing, rubber plantations, and coal power plant.

179. Rakhine State's main economic activities are agriculture and fisheries. Rice remains as the main crop, occupying around 85% of the total agricultural land. Fishing is another major industry with majority of catch transported to Yangon. There are also wood products such as timber, bamboo and fuel wood which are extracted from the mountains.

Table 20 Main economic activities in the project regions/states

Region/State	Main economic activities
Ayeyarwaddy Region	Agriculture
Bago Region	Forestry, agriculture, fishing, industry
Mon State	Agriculture, forestry, fishing, manufacturing (rubber), power and mining
Kayin State	Agriculture, forestry
Rakhine State	Agriculture, fisheries

Source: MIMU

5.8.4 Health

180. 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 21). 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 22).

Table 21 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

Causes	Percent
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 22 Leading Causes of Mortality (2011)

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

181. 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.

5.8.5 Education

182. Myanmar generally lags behind other countries in the region on education indicators due to decades of underinvestment in the education sector. (unicef.org) Pre-school attendance among children ages 3-5 years is quite low with less than a quarter of all children nationwide attending. The situation is similar in Bago West but worse in Bago East, with only about a fifth of children attending pre-school in the latter. The primary school enrollment rate in Bago East (87%) is similar to the national average but in Bago West is lower (81%). Only 51 percent and 44 percent of all children attending primary school actually complete schooling on time in Bago West and Bago East, respectively.

183. In Mon State, pre-school attendance among children aged 3-5 years is quite low with less than a quarter of all children attending pre-school in the country as a whole. Only 13 percent of children aged 3-5 are attending pre-school. The primary school enrollment in Mon State is comparable to the national average but almost 12 percent of

children still do not have access to primary education and only slightly over half (56%) of primary school children in Mon State complete their schooling on time.

5.8.6 Physical Cultural Resources

184. Myanmar is signatory to the 1972 Convention on the Protection of the World Cultural and Natural Heritage (World Heritage Convention). Myanmar has established the National Committee for World Heritage as the coordinating body for its world heritage conservation activities. The parliament has identified the "Pyu Ancient Cities" and "Bagan Archaeological Area and Monuments" as the first sites to be nominated for World Heritage status.

185. Important cultural resources that were identified in the subproject areas include the Mrauk-U archaeological area and monuments in Rakhine State and the Pyu ancient cities, specifically Sri Ksetra in Pyay, Bago Region. These are described as follows:

i. Mrauk-U archaeological area and monuments (Rakhine State, Sittwe District, Mrauk-U Township): The area was known as the capital city of the first Arakanese Kingdom. The site contains some 200 Buddhist monuments (temples stupas, and monasteries), mostly built in the 15th and 16th centuries A.D. It is located at the junction of the deltaic plain and the Arakanese mountains. There are religious monuments, several fortified temples built in well-dressed stone, stone carvings and sculpture.[19] Some of the known temples are Htukkanthein temple, Koe-Thaung temple, Lemyethna temple, Ratana-Pon pagoda, Shite-Thaung temple, Laungbanpyauk pagoda, and Mahabodhi Shwegu temple.

   The subproject in Mrauk-U will avoid the temples and pagodas while chance find of archaeological artifacts will be coordinated with the Department of Archaeology.

ii. Pyu Cities: Beikthano-Myo, Halin, Tharay-Khit-taya (Sri Ksetra): These ancient cities built along the Ayeyarwaddy Valley belong to the Pyu, a people speaking a language closely related to Myanmar and is now extinct. These ancient cities were built from the 1st to the 9th centuries A.D. The stone inscriptions found in some of the monuments provide information of this language. The Pyu culture is characterized by um burial and specific artifacts (coins, ceramic, metalware).[20]

   The Sri Ksetra in Pyay District, Bago Region is the cultural heritage site nearest to the transmission line from Shwedaung. The transmission line in Shwedaung is located about 17 km away from the Sri Ksetra. Although located at a distance from the Sri Ksetra, chance find procedure will be established and coordinated with the Department of Archaeology.

5.8.7 Landmine Contamination

186. The eastern borders of Kayah, Kayin, Shan, and Kachin states and the central region of Bago are believed to be the most affected areas with land mines and unexploded ordnance (UXO).[21] There are also mined areas in borders with Bangladesh, Thailand, and China. Mines are a particular threat in northern and eastern parts of the country as a result of decades of post-independence struggles for autonomy by ethnic minorities.

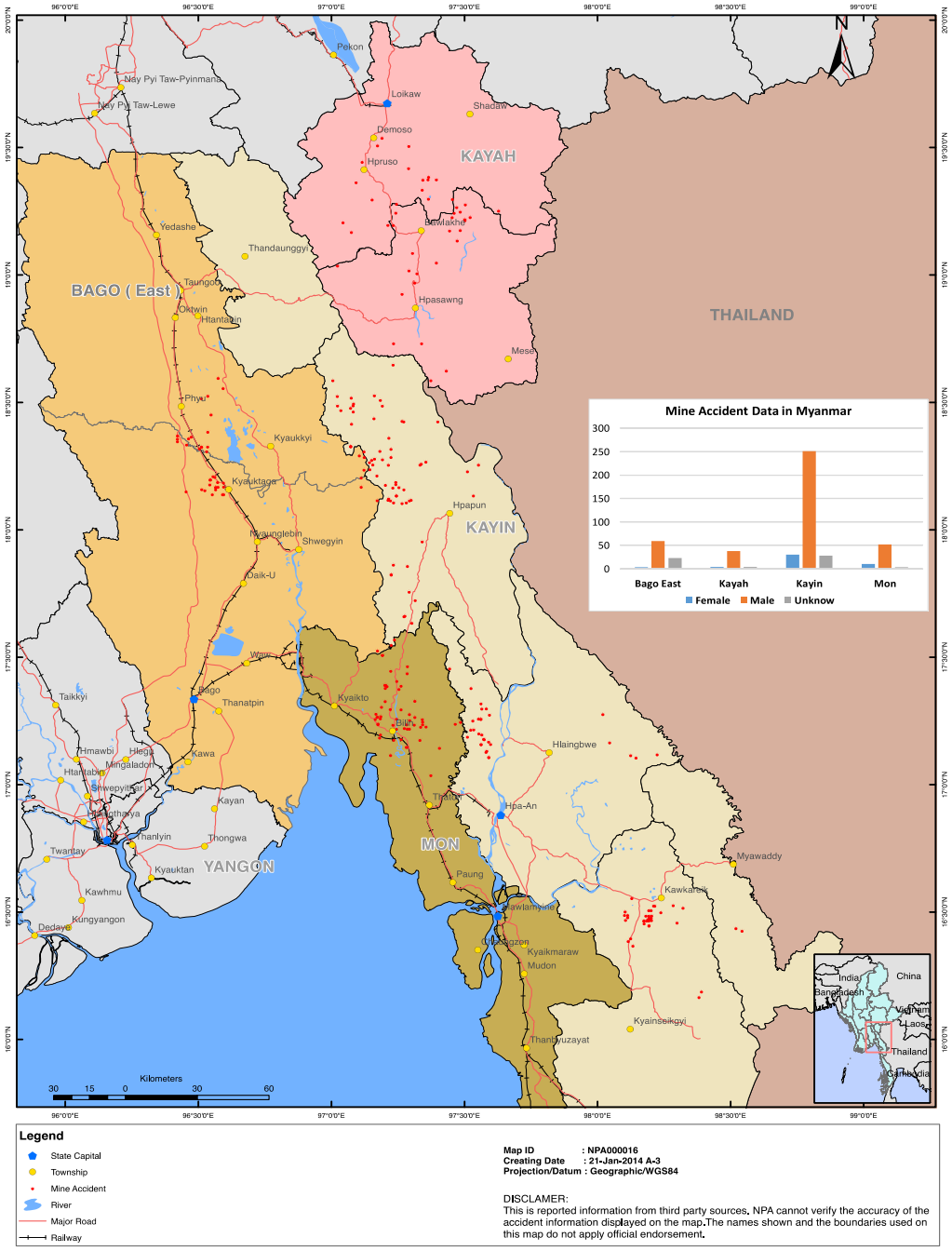
[19] Source: Ref. 824, Department of Archaeology, 04/10/1996
[20] Source: Ref. 820, Department of Archaeology, 04/10/1996
[21] Source: Mine Action Group. www.maginternational.org

187. About 55 townships in Kachin, Kayin, Kayah, Rakhine, and Shan states suffer from some degree of mine contamination. According to the Mine Action Review, Kayin state is suspected to contain the heaviest mine contamination and have the highest number of recorded victims. Based on available information from the Mine Action Monitor, the identified landmine suspected areas of the project are in all seven project townships in Kayin namely, Hpa-An, Paingkyon, Hpapon, Zarthapyin, Kyainsekgyi, Kan Ma Maung, and Kataingti.[22]

188. Figure 17 presents the Mine Accident Data in 2014 which shows that the highest reported mine accident occurred in Kayin State. There are no reports of mine contamination in Ayeyarwaddy Region.

[22] Source: Mine Action Review. www.mineactionreview.org

Figure 17 Mine Accident Data, 2014



Sources: MIMU

6 Information Disclosure and Public Consultation

6.1 Information Disclosure Process

189. A Public Consultation Plan was prepared that covers the consultation and information disclosure activities to be implemented by the Electricity Supply Enterprise (ESE), with the assistance of Project Preparatory Technical Assistance (PPTA) consultants. The ADB Safeguards Policy Statement (2009) and ADB Public Communication Policy (2011) guided the preparation of the plan. Both policies promote transparency, accountability, and the disclosure of information in a participatory manner.

6.1.1 Objectives

190. The public consultation aims to undertake the following:

i. Inform the stakeholders about the proposed project and its objectives

ii. Present the anticipated environmental and social impacts of the project and proposed mitigation measures

iii. Gather concerns and suggestions from the stakeholders on environmental and social issues related to the implementation of the proposed distribution component.

6.1.2 Methodology and Identification of Stakeholders

191. The safeguards team met with ESE and ADB to discuss and design the consultation process following ADB's Safeguard Policy Statement (2009) and the ADB Public Communication Policy. The Public Consultation Plan that outlines the agenda, list of invitees, and draft letters of invitations was developed. Considering the number of subprojects under the Distribution Component, it was agreed with ESE and ADB that public consultation meetings will be organized at the region/state level in Ayeyarwaddy, Bago, Kayin, and Mon and that township consultations will be held in selected townships in each region/state and that participants from other townships will be invited to attend the region/state and township consultations. Consultations in Rakhine State were cancelled due to ongoing conflict and security issues in the state.

192. The following were invited to the consultation meetings: state, district and township level representatives of the General Administration Department (GAD), Agriculture Department, Forestry Department, Environmental Conservation Department, Land Records Department, village/ward administrators, Parliament representatives, civil society groups, community-based organizations, non-government organizations, women's groups (e.g. Women's Affairs), township elders, and affected land owners.

193. The public consultation meetings were supplemented by small group meetings and random interviews with village and township representatives such as monks, land owners, and farmers. Meetings were also held with other relevant national Government agencies in Naypyitaw such as the Environment Conservation Department (ECD), Pollution Control Division and Natural Resource and Environmental Impact Assessment Division (NR-EIA), and Forest Department (FD) of the Ministry of Natural Resources and Environmental Conservation (MONREC), Department of Meteorology and Hydrology of

the Ministry of Transport and Communications and Department of Agriculture and Department of Agricultural Land Management and Statistics of the Ministry of Agriculture, Livestock and Irrigation to gather information on site facts and prevailing conditions. The opinions of all those consulted helped in the planning and design of the Distribution Component and in developing the environmental management plan.

6.1.3 Schedule of Public Consultation Activities

194. Table 23 summarizes the public consultation and information disclosure activities that were conducted for the project while the documentation of the consultations is presented in Appendix B.

Table 23 Schedule of Public Consultation Activities

Date	Activity	Location	Participants
16 August – 13 September 2017	Random interviews with village stakeholders and township representatives	Locations of sub-projects	Village/ward representatives, monks, community members
30 September 2017	Public consultation for Bago Region	Thegon township, Bago West	Representatives of GAD, Township Youth Association, Red Cross, Mother and Child Care Association, community members
9 October 2017	Public consultation for Bago Region	Bago City, Bago Region	Representatives of Mon Literature and Culture Committee, Taw Kywe Inn sub township, Nyaung Lay Bin township, Phyu township, Kawa township, Pyontazar, Red Cross, Pa-O ethnic group in Taw Kywe Inn, Shan ethnic group in Taw Kywe Inn, community members
11 October 2017	Public consultation for Ayeyarwaddy region	Pathein township, Ayeyarwaddy Region	Representatives of Delta Area Protection and Development Organization, community members from Phya Pone
12 October 2017	Public consultation for Ayeyarwaddy region	Zalun township, Ayeyarwaddy Region	Representatives of division engineer's office, Danuphyu township, Zalun Senate, ethnic groups, community members
16 October 2017	Public consultation for Mon State	Kyeikhto township, Mon State	Representatives of Sanung Naing Gyi village trace, village administrator, Forest Department, civil society organization Kyeikhto, Kantkaw ward
17 October 2017	Public consultation for Mon State	State Electrical Office, Mon State	Representatives of Thanbyuzayat community, Mawlamyine, Rubber Plantation and Production Association, community members

Date	Activity	Location	Participants
19 October 2017	Public consultation for Kayin State	State Electrical Office, Hpa-An township	Representatives of Paing-kone village, Women's group, Mother and Child Care Association (Hpa-pun), Paung village, Paingkyone village, community members
20 October 2017	Public consultation for Kayin State	Community Hall in the Monastery, Kyonephe Village, Zarthapyin, Hpa-An	Representatives of Kyonephe village, Thanhle village, Khataratwin village, Zar-thapyin west, Fire Brigade Department of Zarthapyin, and community members

6.1.3.1 Random Interviews

195. The reconnaissance survey and informal interviews were undertaken from 16 August − 13 September 2017. The small group meetings and random interviews were conducted simultaneous with the reconnaissance survey of the project sites during the environmental and social assessment process. The village and township stakeholders were initially informed about the proposed project. Questions on project awareness, perception on the project, land ownership, environmental issues in the project area such as flooding, waste management, distance and presence of protected areas and culturally sensitive areas, and concerns/suggestions/recommendations on project implementation were discussed with the stakeholder/village representatives.

196. The following are the issues raised by the stakeholders who were met:

a. In general, all the stakeholders welcome the proposed project because of the expected benefits of electrification in the villages.

b. There are land owners who are willing to donate their land to the Government to help the community get electricity from ESE.

c. Concerns that were raised are about possible damage to crops (rice paddies). Construction and installation of the transmission lines should be scheduled during the dry season to avoid the planting season of rice.

d. Farmers who were interviewed in Swar township said that they do not care about damage to their crops as long as they have electricity.

e. Some respondents said that current power supply is available only for a few hours daily and that there is frequent power interruption. Damage to equipment and other machines run by electricity is experienced because of the unstable power supply.

f. Those without electricity connection said that the project will help improve their lives because of the convenience it will bring. The project may also help improve business operations.

6.1.3.2 Consultation Meetings at the Regional/State and at Selected Township Level

197. During the reconnaissance survey, affected stakeholders were identified in preparation for the public consultation meetings. The consultation meetings were held at the

regional/state level and at selected township which is strategically located to allow other nearby township stakeholders to attend.

198. Invited to the consultation meetings are the General Administrative Department (GAD) of townships, Environmental Conservation Department (ECD) and Pollution Control Division (PCD) of MONREC, Department of Agriculture, Lands Authority, and Forestry Department. Also invited were community stakeholders that included affected land owners of sites of substations and transmission lines, sharecroppers, women's group in the villages, community-based organizations, and ethnic groups.

199. The following is the agenda of the consultation meetings:

i. Project presentation by ESE

ii. Presentation of environmental and social impacts and mitigation

iii. Open discussion

200. During the open discussion, the participants were asked about the following:

i. Awareness of the project

ii. Perception on the project

iii. Anticipated positive impacts of the project

iv. Anticipated negative impacts of the project

v. Approval/disapproval of the project

vi. Suggestions and recommendations.

201. About 500 participants attended the eight public consultations conducted at the regional and township levels. In general, the participants aired their support to the proposed project. They want the project to be implemented as soon as possible in their respective townships and villages so that the people can enjoy the benefits of electrification. The concerns raised by the participants are on the following:

i. There should be fair compensation for affected land and damage to crops.
ii. The implementation of the project should be done during the summer season to avoid damage to crops.
iii. Safety clearance should be complied with in terms of distance from houses and trees
iv. Community members can be hired during the construction.
v. Cuttings from tree branches should be given to the community for free.
vi. Trainings and information materials should be given to households to increase awareness of the community on electrical safety.
vii. In case of trees along the line alignment, the ESE should inform the Forest Department prior to implementation so that survey can be conducted first.
viii. Areas prone to landslides should be avoided when installing lines.
ix. Protection against lightning should be provided in the substations.

202. The comments from the stakeholders who attended the public consultations and the responses of MOEE/ESE are summarized in Table 24.

Table 24 Summary of Issues raised during the Public Consultations

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
A. Public Consultation held on 30 September 2017 in Thegon Township, Bago West		
U Myo Htut Divisional Senator of Thegon	The Power Network Development Project will assist the national electrification plan of the MOEE. We therefore welcome the proposed project.	Noted
U Than Htaik Aung Township Youth Association	Who will compensate the land, cultivate crops?	The compensation rate for various land and crops will be determined according to the state and division government.
	Can the community work even under the transmission lines?	The community can still continue planting rice under the transmission lines.
	How will you take care of the tree branches? How will you dispose of the cuttings? What are the chances for the community to have work from the project?	The cuttings can be given to the community as fire wood for free. Workers from the community can be hired during construction.
	New substations should be constructed where there are few houses.	This will depend on the technical design.
Dwa Tin Tin Aye Ward (1), Thegon Red Cross	Are there safety rules? There should be workshops and trainings for the community on safety of electrical lines.	The ESE gives pamphlets to households with measures on electrical safety. The measures are according to the electricity rules and regulations.
U Than Htaik Aung Administrator, Township Youth Association	If there is power interruption, it often takes time for ESE to remedy the situation. ESE staff should have training and be qualified.	ESE conducts training for staff every year.
U Thein Htun Community member	The implementation of project should be done during the summer season to avoid damage to crops.	Noted
U Thein Lwin Community member	We welcome and thank ESE for the project. We are happy because our village will be electrified soon.	Noted
Daw Pyone Mother and Child Care Association	We urge ESE to immediately implement the project.	Noted

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
U Win Khaing Community member, Thegon	How much is compensation for crops?	If the pole is in the paddy field, the ESE usually does not provide compensation because the area of the pole is very small. If there is a new substation, the affected land will be compensated.
B. Public Consultation held on 9 October 2017 in Bago City, Bago Region		
U Myat Oo Htun Pyontazar community leader	I appreciate the plan to manage the social and environmental impacts based on the impact assessment. If there are issues, the ESE, community leaders and the community will need to cooperate.	Noted
Daw Tin Nandar Win Volunteer, Red Cross, Bago	We are using fire wood and charcoal for cooking so we spend a lot of money. This will have an impact on the environment. If we get electricity, we will cook using electricity if this is not so expensive. In such way, we can also protect the environment.	Noted
U Khon Win Aung Pa-O Ethnic, Tawkyweinn	We fully support the project.	Noted
U Nay Mainda Shan Ethnic, Tawkyweinn	We fully support the project.	Noted
C. Public Consultation held on 11 October 2017 in Pathein Township, Ayeyarwaddy Region		
U Htun Shwe Delta Area Protection and Development Organization	How much is the land and crop compensation?	The compensation shall be given according to the rate approved by the committee organized by the state and divisional government.
U Thein Htun Community member, Phyapone	What is the rate of return of the project?	This is still being studied.
U Aung Khaing Win Community member, Phyapone	We would like to have electricity as soon as possible. We want the project to materialize as soon as possible.	Noted
D. Public Consultation held on 12 October 2017 in Zalun Township, Ayeyarwaddy Region		
U Soe Paing	The community will benefit 100% from the project. The	Noted

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
Community member	community will give its full support to the project.	
U Soe Lwin Retired Divisional Engineer	The project will support the social and economic development of the community. However, during implementation, the project should prioritize safety first.	Noted
U Kyaw Soe Community member, Danuphyu	We are very happy because the project includes our community. We also appreciate that the project is also protecting the environment.	Noted
U Aung Naing Zalun Senate Representative	We are happy to know that the project will be coordnated with the village community. Prior coordination with the village is very good. We also appreciate that compensation will be given to affected land or property based on discussion with the community.	Noted
U Kyaw Soe Ethnic representative	The line should be 100 feet away from the petrol station.	Noted
E. Public Consultation held on 16 October 2017 in Kyeiktho Township, Mon State		
U Maung Win Community Leader	We are very happy with the proposed project. The existing substation at Kyeiktho is very small and undated so we want to upgrade this substation. There should also be staff housing.	Noted
U Than Lwin Saung Naing Gyi Village Tract, Village Administrator	We are happy with the proposed project and we will support in case ESE needs out help.	Saung Naing Gyi substation is a JICA project. When ESE needs help, we will let the community know. We appreciate your help to ESE.
U Haung Lwan Officer, Forest Department, Kyeiktho	In case there are trees that will be cut along the alignment, please let the Forest Department know about this as early as possible so that we can conduct the survey first. Some areas for the elecrtric lines and posts may have problems about landslide which is dangerous. When ESE chooses the area for the posts, please consider the	When the proposed project is confirmed by ESE, we will conduct the survey of the lines and the post before implementation.

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
	trees to be cut and landslide prone areas.	
U Aung Zin Latt Civil Society Organization, Kyeiktho	When the transmission line is constructed, are there impacts on social and environment?	We will avoid the impacts on the people and the environment. If there are some impacts, we will discuss this and implement measures to avoid adverse impacts.
U Min Min Aung Kantkaw Ward Administrator, Kyeiktho	Before the project is implemented, ESE needs to coordinate and discuss first with the land records department and the general administration department with regards to the right-of-way.	We will do this first before implementing the project.
F. Public Consultation held on 17 October 2017 at the State Electrical Office, Mon State		
U Ban Moe Thanbyuzayat community	When the project is confirmed and before construction of the transmission line, ESE needs to conduct survey first of the alignment. In the past, there was no survey and so many trees were taken off and caused severe impact to the environment.	Everytime ESE constructs the lines and installs the posts, we conduct the survey first. There are rules and regulations for the constrution of lines and posts because we need to make sure that the alignment will meet electrical safety and clearance requirements.
U Aung Min Mawlamyine	How much is the loan from ADB? When will the Government get the loan? How about the interest rate? We want the project to be implemented as soon as possible.	The total loan is about 400 million for the five states/regions in Kayin, Mon, Ayeyarwaddy, Rakhine and Bago. Maybe by next year, after the confirmation of the project project, we can implement the project. We do not know yet the interest rate.
U Aung Zin Deputy Chairman of Rubber Plantation and Production Association	In some projects, the compensation requested by the owner of rubber plantation was too much. For example, the market price at for one acre for rubber is 50000 or 60000 but	We will choose the alignment of the lines and posts where there is no impact. If we cannot avoid, we will choose the alignment with the least

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
	they want 100000. In this project, how will you handle the compensation in such case?	impact. When the project is confirmed, we will request the help of the community to give us the best alignment or route. If there is compensation, ESE will coordinate with the community to discuss the fair price, agreeable to both the affected households and ESE.
G. Public Consultation held on 19 October 2017 at the State Electrical Office, Hpa-An township		
U Win Shwe Paingkyone Village Administrator	How much is the price of land for one acre? The land owner wants 80 lakhs for one acre. On the land there are mango trees and palms.	We cannot determine at this time the price of land because the project is still in the proposal and study phase. When the project is confirmed, the price will be the market price agreed with the owner and ESE. This will depend on the government price, what is planted on the land, for example, rubber or teak, etc.?
Daw Sandar Hlaing Mother and Child Care Association, Hpa-Pun	The local people warmly welcome the project and we want it to proceed as soon as possible.	Noted
Daw Shwe Hnin Paung Village	We warmly welcome the project because it has many advantages in terms of economic, education, and health.	Noted
U Win Swe Paingkone Village Administrator	When will the project start?	We cannot say the exact date but maybe in 2018.
H. Public Consultation held on 20 October 2017 at the Community Hall in the Monastery, Kyonephe village, Zarthapyin, Hpa-An		
U Than Win Kyonephe village	What are the advantages of the new substation? Will the project have impacts on crops? What is the quality of electricity?	When there is a new substation, the quality of electricity will be better and more reliable than before. For the crops, the ESE will avoid and reduce impacts to crops, the community, and the environment as much as we can. But if there are high trees near the transmission line, the ESE will need to cut or trim the

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
		trees because of safety clearance requirements.
U Thein Myint Kyonephe village	For the construction of the substation, are there any safety issues? How will this be managed? Will there be danger of thunder because of substation near the village?	ESE will take precautionary measures to ensure safety. MOEE will make sure that safety of the community is a priority. There is no impact on the environment and community because of the substation. There will be lightning arresters and management system at every substation so there is no need to worry about this.
Daw Win Shein Kyonephe village	Can villagers build a house and how many feet away from the substation?	There are guidelines under the electricity rules on the safe clearance from lines depaneding on the voltage of the line.
Daw Ngwe Wint Kyonephe villahe	Will there be involuntary acquisition of land?	ESE will buy the land for the substation at fair price.
U Aung Naing Oo Thanhle village administrator	We want the project as soon as possible.	Noted
U Htun Myint Kyonephe village	We want the project to be implemented very soon.	Noted
Daw Hla Than Kyonephe village	We support the project and we hope that this will be implemented soon.	Noted
U Tin Ohn Than Khatar atwin village	We hope the project will provide good quality voltage.	Noted
U Soe Tun Khatar atwin village administrator	The project should provide good and reliable voltage.	Noted
U Ngwe Tun Zarthapyin West	When will the project start?	If the project is confirmed, maybe the project will operate in 2019.
U Hlaing Htwe Office of Fire Department, Zarthapyin	Is there any skills training for electrical safety?	Skills training are provided for staff but there is also basic training on electrical safety which is held for one week. ESE just completed four trainings at the office.

6.1.3.3 Meetings with Government Agencies

203. Interviews with relevant Government agencies such as MONREC and various departments were conducted as part of the due diligence of the proposed project. The in-depth interviewd primarily focused on presenting the project concept design, obtain baseline environmental, land use and cultural information for the project sites as well as Government clearance requirements. The opinions of the agency representatives who were interviewed on environmental concerns to be considered in the design and their suggestions to properly implement the project were also discussed. Table 25 summarizes the important issues that were discussed during the in-depth key informant interviews.

Table 25 Summary of Issues Identified during Meetings with Government Agencies

Agency/Office/ Persons Consulted	Date of Meeting	Issues Discussed
Environmental Conservation Department Naypyitaw U San Oo, Ph.D. - Director	September 14, 2017	• The proposed distribution component will only require an EMP. The outline for the EMP is in paragraph 63(h) of the EIA Procedures. The monitoring requirements is in paragraph 109. The MOEE has to disclose the IEE or EMP at its website. • There are four legal instruments on environmental management. These are: (i) Environmental Conservation Law, 2012, (ii) Environmental Conservation Rules, 2014, (iii) EIA Procedures, 2015, and (iv) National Environmental Quality Emission Guidelines (NEQEG), 2015. • The NEQEG adopts the guidelines from 5 countries. The environmental quality standards is still being developed but once this is completed, the standards will replace the NEQEG. • There are no regulations yet on solid waste and hazardous waste management but city development committees such as in Yangon have developed rules for waste management.
Pollution Control Division, Naypyitaw U Min Maung - Director	September 19, 2017	• There are no data on air and water quality since the department has just been organized in 2012. • The Myanmar Environment Institute is conducting air quality and water quality analysis as part of the process of developing the environmental standards. Sampling was conducted recently in selected areas in Bago and Ayeyarwaddy. • The National Waste Management Strategy and Action Plan has been

Agency / Office / Persons Consulted	Date of Meeting	Issues Discussed
		drafted with support from IGES and UNEP. The plan adopts the 3Rs of waste management heirarchy. • The Hazardous Waste Master Plan is still being developed with support from the Norwegian Government. This is not yet ready for sharing. • Currently, there are no regulations on hazardous waste and there are no recognized hazardous waste treaters in the country. The project can just store and properly manage the hazardous wastes while the regulations is still being drafted and an established hazardous waste treater is identified.
Forest Department Naypyitaw U Tin Htun - Director	September 19, 2017	• MOEE needs to submit an official letter to the Forest Department with a map showing the line route. The Forest Department will then conduct a field survey to check if there are trees along the route. • The Forest Department will coordinate with the Division and State during validation and then inform MONREC about its findings. • Trees that are inside a private property and compound are not regulated. • Trees along the road or on forest land, permanent forest estate, protected area and Government land for disposal are regulated by the Forest Department. • For every tree that will be cut in protected area or forest tree plantation, the compensation is: for teak > 1 ft circumference = 15,000kS; for other hardwood >1 ft circumference = 7,500Ks. There is also additional cost for seedlings and replanting. • For teak and hardwood trees in permanent forest estate and land for disposal of Government, the compensation is the same but there is no additional cost for seedlings and replanting. Trees along the road is part of land for disposal of Govern-ment. • For trees in private land, the MOEE just needs to negotiate with the owner and discuss with the General Administration Department.

Agency/Office/ Persons Consulted	Date of Meeting	Issues Discussed
Department of Meteorology and Hydrology, Ministry of Transport and Communications, Naypyitaw Daw Khin Cho Cho Shein - Director	September 22, 2017	• The Myanmar Action Plan for Disaster and Climate Change Reduction 2012-2016 was completed in April 2017. The plan covers all regional and states of Myanmar. There is a profile for Rakhine an Ayeyarwaddy in the UNDP report. • In 2015, strong typhoon hit the country and the states/regions of Chin, Rakhine, Bago, Magway, and Ayeyarwaddy were declared as flood-prone areas.
Department of Agriculture, Ministry of Agriculture, Livestock and Irrigation, Naypyitaw Daw War War Thein – Deputy Director (Land Use Division) U Than Htut – Director (Statistics)	September 22, 2017	• Majority of land in Myanmar is generally classified as agricultural land. The classification includes agricultural (orchard, rubber, farm, plantation), lowland (for rice cultivation), upland (for other plants and crops), and sedimentary deposits (near river). There are also coastal areas where mangroves exist.

6.2 Future Public Participation and Information Disclosure

204. The stakeholder consultation strategy that was developed and implemented in this IEE will be continued during detailed design of the project. The first step will be to disclose the English version of the draft IEE at the ADB website and the Burmese version at the MOEE website. At a minimum, the Executive Summary of the IEE will be translated in Burmese language and distributed to the General Administration Offices of townships and regions/states. The IEE should also be available at the regional and state ESE offices.

205. As indicated during the public consultations, the stakeholders would like to be consulted and informed prior to the start of the project implementation. During detailed design, the transmission line alignment and proposed locations of poles will be presented to the villages, affected landowners and township representatives to discuss the most viable option for the location of poles. Disturbances and damages that may occur and how this will be avoided will be discussed including acceptable compensation for affected land, crops, and trees. These issues will be reviewed during follow-up consultations throughout the construction phase until the completion of the project.

206. During operation of the project, households will be provided with pamphlets containing information about electrical safety, safety clearances, and energy conservation measures.

7 Potential Environmental Impacts and Mitigation

207. The environmental impacts were identified based on the scope of work and by evaluating the environmental situation at the project areas. The identification of environmental impacts was mainly based on the technical information related to project components design and operation, field visits, and information from stakeholder consultations.

208. The impacts are presented according to those that are related with the design, selection and location of the project facilities; impacts associated with construction activities; and impacts related to the actual operation of the project.

7.1 Pre-Construction Phase

209. The potential environmental impacts during the design and pre-construction phase of the project are related to the siting of the substations and route of transmission lines. There is potential for the substations and transmission lines to affect houses, agricultural land, plantation areas, and trees along national/district/village roads.

7.1.1 Land acquisition and damage to trees and crops

210. Impacts. The proposed project will involve permanent and temporary land acquisition. Land will be permanently affected by the construction of the substations and installation of transmission poles. Permanent land acquisition will be for the substation area and for the location of transmission poles.

211. For the transmission line route along the road, there are also trees that may be cut to ensure compliance with electrical safety clearance. Based on information from the Forest Department, trees along the road are regulated by the Department since roadside trees are considered as within the area of Government land for disposal. Certain types of trees such as teak trees and other hard wood species along the road will require compensation according to the Forestry Law. There are also substation areas where there are teak trees, cashew plantation and rubber trees in privately owned land.

212. In addition, there will be land that needs to be temporarily acquired for the access or paths going to the pole sites from the road and land and crops that will be damaged during pole installation and line stringing. There will also be temporary material storage sites and construction camps during the construction of the project. Other areas that will take up land temporarily during the construction stage are borrow areas and spoil disposal sites.

213. The information on permanent and temporary land acquisition and affected structures, crops, trees and other properties will be further detailed in the Resettlement Plan.

214. Mitigation Measures. The final design of the route of the transmission line will be refined to avoid houses and trees to the maximum extent possible. The maximum allowable height of a tree below the transmission line will be maintained in accordance with the requirements of the Electricity Law. Tall trees within the ROW will be removed or trimmed as necessary to comply with the minimum conductor clearance.

215. If there are roadside trees to be cut, an official letter will be submitted by the MOEE to the Forest Department together with the map showing the line route to identify

trees that will be cut and the appropriate compensation needed when there are teak and hardwood trees that will be affected. For trees in private land, the MOEE/ESE will negotiate with the land owner in coordination with the General Administration Department (GAD) of the town and village.

216. Continuous information disclosure and consultation with affected persons will be conducted in coordination with the GAD and village/ward heads. Landowners will be compensated for temporary loss of access to crop areas during pole installation and line stringing and from damage brought about by hauling of materials to sites. The ESE will design and provide an appropriate land acquisition and compensation plan for the affected areas in accordance with ADB and the national requirements.

217. After the completion of construction works, the temporary access to the pole sites will be restored to original condition before the same is returned to the affected person. Any damaged crops or income loss arising from the inability of the affected person to plant crops during the temporary use of land will be compensated by the civil works contractor. The ESE will ensure that this condition is stipulated in the contract of the civil works contractors.

7.1.2 New Substation Environmental Design

218. Existing Condtiions. The environmental compliance audit of existing substations showed that there are areas for improvement and corrective actions that could be implemented in the design and operation of the proposed project. The environmental compliance audit report is presented in Appendix D. Some of the issues noted during the audit are the following:

i. There were traces of oil spill surrounding transformer areas notably from periodic testing of oil and replenishment of oil.

ii. The existing design of transformer pads in all the substations do not have oil pits that could contain spill in case of breakdown of the transformer.

Figure 18 Typical configuration of transformers at existing substations standing on concrete platform/foundation

The transformer platform at Oktwin substation but without oil pit.

A 66/11 kV transfortmer at Nga Yoke Kaung installed in 2015 but no oil containment. The transformers are standing on concrete foundation.

iii. Lack of hazardous waste management system, i.e for old batteries, damaged equipment. There is a substation in Kanyuktwin where a damaged suspected PCB transformer was found.

iv. Lack of new materials and equipment storage area at substations. The substations have limited area for the control room, office and staff house. A substation in Oktwin temporarily stores new batteries in a makeshift hut which exposes the new batteries to environmental elements.

v. Drainage canals do not drain towards the road canal but to adjacent land or paddy field. There are substations which will require backfilling to elevate the land up to the level of existing substation and road such as in the case of Oktwin and Kanyuktwin substations. Backfilling would result to soil runoff into adjacent paddy fields since the substations do not have drainage canals leading to the road canal.

vi. Lack of appropriate fence and warning signs at substations that could deter animals and unathorized persons from entering the compound. Existing substation fence typically consists of barbed wire which will not restrict entry of unauthorized persons and animals to the substation compound. A newly built substation in Nga Yoke Kaung has a sturdy fence but it is not high enough to prevent people from going over the fence. Warning signs are also not available that would deter people from entering dangerous electrified areas in the substation.

Figure 19 Examples of existing substation fence

Barbed wire fence in existing Thegon substation which will not prevent people and animals from entering the substation compound.

Fence at Nga Yoke Kaung substation which was installed in 2015. The fence is quite sturdy and includes a concrete foundation to prevent animals from entering under the fence. However, the fence is not high enough and one can easily go over it.

vii. Lack of personnel protective equipment (PPE) for workers. Substation workers were found to be wearing only bare slippers and no hard hats while roaming around the substation premises. There were also not enough working fire extinguishers.

viii. There is no monitoring of electromagnetic field (EMF).

ix. There are still sulfur hexafluoride (SF_6) circuit breakers with ceramic insulators at the existing substations which are more prone to breaking and explosion and release of SF_6 gas[23].

219. Corrective Actions. During detailed design of the substations, there are several recommendations to improve the design and make it more environmentally sound. The following design parameters will be considered for the new substations:

i. The design of the transformer pad area will include an oil pit to ensure that any leak from the transformer can be collected, thus, avoiding any spill to the ground and the surrounding areas. Examples are shown in Figure 20.

Figure 20 Examples for oil pits for the proposed project

Example of oil pit with filter system for small transfomer

Example of oil pit for large transformer

Source: https://www.gmtinternational.fr/

ii. Storage area for new materials and spares will be provided at the substation to avoid damage and exposure of new materials and parts to environmental elements. An inventory of spares will be kept at the substation.

iii. Adequately sized drainage canals at the substations will be provided. The drainage canals should drain towards the road canal and not towards adjoining areas and paddy fields.

iv. The substations will be provided with security fence to avoid unauthorized persons from entering the compound. The proposed fence will be galvanized mesh wire, 2.2-meter high, with an outgoing anti-climbing section and with concrete below to prevent animals from entering. In addition, warning signs will be provided to inform the people about dangerous electrified areas in the substation.

[23] SF_6 is a potent greenhouse gas that was evaluated by the Intergovernmental Panel on Climate Change (IPCC) with a global warming potential of 23,900 times more than carbon dioxide (CO_2)

Figure 21 Example of proposed substation fence

Example of galvanized mesh wire with outgoing anti-climbing section
Sources: http://kansasfenceco.com/photo-gallery/5211358; http://www.fencedout.com.au/portfolio/page/7/

Example of security fence with warning signs.

v. The technical design of the substations will consider the use of SF_6 circuit breakers because of its technical and economical advantages. To avoid damage in case of explosion that would cause the release of SF_6 gas, the project will use insulators made of composite and rubber instead of ceramic insulators.

vi. Non-PCB containing transformers will be installed at the substations.

vii. Waste segregation areas will be designated at the substation compound for hazardous wastes and damaged materials. The different types of hazardous wastes such as old batteries, damaged meters, capacitors, switches, used oil, and transformers will be placed in the hazardous waste storage area before these are collected by the ESE regional warehouses.

viii. Waste segregation areas for regular solid wastes will be designated inside the substation compound. Biodegradable and non-biodegradable waste bins will be provided with appropriate labels to guide substation staff of the types of wastes that will be disposed in each bin.

ix. Electromagnetic field (EMF) will be regularly monitored at the substations and at the periphery particularly those near residential houses and sensitive receptors.

7.2 Impacts and Mitigation Measures during Construction Phase

220. Construction activities at the substations will include landfilling and earthworks, civil works for the foundations, substation building, and other structures, installation of

the new transformers and other equipment, and testing and commissioning. The constructon works for the transmission lines will involve excavation/digging and installation of tower footings, movement of construction vehicles, line stringing and installation of electrical equipment. Construction activities of the proposed subproject sites are expected to generate the following impacts:

i. Requirement for borrow materials for the substations

ii. Sediment generation and soil runoff caused by excavation and earthworks

iii. Effect on air quality from vehicle and equipment exhaust and dust generated from construction activities

iv. Noise caused by vehicle and equipment

v. Effect on rice fields, cropland, and canals, from disposal of construction wastes, including domestic waste

vi. Traffic hazards and road degradation during the transport of materials and temporary parking of the vehicles along narrow roads

vii. Effect on health and safety of workers.

7.2.1 Borrow materials

221. Borrow materials will be required for the landfilling of substations to elevate the ground up to the level of existing roads. The landfilling works will be mostly in substations near paddy fields where elevation is about 1.5 meters below the road. It is estimated that for one substation, an average of 9,000 cubic meters of soil will be needed to backfill the area.

222. The backfill requirement will necessitate sourcing of materials only from legitimate sources. Quarrying of rivers will not be allowed without an appropriate permit from the Government. The contractor will be required to gather borrow materials from permitted sources only.

223. Construction materials will be sourced from approved sources, that are documented, where necessary, by (i) agreement of Landowner – e.g., lease contract; (ii) village approval; (iii) Environmental approval from the Environmental Conservation Department; and/or (iv) mining permit from the Department of Mines or township or district General Administration Department.

7.2.2 Soil runoff

224. Impacts. The agricultural land in the immediate vicinity of substations and along the ROW of the transmission lines will be impacted by runoff. During the construction period, civil works include land clearing, earthworks (backfilling and excavation), leveling, and grading. This will modify the landscape and change on-site drainage patterns. The result will likely be an increase in runoff to nearby properties which may result in an increase in soil erosion and sedimentation of canals, creeks and rivers.

225. Mitigation Measures. Timing is also one of the critical factors involved in erosion and sedimentation control in construction sites. Careful scheduling of construction operations can minimize the exposed area during the rainy season. Site clearing, earthworks, and other civil works will be scheduled during the dry season.

226. In order to prevent erosion and runoff of sediments, silt traps or temporary sedimentation facilities will be set-up to trap and settle out runoff from the construction

area. Likewise, temporary barriers and trenches will be constructed around the stockpiles of materials to control surface runoff.

227. The effect of sedimentation during project construction is only temporary. Upon completion of the construction stage, exposed surfaces at poles will be secured for structural stability.

228. The Contractor will be required to institute proper preventive and control measures that includes the following:

i. Excavation activities will be scheduled during the dry season.

ii. Stockpile of excavated soil may be covered and stabilized to prevent runoff.

iii. Provide sediment trap or inlet protection (fabric barriers around inlet entrances or block and gravel protection) to slow runoff velocity and catch sediment and other debris at the drain inlet.

7.2.3 Impact of fugitive dust and other emissions

229. Impacts. Air quality can be affected by the operation of vehicle and equipment, excavation and backfilling of soil, and transport of materials. There will be exhaust gas emissions containing TSP, SOx, NOx, and CO during operation of vehicle and equipment. Dust generation is expected with an increase in TSP ground level concentration due to earthworks, contact of machinery with bare soil, and exposure of bare soil and soil piles to wind.

230. Given the short duration of the construction period, the temporary nature of the construction activities and the rural setting at the project sites, the impacts associated with air and noise emissions are not expected to be significant. Mitigation measures such as dust suppression and minimization of traffic movements will be specified in the construction contracts.

231. Use of vehicle and equipment will be periodic and temporary. Therefore, impact on air quality to the community is low and localized within the pole locations.

232. Mitigation Measures. Best management practices will be applied to minimize impacts coupled with effective environmental monitoring. Mitigation measures to be applied include:

i. Stockpile of excavated soil will be covered and kept moist.

ii. Vehicles and equipment will be maintained regularly to ensure emissions comply with the standards.

iii. Construction materials such as cement, sand and aggregates will be covered during transit and while stored on-site.

iv. Burning of waste materials will be prohibited.

v. Require construction haulers to cover materials with tarpaulin or other suitable materials during transport of materials.

vi. Impose speed limits on construction vehicles.

7.2.4 Noise

233. Impacts. Noise produced during construction within the transmission poles will have negligible impact on the community because the villages are located far from the

site to be affected by construction noise. However, noise due to the movement of vehicles along the village access road and also in some areas along the ROW of the lines may potentially result to nuisance.

234. Mitigation Measures. Measures that can be applied to minimize impacts of noise are:

i. Operate construction equipment only at daytime and minimize works at night.

ii. Maintain regularly all vehicle and equipment to ensure good-working condition.

iii. Require drivers to minimize blowing of horn and to comply with speed limits, particularly when passing through residential areas.

iv. The Contractors will coordinate with the concerned communities on the agreed schedule of construction and transport of materials.

v. Comply with "Environmental, Health, and Safety Guidelines" (IFC) on the maximum noise limits on construction equipment near receptor sites, along access roads and some areas along the ROW, i.e. not more than 3 dB maximum increase in background levels.

7.2.5 Generation of construction wastes

235. Impacts. Different types of construction wastes are expected from project construction. These are old/dismantled equipment and parts, domestic solid waste, domestic wastewater, inert construction waste, hazardous waste, and excavated soil.

i. Old equipment and parts. There are subprojects which will require upgrading of substations and lines which will result to the dismantling and replacement of old equipment and electrical parts such as cables, conductors, switches, and other accessories. There are a number of transformers and equipment that will be dismantled and replaced which can accumulate at existing substations. Some of the equipment are still operational and could be utilized in areas which are in need of electricity. The impact is considered moderate because of the limited space available at existing substations and warehouses to accommodate the bulk of old equipment and parts that will be generated. A materials management plan is needed to handle these old equipment during the construction/rehabilitation/expansion of the substations and installation of lines.

ii. Domestic solid waste. In general, construction workers generate the domestic solid waste, which may include food wastes, plastic and glass bottles, paper, cardboard, and packaging wastes, among others. The impact is considered low, localized and short-term.

iii. Domestic wastewater. The direct discharge of domestic wastewater by construction workers may result to unsanitary conditions within the construction sites. If disposed untreated, the wastewater will cause degradation of water quality and contamination of groundwater that may lead to spread of waterborne diseases.

iv. Inert construction waste. These wastes can be scrap wood and metals, cement bags, aggregates and concrete debris, among others. These wastes are generally disposed of and/or landfilled in appropriate sites and represent no direct danger to health and thus considered of low impact.

v. Hazardous waste. Hazardous waste may include contaminated soils and machinery maintenance materials such as oily rags, used oil filters, used oil, empty paint and solvent containers, spent batteries, and spill cleanup materials. This will occur at substations and at regional/state warehouses particularly in the warehouses where minor transformer repair activities are being done. Potential release activities may be during storage, transfer, and disposal of these wastes. Wastes generated are anticipated to be small yet harmful to the environment and public health. The impact is considered high and localized for a short-term.

vi. Excavated soil. Most of the excavated soils are intended as fill material onsite. There is no anticipated waste from excavated soil.

236. Mitigation Measures. The Contractor will be required to prepare, educate workers and implement a material and waste management plan as part of the EMP. Mitigation measures to be applied include:

i. Develop a materials management plan in coordination with the ESE regional/state warehouses for the safe and organized storage and disposal of old equipment and materials that will be generated during the upgrade of substations and lines. The plan will include the inventory of dismantled equipment to keep track of the location of equipment, particularly transformers.

ii. Provision of adequate onsite sanitation facilities to prevent untreated sewage from being channeled into the drainage canals, irrigation canals, river and on land.

iii. Implementation of appropriate solid waste and construction waste collection and disposal system, with provision for stringent waste segregation of hazardous and non-hazardous waste.

iv. Designation of areas of impervious surface for equipment services, refueling, and wash down. The maintenance area for minor repairs at the regional warehouses will be provided with oil and grease traps to prevent oil from being washed into the offsite drainage canals.

v. Prohibit burning of wastes.

vi. Provide properly labeled waste disposal bins.

vii. Implement proper labeling and storage in leak-proof containers for hazardous wastes, on areas with concrete surface and secondary containment to prevent potential spills and leakages reaching soil or groundwater.

viii. Provide oil and grease traps.

ix. Provide portable spill containment and cleanup equipment.

7.2.6 Traffic hazard and road degradation

237. Impacts. There will be increase movement of heavy vehicles to the site during the transport of materials and equipment. This will result to an increase in risk of traffic-related accidents and injuries to local communities and local road degradation. Local

road networks particularly the 2-lane village roads to the lines, will be used and large vehicles containing special loads may cause traffic if unplanned and uncontrolled.

238. The impacts on traffic are anticipated to be low and short-term since temporary parking of delivery/hauling trucks along road will be done within a very limited time.

239. Mitigation Measures. The Contractor will be required to prepare, educate workers, and implement a traffic management plan as part of the EMP. Mitigation measures to be applied will include:

i. Schedule of movement of heavy vehicles will avoid peak hours of local road network wherever practicable.

ii. Monitor traffic at access roads to ensure project vehicles are not causing congestion.

iii. Ensure vehicles are maintained regularly and require that vehicles and machinery using combustion engines has and maintains valid operating permits throughout the project schedule. The permits shall form part of the bid documents.

iv. Manage traffic by posting warning signs and assigning flag persons to direct traffic on affected roads.

7.2.7 Impact on health and safety

240. Impacts. Construction activities may cause harm and danger to the lives and welfare of workers. Hazards during project construction and equipment installation include exposure to EMF, live power lines/equipment, chemicals and fire and explosion. General construction impacts include physical hazards, trip and fall hazards, exposure to dust and noise, falling objects, and ergonomic injuries and illnesses. These impacts are anticipated to be high during line synchronization.

241. Mitigation Measures. The Contractor will be required to prepare, educate workers, and implement a health and safety plan as part of the EMP. Mitigation measures to be applied will include:

i. Contractor must prepare, educate workers, and implement an Electrical Safety Plan; Fire Prevention, Safety and Management Plan; Education and Awareness Plan for HIV/AIDS, malaria and other diseases; and Integrated Control Strategy for Mosquito and Other Arthropod-borne Diseases as part of the Health and Safety Plan of the CEMP.

ii. Ensuring live-wire work is conducted by trained and certified workers with strict adherence to specific safety and insulation standards in electrical safety.

iii. Require workers to adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities in the ROW.

iv. Implement fall protection systems that include provision of hoisting equipment, safety belts and second (backup) safety strap for workers.

v. Conduct training of workers in the identification of occupational hazards.

vi. Provision of first-aid facilities readily accessible by workers.

vii. Post safety signs, reminders, or warning notices at visible areas onsite.

viii. Follow electrical safety regulations and good practices.

ix. Hire only trained and certified workers on electrical works.

x. Plan work site layout to minimize need for manual transfer of loads.

xi. Provide appropriate and accessible fire fighting equipment.

xii. Ensure unobstructed access of fire responders and egress of vehicles.

xiii. Provide security personnel in areas where appropriate.

xiv. Strictly implement a "No Alcohol and Drug Policy".

xv. Prohibit illegal activities such as but not limited to gambling.

xvi. Inform and educate workers on the Health and Safety Plan.

7.2.8 Community health and safety

242. Impacts. The project construction will result to moderate impacts associated with community health and safety such as unauthorized entry by the villagers into dangerous working areas.

243. Mitigation Measures. To mitigate these potential impacts, the civil works contractor will be required to develop community health and safety measures that include posting of warning signs to deter the public from entering dangerous work areas. The warning signage will be printed clearly in Burmese language for better understanding of the villagers. In order to minimize risks from construction traffic, all delivery vehicles will be required to observe the speed limit when passing through built-up areas. The contractors will be required to disseminate the plan to workers.

7.2.9 Impact on Natural Resources and Protected Areas

244. There are no identified environmentally sensitive areas in the immediate vicinity of the project sites. The sites are located near community areas where land has been disturbed by human activities.

7.2.10 Impact on Culturally Sensitive Areas

245. There are two cultural, heritage sites that were identified near subproject areas, namely, (i) Mrauk U archaeological area and monuments in Rakhine State and (ii) Sri Ksetra of the Pyu cities.

246. The Mrauk U archaeological area and monuments in Rakhine State contains temples, stupas and monasteries. The subproject nearest to this area is the Teinnyo (Mrauk U) 66/11 kV 5 MVA new substation and switchbay and the 66kV transmission line from the Mrauk U substation to Teinnyo village. The subproject will avoid the archaeological area and monuments and chance find procedures will be implemented in the event that physical cultural resources are unearthed during digging. The Department of Archaeology will be informed in case of chance find.

247. The Sri Ksetra in Pyay District, Bago Region is about 17 km away from the transmission line in Shwedaung. Although located at a distance from the heritage site, chance find procedure will be implemented. Any chance find of artifacts in this area will be

reported to the Department of Archaeology. Workers will be oriented and informed about the chance find procedure.

7.3 Operation Phase

248. The potential impacts of the operation and maintenance of the substations and transmission lines are generally related to the occupational and community health and safety issues as well as management of hazardous wastes. The impacts are reversible, manageable, and can be mitigated with proper engineering and management controls. Among the significant environmental impacts of the operation of the lines are:

i. Hazards to occupational and community health and safety such as exposure to high-voltage electrical equipment (electrocution), working in high elevation, exposure to EMF

ii. Generation of hazardous wastes.

7.3.1 Occupational health and safety hazards

249. Impacts. The occupational health and safety issues inherent to the operation of the substations and transmission lines include hazards due to exposure to live power lines and high voltage systems, working in heights and risks of accidents. Accidents that may occur include electrocution, fires, and explosion.

250. Workers may come in contact with live power lines during the maintenance of the facilities and electrocution from direct contact with high-voltage electricity. Electrocution is a hazard directly related to power facilities.[24] Furthermore, electric utility workers have higher exposure to EMF than the general public because of working in close proximity to electric power lines.

251. Accidents may also happen when working in high elevation. A worker safety plan will be implemented to reduce risks that include testing of structural integrity prior to proceeding with the work and the use of fall protection measures.

252. Mitigation Measures. Once the project is turned over by ESE to the regional/state ESE, all matters related to the operation and maintenance of the substations and transmission lines shall be supervised by regional/state ESE, including compliance with environment, health, and safety measures. The regional/state ESE shall be guided by the "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC) dated 30 April 2007 when working at the power lines facilities. Some of the prevention and control measures for health and safety when working with live high-voltage electrical equipment are:

i. Restricting access to electrical equipment by workers only trained and certified to work on electrical equipment. Personnel will wear PPEs at all times when entering danger zones.

ii. Adherence to electrical safety standards

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

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

iv. Provision of personal safety devices or PPEs for workers. ESE personnel will continue to be required to use appropriate PPEs and will attend appropriate safety training.

v. Observe guidelines to minimum approach distances when working around operational equipment. The entrance to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors will be kept locked unless such entrances are under the observation of a qualified person at all times.

vi. Identification of potential exposure levels in the work area including surveys of exposure levels and establishment of safety zones

vii. Posting of safety reminders and warning signs.

viii. Check compliance with "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC): Table 3 on the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[25] exposure limits for occupational exposure to electric and magnetic fields.

253. Switchboards, panel boards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized will be field marked to warn qualified persons of potential electric arc flash hazards.

7.3.2 Community health and safety

254. Impacts. The community may also be exposed to electrocution hazards as a result of direct contact with high voltage electricity or from contact with tools, vehicles, or other devices that come in contact with high-voltage electricity.

255. Mitigation Measures. To prevent these hazards, ESE needs to implement the following improvements:

i. Regularly check compliance of the transmission lines with the safety clearances

ii. Provision of warning signs at substations, particularly those located near built-up areas

iii. Grounding of conducting objects such as fences or other metallic structures near power lines.

iv. Check compliance with "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC): Table 1. ICNIRP exposure limits for general public exposure to electric and magnetic fields.

v. Regularly check compliance with list of prohibited activities within the ROW

7.3.3 Oil spill from transformer

256. Impacts. The ESE does not implement any servicing of transformers and other equipment at existing substations. This reduces the risk of oil spill. However, there are

[25] ICNIRP is a non-governmental organization formally recognized by the World Health Organization (WHO), which published the "Guidelines for Limiting Exposure to Time-varying Electric, Magnetic, and Electromagnetic Fields" following reviews of all the peer-reviewed scientific literature, including thermal and non-thermal effects. The standards are based on evaluations of biological effects that have been established to have health consequences. The main conclusion from the WHO reviews is that exposures below the limits recommended by the ICNIRP international guidelines do not appear to have any known consequence on health.

instances where minimal oil sample is taken from the transformer for testing. This process causes some oil to drip from the transformer. 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. The current design of substations does not provide for oil pits at transformer area, thus, increasing the risk of oil contamination of surrounding area in case of a major oil spill, i.e. breakdown or explosion of a transformer. The impacts are considered to be high.

257. Mitigation Measures. The areas around the transformers at substations will be provided with secondary containment with impervious bund capable of containing potential oil spill in the area. Discharges from these spill bunds will be directed to the oil-water separator.

7.3.4 Contribution to Climate Change

258. Currently, diesel generators are being used in subproject areas which are not yet tapped into the distribution system such as in Nga Yoke Kaung (160kVA), Hpapon (315 kVA), Kyainsekgyi (120 kVA + 240 kVA), Kan Ma Maung (365 kVA), and Gwa Kyain Ta Li (300 kVa + 200 kVA). The ESE supplies energy by means of diesel generators to these remote villages. There are also areas which suffer from frequent power interruption in which customers use diesel generators to supply power to households and businesses. These instances involve costs for fuel necessary for supplying the energy to households.

259. With the implementation of the project, new substations and transmission lines will be built which will displace the use of diesel generators. The PPTA consultants calculated the CO_2 emissions based on the energy consumption in the villages within the the scope the project that is supplied by diesel generators. Information were also provided by ESE and from previous experience of the PPTA technical team in other projects.

260. Based on information from the Myanmar Census Report 2015, 32.4% of households are electrified and 9.3% have electricity by means of generators. This information was compared with the ESE data on existing households in each subproject that are already electrified and the new connections with the proposed project.

261. From the statistical data and information available, it was calculated that the average annual consumption is about 767 kWh per household. This data was taken to calculate the average consumption of the villages in Nga Yoke Kaung, Hpapon, Kyainseikgyi, Kan Ma Maing, and Gwa (Kyain Ta Li). The average annual consumption of these villages supplied by diesel generators is around 2,585 MWh which is equivalent to about 2,327 tons of CO_2 emissions.

262. Using the data on the new household connections with the proposed project, the average annual consumption of these villages supplied by diesel generators is around 36,286 MWh which is equivalent to 32,658 tons of CO_2 emissions.

263. Based on this information, with the proposed project, it is expected that there will be less dependence on diesel generators which will translate to reduction on fuel cost and an estimated reduction of CO_2 emissions of around 34,985 tons per year.

7.3.5 Emergency Preparedness at Substation

264. Impacts. There are several risks that could occur with the operation of the substations. Among these are the likelihood of damage to equipment over time which could cause fire events and explosion of equipment.

265. Mitigation Measures. In case of fire events, explosion, and other related situations, a fire management program is included in the emergency preparedness and response plan of the substations. Sufficient number of fire protection equipment, fire suppressants, and fire water tank will be available to address the emergency requirements of substations.

266. Workers are also trained on emergency preparedness and response procedures and a manual on safety and emergency procedures is prepared and disseminated to workers. The health and safety guidelines include measures for fighting oil fires and cautionary measures when working with live power lines and working at height.

7.3.6 Trimming of vegetation

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

268. Private and communal trees and plants about 20 ft. height within the ROW will be either removed or trimmed 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 trimmed to reduce the potential to fall and strike these structures. Tree removal or trimming will also be undertaken immediately outside the ROW to prevent trees from falling and striking the lowest conductor.

269. 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 transmission 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.

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

7.4 Associated Facilities

271. The existing substations where the upgrading will be undertaken or new transmission lines will connect are considered as associated facilities of the project. An environmental compliance audit has been undertaken at these existing substations as part of the due diligence. The report is presented in Appendix D and documents the observations and corrective action plan.

7.5 Cumulative Impacts

272. The operation of the proposed substations and transmission lines are expected to result to beneficial social impacts to the community because of improvement in power supply. Furthermore, there are anticipated impacts associated with land use changes

because of the project. Rural urbanization and economic restructuring from agricultural to non-agricultural sectors is anticipated.

8 Analysis of Alternatives

273. Electricity transmission and distribution network in Myanmar is in need of substantial rehabilitation, upgrading and development. The increase in demand patterns during the last years and the demand forecast for the next five years have made the network structure insufficient to support the present load and the future demand projections.

274. The energy consumption varies highly between the different regions and states. There is a growing demand for electricity in the regions/states of Ayeyarwaddy, Bago, Mon, Kayin, and Rakhine. As the project benefits outweigh the potential environmental costs, the no-project alternative was rejected.

8.1 Selection of Regions and States

275. The energy consumption varies highly between the different regions and states. There is a growing demand for electricity in the regions/states of Ayeyarwaddy, Bago, Mon, Kayin, and Rakhine. In Ayeyarwaddy region, there is high population density and low electrical consumption per capita which indicates that the demand for development of the electrical grid in the region is high. Between 2017 and 2022, the maximum energy consumption per year will increase by 87.1% in Ayeyarwaddy, by 35.1% in Bago, by 62.5% in Mon, by 74.6% in Kayin, and by 199.8% in Rakhine.[26]

276. The regions and states were selected because in the increasing demand forecast for the next years and that the current situation of the distribution facilities will lead to high technical losses, poor quality and low reliability of power supply if the system is not upgraded.

8.2 Selection of Subproject Sites

277. In accordance with the ESE Development Plan, the subproject sites are currently without electricity. These sites complement the master plan and thus support the expansion of the distribution system in new areas. The subproject sites that were selected reinforces the existing distribution system through upgrading of old facilities. This will help ESE to expand its distribution coverage.

278. The sites were also selected to mitigate technical problems such as high losses, high voltage drop, low reliability and frequent power outages.

279. Another factor that was considered in the selection of subproject sites are the social benefits with the greater number of households that will have access to electricity. The subprojects are expected to bring electricity to schools, hospitals, temples, and offices. Based on initial estimates the project is expected to electrify 2,232 villages and

[26] Feasibility Study Myanmar Power Network Development Project, November 2017

343,788 households. Access to electricity in the areas covered by the project will also boost economic activities in these townships and villages.

280. Ownership of land is an important factor being considered by ESE in selecting alternative locations of substations.

8.3 Alternatives to Distribution System Configuration

281. The technical design team considered several alternatives to the configuration of the distribution system by studying several scenarios regarding the load flow of the transformers and by evaluating the losses in each component. These scenarios include evaluation of transformer load at 60%, 80%, and 100% of the existing and upgraded distribution system. The load flow analysis provided information on the losses and voltage drop of the existing distribution system as compared to values in the upgraded distribution system.

8.4 Alternatives to Substation Design

282. The typical substation design proposed for the 66kV and 33kV distribution substations is the simple bus bar substation. The design uses an H-arrangement which is used for supplying power to industrial consumers and distribution and transformer substations. According to the Feasibility Study, with only one busbar and a minimum equipment, the proposed H-arrangement is an economical solution to serve basic primary needs.

8.5 Alternatives to Transmission Lines

283. The design of the 66kV and 33kV lines will be overhead lines supported by concrete poles. The design of the tower will use the standard design.

284. Alternatives of alignment of the transmission lines will be along roads or through paddy fields. There are also short connections from planned substations to existing overhead lines. The technical team assessed that there are no obstacles to the in-out lines.

285. During detailed design, the exact location of the poles will be determined through ground truthing survey. The line alignment will avoid as much as possible houses and buildings and tall trees.

9 Grievance Redress Mechanism

286. A Grievance Redress Mechanism (GRM) is a systematic process for receiving, validating and addressing affected people's project-related complaints. A GRM is developed to address concerns of the community and stakeholders about the project in a transparent and timely manner.

9.1 Type of Complaints

287. Complaints about the implementation of the project may occur during the different phases of the project, i.e. site preparation, construction and equipment installation and during operation. Any affected person may raise and submit a complaint if the project activity has a detrimental impact on the environment, the community, or the quality of life of the people. Grievances may include the following:

- Negative impacts on a person or a community that includes adverse changes on the way of life and livelihood such as loss of trees, land, crops, water supply, power supply, irrigation, and other nuisances;
- Hazards to community health and safety including electrocution, fires, and explosion;
- Construction-related nuisances such as noise and dust generation and improper disposal of wastes;
- Failure to comply with environmental policies, safety clearance requirements and other legal obligations;
- Peace and order problems in the community due to presence of migrant construction workers.

9.2 Accessibility

288. The proposed project and the GRM should be presented to villages/wards, townships and affected households during follow-up consultation meetings with stakeholders and affected communities.

289. The MOEE through the ESE as the Project Management Unit (PMU) shall be the focal department of MOEE during the construction phase. When the project becomes operational, the regional/state ESE (PIUs) will take over the responsibility of managing the project. The PIUs, being located in townships and closer to the community, will be in-charge of ensuring that community complaints are properly heard and acted upon in a timely manner.

290. The MOEE shall set-up a hotline for complaints, including responsible persons under ESE in Naypyitaw and regional/state ESEs in Ayeyarwaddy, Bago East, Bago West, Mon, Kayin, and Rakhine. The name(s) of the ESE contact person(s) and the hotline

number shall be placed on notice boards at the construction site, project office and at local government offices, e.g. villages, townships and district offices.

291. Affected people will be free to express their grievances in writing or verbally through the village/ward administrators and these would be referred to the ESE region/states for appropriate action.

9.3 Grievance Resolution Process

292. A project grievance can be defined as an actual or perceived project-related problem that gives ground for complaint by an affected person. As a general policy, ESE in Naypyitaw (during construction) and ESE region/state office (during operation) will work proactively toward preventing grievances through the implementation of mitigation measures and community liaison activities that anticipate and address potential issues before they become grievances. In order to address complaints, a project grievance redress mechanism (GRM) will be developed in accordance with ADB requirements and Government procedures. The GRM will be presented during follow-up consultation meetings with the communities.

293. The GRM will be established to provide an effective and transparent channel for lodging complaints and for addressing grievances. The GRM will be established prior to the construction and will be maintained during operation and maintenance.

294. The grievance resolution process shall be deliberated and acted upon by three important entities: (i) Village/Ward Administrator; (ii) ESE region/state and (iii) Contractor.

295. The village/ward administrator shall:

- Act as the first line of the branch of government that will receive a complaint;
- Register the complaint from an affected member of the community;
- Documents the resolution of the complaint; and
- Refer the complaint to higher level of executive branch if the complaint is not resolved by ESE and the contractor.

296. The ESE region/state shall:

- Validate community complaints;
- Coordinate with the contractor regarding actions towards the resolution of complaints;
- Communicate actions undertaken by the contractor to the village/ward;
- Monitor project performance to avoid recurrence of the problem;
- Report all complaints received to the ESE (PMU) including actions undertaken to resolve the complaint.

297. The Contractor shall:

- Immediately act on community complaints that may occur during the consgruction phase;
- Coordinate with the affected person/household and village/ward administrator towards the resolution of complaints;
- Report any actions undertaken to the ESE region/state and the village/ward; and

- Monitor measures undertaken to resolve community complaint to avoid recurrence of the problem.

298. Normally, complaints related to environmental issues are resolved at the level of the village/ward. The following are the steps for the GRM:

i. Step 1: For complaints occurring during the construction phase, affected person can register the complaint directly to the Contractor and the head of the village/ward referring to contact information prescribed in the information boards at the project sites. Upon receipt of the complaint, the contractor is required to record/document all complaints and to coordinate with the affected person/household and the village/ward administrator immediately and to provide mitigation actions to the complaint within one day. The Contractor is required to report complaints received, resolved, and unresolved to the ESE region/state through the monthly progress report.

ii. The Contractor will be given 15 days to resolve the complaint and provide feedback to the affected person and the village/ward administrator on the resolution of the complaint. If the complainant considers the issue to be satisfactorily resolved, the village/ward administrator documents the resolution of the complaint. ESE region/state will continue monitoring the implementation of remedial measures undertaken by the contractor.

iii. Step 2: If the complainant is not satisfied with the action (s) undertaken by the Contractor, the affected person can inform the General Administrative Department (GAD) of the concerned township. The township GAD will then call a meeting with the complainant, ESE region/state and the Contractor to resolve the complaint. After discussion of the possible solutions, the ESE region/state monitors the resolution of the complaint. The Contractor shall be required to report any action to the ESE region/state in the monthly project progress reports.

iv. Step 3: If the complainant is not satisfied with the action (s) undertaken at the level of township, the affected person may elevate the case to the district level for resolution.

v. Step 4: Complaints not resolved at the district level is elevated to the region/state level for resolution.

vi. Step 5: The affected person's last recourse if the Court for complaints not resolved in the various level of Government. The decision of the Court becomes the final legal basis for the decision on the complaint.

9.4 Other requirements

299. The ESE region/state may contact the complainant at a later stage to check if activities continue to pose problems to the affected person or community. If there is a remaining problem, the issue will be treated as a new complaint and may re-enter the GRM process.

300. Affected persons having complaints or grievances will not be responsible for paying any administrative and legal fees in filing their complaints. Any site clearing is not allowed while the resolution of the complaint is still pending.

301. In cases where the affected person is illiterate, the affected person can ask assistance from one representative of his household or village member who can then write all the complaints and grievances to be submitted to the district level for resolution.

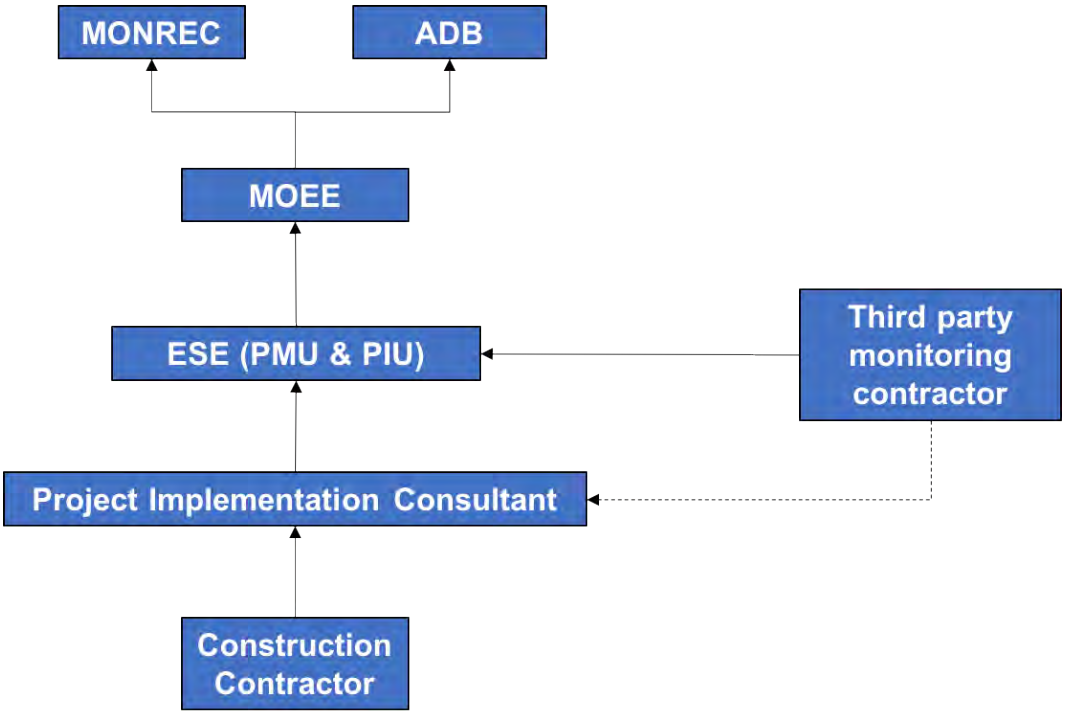
10 Environmental Management Plan

302. This chapter presents the guidance to MOEE/ESE in the identification and management of potential environmental impacts of subprojects under the Distribution Component. The potential impacts were identified based on the results of the environmental assessment conducted on the proposed substations and transmission lines. The framework on environment safeguards of the distribution component includes a screening criteria, the requirements and outline in the preparation of EMPs in accordance with Myanmar's EIA Procedures and ADB SPS (2009), and the institutional plan to implement these environmental measures.

10.1 Institutional Arrangements and Responsibilities

303. There are different institutions that wil play crucial roles in the implementation and monitoring of environment safeguards of the distribution component. These are the (i) ESE (Power Distribution Department) under the MOEE, (ii) ESE Region/State offices, (iii) Project Implementation Consultant (PIC), (iv) Contractor, (v) Ministry of Natural Resources and Environmental Conservation (MONREC), and (vi) environmental quality monitoring sub-contractor (mentioned as third party monitoring contractor in the Figure 22). Figure 22 presents the reporting relationships of these organizations.

Figure 22 Institutional reporting relationship on environment safeguards of the project



304. Currently, there is no environment and social management unit or staff at ESE to oversee safeguards requirements of the project. The ESE, specifically the Power

Distribution Department, as PMU, and the region/state ESEs as PIUs are the key institutions that will play crucial roles in ensuring environment and social management. The PMU and PIUs will be supported by the Project Implementation Consultant (PIC).

305. The following are the administrative and environmental management responsibilities of institutions involved in the distribution component:

10.1.1 Ministry of Natural Resources and Environmental Conservation (MONREC)

The MONREC is responsible for:

i. Review of the subproject EMPs and periodic environmental monitoring reports submitted by ESE;
ii. Conduct of monitoring and inspection of subprojects to determine compliance with all environmental and social requirements;
iii. Calling the attention of MOEE/ESE in case of non-compliance with environmental regulations, including requiring corrective actions to prevent adverse impacts and risks from becoming serious;
iv. Imposing penalties and other enforcement sanctions as applicable in accordance with existing environmental laws and regulations.

10.1.2 ADB

306. The ADB is responsible for:

i. Assisting the ESE (PMU) with review of CEMPs;
ii. Conduct of periodic site visits of subprojects with adverse environmental impacts or issues;
iii. Conduct of supervision missions for detailed review of subprojects with significant adverse environmental impacts;
iv. Reviewing the periodic environmental safeguard monitoring reports submitted to ensure that adverse impacts and risks are mitigated as planned; and
v. Disclosure on ADB website of semi-annual environmental monitoring reports.

10.1.3 MOEE

307. The MOEE is the Executing Agency (EA) of the project and the primary point of contact with ADB. The MOEE will assume the overall responsibility in implementation and compliance with loan assurances, including all the requirements specified in the EMP. Responsibilities of the MOEE include the following:

i. Overall project planning and management, coordination, monitoring and supervision of the project.

ii. Submission of progress reports and evaluation reports, including semi-annual environmental monitoring reports to ADB and ECD.

iii. Monitor, coordinate and supervise that environmental management measures are incorporated in the project design and construction activities of ESE and Contractor.

iv. Ensure that the ESE has conducted an IEE, prepared an EMP, and secured the necessary approvals for the distribution component.

v. Identify any environmental issues during implementation and propose necessary corrective actions.

10.1.4 Electricity Supply Enterprise (ESE), Naypyitaw

308. The ESE of MOEE in Naypyitaw is the Implementing Agency (IA) of the Distribution Component. A Project Management Unit (PMU) within the ESE in Naypyitaw will be organized to oversee implementation of the subprojects and in coordinating activities with the MOEE and other departments, ESE regions/states, and with other Government agencies particularly ECD and Forest Department. The ESE / PMU will also be responsible for the detailed engineering and design, preparation of bid documents, pre-qualification of bidders, bidding and award of contracts, contract administration and construction supervision. The PMU will also establish the PIU at the ESE regions/states of the project.

309. With regard to environment safeguards, the PMU (ESE) will be responsible for the following:

i. Ensure compliance with ADB and ECD environmental requirements.

ii. Organize an environmental and social safeguards unit at ESE head office in Naypyitaw under the Power Distribution Department and appoint staff at the region/state ESEs to supervise safeguards management of the project.

iii. Ensure that environmental management is taken into consideration in the design and construction of each subproject.

iv. Ensure that the EMP is included in the bidding documents and civil works contracts.

v. Review and approve the EMP to be implemented by Contractors prior to start of construction.

vi. Ensure sufficient funding for implementation of required mitigation and monitoring measures in the EMP throughout the construction phase.

vii. Provide oversight on the environmental management aspects of the project and ensure that Contractors develop and implement the EMP properly.

viii. Ensure that the contractors comply with the Government's environmental rules and regulations.

ix. Review and consolidate the monthly environmental monitoring reports submitted by construction contractors for submission to ADB on a semi-annual basis.

10.1.5 Region/State Electricity Supply Enterprise (ESEs) in Ayeyarwaddy, Bago East, Bago West, Mon, Kayin, and Rakhine

310. The region/state ESEs in Ayeyarwaddy Region, Bago East, Bago West, Mon State, Kayin State, and Rakhine State will act as the Project Implementing Units (PIUs). Administration of ESE in Bago Region is divided into Bago East and Bago West, therefore, six PIUs will be organized to support the ESE/PMU in reviewing the detailed design and in the construction and operation of the subprojects.

311. During the pre-construction phase, the responsibilities of the PIUs related to environment safeguards are:

i. Assist the ESE (PMU) in organizing follow-up meetings and consultations with affected landowners/households, General Administration Department (GAD) and other stakeholders;

ii. Assist the ESE (PMU) during the survey of the ROW of the transmission lines and in selecting the most feasible alignment that will ensure safety clearances are met;
iii. Assist the Forest Department during the survey of the line alignment if there are affected trees in the ROW;
iv. Coordinate with sensitive receptors near the substations and along the alignment of the lines prior to implementation of the project.

312. During the construction phase, the PIUs will be involved in the following:

i. Undertake regular construction site inspections to ensure that the contractor implements the EMP;
ii. Ensure that the construction of the project meets the final detailed design;
iii. Coordinate with the regional warehouses to avoid stockpiling of dismantled old equipment at substations and maintain an inventory of dismantled equipment;
iv. Investigate complaints or grievances from stakeholders as a result of project activities and find remedial actions to immediately resolve the complaint in accordance with the Grievance Redress Mechanism (GRM).

313. Once the project has been completed and turned over, the PIUs will be involved in the day-to-day operations including the monitoring of waste management, ensuring health and safety of workers and in maintaining adequate ROW of the transmission lines. Specifically, the region/state ESEs (PIUs) will have the following tasks with regards to environment safeguards:

i. Ensure that environment, health and safety management is taken into consideration during construction and operation.

ii. Ensure overall compliance of subprojects with environmental rules and regulations.

iii. Conduct regular inspections on the implementation of environmental mitigation measures.

iv. Undertake immediate action on community complaints about a subproject.

v. Maintain an inventory of new materials and old equipment and ensure safe and sound disposal of wastes as part of the materials management plan.

10.1.6 Project Implementation Consultant

314. The Project Implementation Consultant (PIC) is a multi-disciplinary team to be engaged by MOEE and ESE during the implementation of the project in particular to the review and update of bidding documents, assistance to MOEE and ESE in conducting the bidding process for the contract packages financed by ADB and the Government, preparation of the subproject EMPs, providing assistance to ESE in obtaining approval of the project from MONREC, supervising project implementation and management, including design, supply, installation, and commissioning works, and assistance in capacity building for MOEE, ESE (PMU), and ESE regions/states (PIUs) in financial management, disbursements, reporting, social and environmental management, coordination with stakeholders, and overall project implementation and monitoring.

315. The responsibilities of the Project Implementation Consultant (PIC) on environment safeguards are:

i. Preparation of EMPs to meet the final detailed design of the subprojects based on actual site conditions and in accordance with the requirements of the EIA Procedures (2015) of Myanmar.

ii. Assist the ESE (PMU) and MOEE in submitting the EMPs to ECD for approval of MONREC prior to start of construction activities.
iii. Supervision and monitoring of and reporting on the contractor implementation of the EMP on behalf of ESE (PMU).
iv. Supervision of environmental quality monitoring sub-contractors.
v. Assist ESE (PMU) in preparing of the semi-annual environmental safeguard monitoring reports;
vi. Assist ESE (PMU) in organization of training and capacity development.
vii. Provide technical direction and support to the ESE (PMU), ESE regions/states (PIUs) and the contractor in implementing and monitoring the EMP.
viii. Develop a simple report template or checklist for construction contractors that will serve as a guide in the monthly reporting to the ESE (PMU) and PIUs on environmental issues and mitigation measures during the construction phase.
ix. Prepare a consolidated monthly environmental monitoring for submission to the PMU;
x. Prepare draft semi-annual monitoring report for submission to the PMU. The PMU will finalize and submit to MONREC and ADB.
xi. Orient the contractors on the implementation of the EMPs and on the monitoring and reporting of implementation of mitigation measures.
xii. Review monthly environmental reports / checklists prepared by the contractor.

10.1.7 Construction Contractors

316. The responsibilities of the Contractors include:

i. Implement the contractors environmental management plan (CEMP).
ii. Prepare monthly environmental monitoring reports / inspection checklists on mitigation and monitoring activities of the EMP.
iii. Report environmental issues at construction sites to the PIC and PIUs.
iv. Immediately act and resolve complaints received from the community.
v. Undertake restoration of damaged land after completion of construction activities including areas used for the construction camp and borrow materials.

317. Contractor Environmental Management Plans. Before the construction starts, including site preparation and clearance, each Contractor will prepare a Contractor Environmental Management Plan (CEMP) consistent with the EMF Framework. The CEMP is to include all mitigation measures and monitoring requirements to be carried by the Contractor. The CEMP will be submitted to the Project Implementation Consultant (PIC) for review and approval. Contract documents shall explicitly indicate the requirement for the CEMPs. Construction cannot start until all CEMPs are prepared. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP and CEMP is included in the Contractor Bid price.

10.1.8 Environmental quality monitoring sub-contractor

318. The environmental quality monitoring sub-contractor is an independent entity that will be responsible for conducting sampling and analysis of ambient air quality and water quality on behalf of ESE (PMU). Sampling will be arranged for subproject sites

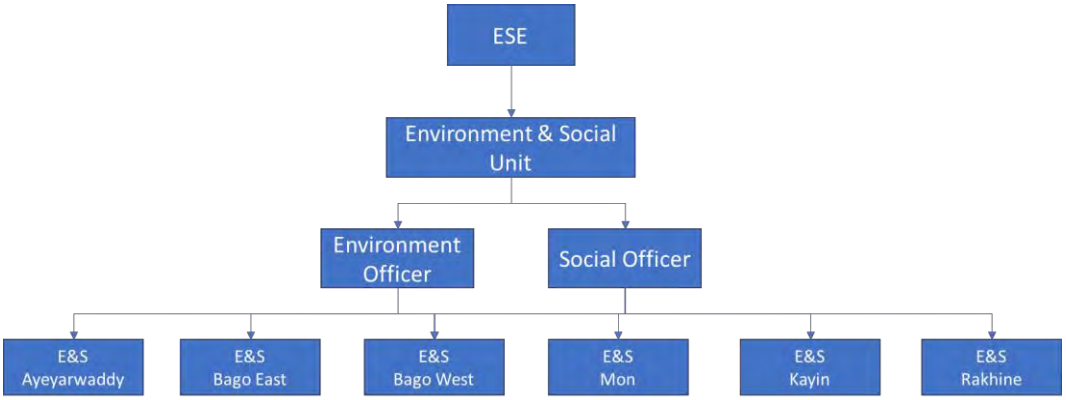
including construction camps which are located near community areas for ambient air quality and near water bodies for water quality.

319. Noise and EMF monitoring will be undertaken by the PIUs and PMU during the inspection of project facilities and will not be contracted to environmental quality monitoring sub-contractors. Noise meters and EMF meters will be procured for the PIUs and PMU under the project to enable the PIUs and PMU to continuously monitor noise and EMF beyond project construction. The PIC will be tasked to provide training to the PIUs and PMU on noise and EMF monitoring.

10.1.9 Environmental Staffing Requirements

320. At present, ESE is not ready to establish Environment and Social (E&S) unit but ESE will propose to MOEE for the designation of Environment and Social safeguards staff who will serve not only ADB projects but also projects funded by World Bank, JICA, KFW and other institutions. The E&S staff at the PMU will be composed of the E&S manager and two staff to handle environmental concerns and social issues of the project on a full-time basis. Figure 23 presents the proposed organizational structure on environment and social safeguards.

Figure 23 Proposed organizational structure on environment and social safeguards



321. Each PIU will designate a staff who will be assigned as environment and social safeguards staff, concurrent to existing assignment. The PIU E&S staff will coordinate with the E&S Unit of the ESE in Naypyitaw and will act as the focal person on the field in overseeing the implementation of environmental mitigation measures.

322. The PMU and PIUs will be assisted by the environment specialist of the PIC. The PIC will conduct training for the E&S staff in Naypyitaw and at the regions/states.

323. Table 26 presents the indicative staffing on environment and social safeguards including external implementation and monitoring consultants

Table 26 Indicative staffing on environment and social safeguards

Entity	Position	Type of Assignment
ESE Environment and Social staff for ADB,	Environment and Social Manager	Full time

World Bank, JICA, and KFW projects	Environment Officer	Full time
	Social Officer	Full time
ESE Regions/States (PIUs)	E&S staff at each PIU	Part time (concurrent with existing assignment)
Project Implementation Consultant	Environment safeguard specialists	Intermittent during construction
Enviromental quality monitoring contractor	Independent environmental monitoring	Contracted as needed

10.1.10 Institutional Capacity Development

324. To strengthen the capacity of the implementing agencies in the implementation of the EMP, a capacity development program for MOEE, ESE (PMU) in Naypyitaw and regional/state ESE (PIUs) in Ayeyarwaddy, Bago, Mon, Kayin, and Rakhine will be developed by the PIC on the implementation and monitoring of the EMP and Environmental Monitoring Plan (EMoP). The program will focus on community safety, EMP preparation and implementation, inspection and corrective action, and the proper management of waste materials.

325. The following outlines the proposed trainings to be developed under the project:

i. Workshop on environmental impact assessment, environmental management plan, and environmental management plan for ESE (PMU), ESE regions/states and construction contractors
ii. Training on inventory and management of hazardous wastes
iii. Training on materials management planning
iv. Training on environmental quality monitoring and reporting.

10.2 Environmental Management Plan Framework

326. The Distribution Component of the Power Network Development Project has been screened by ECD under the Myanmar EIA Procedure (2015). ECD requires that an EMP be prepared for each transmission line and for each substation. As it is not possible to prepare all the necessary EMPs during project preparation due to limited time and financial resources, the EMPs will be prepared during project implementation by the PIC. These EMP reports must be prepared prior to tendering as the EMPs must be included in the bidding documents. A standardized Environmental Management Plan Framework will be used as a guide to preparation of all the necessary EMP reports.

10.2.1 Subproject Definition

327. For purposes of this EMP Framework, a subproject is defined as:

328. "one or more substations and/or one or more transmission lines connected into a single distribution system"

329. Specific subprojects will be defined based on the Project Procurement packages and lots for substations and distribution lines. Individual contracts will be prepared for

each lot. Currently, there are six lots (Ayeyarwaddy, Bago East, Bago West, Mon, Kayin, and Rakhine) for substations and six lots (Ayeyarwaddy, Bago East, Bago West, Mon, Kayin, and Rakhine) for distribution lines. Individual contracts will be prepared for each lot.

330. An EMP will be prepared for each subproject. This approach has been adopted to align the EMPs with the scope of civil works of the Contractors. Each contract will be required to prepare a Contractors Environmental Management Plan (CEMP).

10.2.2 Applicability

331. The EMP Framework does not apply to:

i. Subprojects with activities listed on the Prohibited Investment Activities List in Appendix 5 of the ADB Safeguard Policy Statement; or
ii. Subprojects that do not comply with national environment, health and safety laws and regulations; or
iii. Subprojects that have potential to cause significant irreversible, diverse or unprecedented adverse environmental impacts and are considered as Category A under ADB SPS (2009).

10.2.3 General Criteria

332. All applicable subprojects must meet the following general criteria:

i. Subprojects must not have the potential to directly or indirectly result in conversion or degradation of natural habitat such as primary forests or wetlands;
ii. Subprojects must not fall in part or in whole within a legally protected area, national park, wildlife sanctuary, nature reserve, wetlands, an area supporting high biodiversity value or qualifying as critical habitat;
iii. Subproject must not utilize water from or discharge to a water body in a legally protected area, an area supporting high biodiversity value or qualifying as critical habitat;
iv. Subprojects must not have the potential to directly or indirectly result in permanent damage to physical cultural resources of national or international importance; and
v. Subproject must not require removal of any physical cultural resources.

10.3 Preparation of Environmental Management Plans

333. Tables 27 to 29 present the proposed environmental mitigation measures to be implemented to address potential adverse impacts of the distribution component, according to stages of implementation.

334. The EMP report to be submitted to ECD and to be included in the tender documents will contain the following:

i. Executive Summary
ii. Introduction
iii. Description of the subproject components and activities to be implemented by project phase with overview maps, site layout, aerial photos/satellite images;
iv. Project's environmental, socio-economic and where relevant, health policies and commitments, legal requirements and institutional arrangements;
v. Summary of impacts and mitigation measures;

vi. Overall budget for implementation of the EMP;
vii. Management and monitoring sub-plans by project phase (pre-construction and construction) that will include management and monitoring to address and satisfy all relevant environmental and social management and monitoring issues such as but not limited to noise, vibration, waste, hazardous waste, wastewater and storm water, air quality, odor, chemicals, water quality, erosion and sedimentation, biodiversity, occupational and community health and safety, cultural heritage, employment and training and emergency response.
viii. Implementation Arrangements
ix. Conclusion

335. Appendix F presents the outline of the EMP framework.

336. As previously mentioned, the construction contract package for the PNDP Distribution Component is designed with contract package for the substations and another for the transmission lines. Each package contains six lots, representing the lots for (i) Ayeyarwaddy, (ii) Bago East, (iii) Bago West, (iv) Mon, (v) Kayin, and (vi) Rakhine. In order to align with the current design of the construction contract packages, standardized EMP matrices have been prepared in Appendices G and H for the substation contract and distribution contract, respectively.

10.4 Environmental Management Plan Review and Approval

337. The Project Implementation Consultant (PIC) of the PNDP Distribution Component will be responsible for preparing all the EMPs needed for the distribution systems.

338. The EMP reports will be reviewed and endorsed by the Project Management Unit (PMU) of the Distribution Component and then these EMP reports will be submitted to the ECD of MONREC for review and approval.

339. These EMP reports must be prepared and approved prior to tendering as the EMPs must be included in the bidding documents for contracts.

10.5 Supervision and Monitoring of EMP Implementation

340. The environmental supervision and monitoring of the EMP implementation will be undertaken using the institutional arrangement outlined in Section 10.1.

341. The following tables present the environmental mitigation measures to be implemented to address potential adverse impacts of the distribution component, according to stages of implementation.

Table 27 Environmental Management Plan during Pre-construction Phase

Environmental Aspect	Impact/Risk	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Subproject EMP	EMP does not reflect final subproject design	- Develop subproject EMP that includes mitigation measures defined in this IEE, updates reflecting detailed design including use of borrow materials from permitted sources, management of construction camps, water/air/noise quality, waste management, occupational and community health and safety plans, chance find procedures of artifacts, and procedures on discovery of land mine/UXO. - Assist ESE (PMU) in submitting the subproject EMP to ECD in compliance with the requirements in seeking the approval from MONREC.	PIC in coordination with ESE (PMU)	US$76,896 (Part of PIC cost)
Tender documents and works contracts	Lack of environmental clauses in tender documents and contracts	- Include environmental clauses and the EMP in tender documents and works contracts	ESE	Part of above cost

Environmental Aspect	Impact/Risk	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Environmental elements in design of new substations and redesign of existing substation	Lack of measures to manage oil spill, wastes, occupational health and safety in substations	- Incorporate environmental elements in the design of substations to include: i. provision of oil pits in transformer area ii. design of adequately sized drainage canals which drains towards the road canal and not at adjoining areas and paddy fields iii. provision of proper fence around the substations iv. consider alternatives to SF6 circuit breakers with insulators made of composite and rubber instead of ceramic insulators v. use of non-PCB transformers vi. provision of storage area/room for new materials and spares vii. provision of waste segregation areas for hazardous waste and damaged equipment/materials viii. provision of waste segregation bins for solid waste/garbage (biodegradable and non-biodegradable bins) ix. monitoring of EMF at substations	ESE	Part of design cost
Survey of trees, affected structures, crops, and land at substations and along the transmission line alignment	Damage to trees, crops, land during construction	- To the extent possible, avoid cutting of trees in selecting the line alignment. - Survey of roadside trees, in coordination with the Forest Department; comply with the requirements of the Forestry Law with regards to compensation of regulated trees such as teak and other hardwood species. - Survey of affected structures, land, crops and trees in private land in coordination with landowner, farmer, and General Administration Department	ESE, PIUs	Part of pre-construction cost

Environmental Aspect	Impact/Risk	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Screening of sub-station construction sites and transmis-sion line alignment for landmine/UXO	Land mine/UXO contamination	- Survey of suspected land mine/UXO contaminated sites in Kayin state: all seven townships (Hpa-An, Paingkyon, Hpapon, Zarthapyin, Kyainsekgyi, Kan Ma Maung, and Kataingti) - Demining of areas identified as landmine/UXO contaminated prior to start of construction	Demining entity	To be determined
Grievance redress mechanism	Community com-plaints	- Establish a GRM to handle and resolve complaints from the community - Disclose the GRM during follow-up consultations with the community	ESE	Part of design cost

Table 28 Environmental Management Plan during Construction Phase

Environmental As-pect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Finan-cial Arrangements
Contractor's EMP	EMP do not reflect issues at construction camps, borrow areas and spoils disposal area	Require the contractor to provide measures and budget that addresses issues at construction camps, borrow areas and spoils disposal area in addition to the EMP measures identified in bid documents. The CEMPs should be reviewed and approved by PIC, PIUs and PMU prior to start of construction works.	Contractor	US$9,000	Approved CEMP with budget
Removal of affected roadside trees	Loss of vegetation	Compensation of trees to be cut	Contractor	US$8,160	Approval of Forest Department

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Financial Arrangements
		Replanting of trees in areas identified by the Forest Department			Include in CEMP with budget
Removal of trees within substation site	Loss of vegetation	Compensation of trees to be cut in coordination with landowner	Contractor	US$3,574	Approval of landowner Include in CEMP with budget
Sediment runoff	Soil erosion Damage to rice fields and canals	Inspect if runoff of soil flows into nearby rice fields, cropland and canals. Schedule excavation work during the dry season. Install silt traps, deviation channels, barriers or trenches around the stock piles of materials and soil.	Contractor	US$21,000	Approved CEMP
Dust emission from the earthworks and movement of vehicles.	Air pollution	• Water spinkling of areas prone to dust emission • Cover and keep excavated soil and stockpile of aggregates moist • Regularly maintain vehicles and equipment to ensure emissions comply with standards • Prohibit burning of waste materials. Unauthorized burning of construction materials and refuse shall be subject to penalties against the Contractor. • Cover materials with tarpaulin or other suitable materials while in transit.	Contractor	US$9,600	Approved CEMP

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Financial Arrangements
		• Impose speed limits on construction vehicles			
Noise	Noise from vehicles and construction activities	• Noise levels from equipment and machinery shall conform to the "Environmental, Health, and Safety Guidelines" (IFC) • Property maintain machinery to minimize noise • No construction shall be allowed between nighttime hours of 22:00 to 06:00 • Require drivers of construction vehicles to minimize blowing of horn and limit speed when passing through residential areas.	Contractor	US$5,000	Approved CEMP
Generation of wastes	Old equipment and parts, Domestic solid wastes, domestic wastewater, inert construction wastes, and hazardous wastes during construction may result to pollution of land.	• Implement a material management plan that includes safe and organized storage of dismantled equipment and parts in a safe area at the substation for later hauling by ESE regional/state warehouses • Undertake waste reuse and recycling, where possible, and dispose only in approved sites. • Provide temporary storage of hazardous wastes	PIUs Contractor	US$9,600	Approved CEMP

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Financial Arrangements
		• Undertake segregation of hazardous and non-hazardous wastes in properly labeled waste disposal bins. • Instruct workers not to indiscriminately dispose wastes particularly at surrounding areas • Store hazardous wastes on leak-proof containers with proper label and place on areas with concrete surface and secondary containment. • Prohibit burning of wastes • Conduct refueling and equipment servicing only in designated areas with impervious surface. • Provide oil and grease traps and other spill containment measures. • Provision of adequate onsite sanitation facilities to prevent untreated sewage from being channeled into drainage canals, river and on land.			
Traffic hazard and blocking of road access	Risks to community health and safety and blocking of road access due to temporary parking of trucks during transport of materials and equipment to the sites.	• Manage traffic by posting warning signs and assigning flag persons to direct traffic on affected roads. • Impose speed limits to hauling vehicles particularly when passing through settlement areas.	Contractor	US$2,400	Approved CEMP

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Financial Arrangements
Damage to crops, land or income loss from temporary use of land for access to tower locations	Transport of materials to pole sites may damage crops and land.	• Contractor will discuss with affected person to reach a consensus on renting land or compensating crops. • Contractor will be required to restore to original condition the affected land after construction is completed and before it is returned to the affected person. • Any damaged crops or income loss during the temporary use of land will be compensated by the civil works contractor.	Contractor	US$7,800	Approved CEMP
Occupational health and safety	Workers may be exposed to dangers of live power lines/equipment, chemicals, fire and explosion, physical hazards, exposure to dust and noise, falling objects, and ergonomic injuries	• Implementation of electrical safety plan, fire prevention, safety and management plan, education and awareness plan for HIV/AIDS, malaria and other diseases • Cover energized parts and hardware • Ensure live-wire work is conducted by trained and certified workers with strict adherence to specific safety and insulation standards. • Require workers to adhere to local legislation, standards and guidelines relating to minimum approach distances for excavations, tools,	Contractor	US$4,400	Approved CEMP

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Financial Arrangements
		vehicles, pruning, and other activities in the ROW. • Implement fall protection systems that includes provision of hoisting equipment, safety belts, second (backup) safety strap for workers • Provision of first-aid facilities readily accessible by workers • Posting of safety signs, reminders or warning notices • Hire only trained and certified workers on electrical works • Provide appropriate and accessible fire fighting equipment • Ensure unobstructed access of fire responders and egress of vehicles • Strictly implement a "No Alcohol and Drug Policy" • Prohibit illegal activities including gambling • Inform and educate workers on the Health and Safety Plan.			
Community health and safety	Nuisances and hazards due to construction traffic, transport of materials, fires, emergency spill of materials, and unauthorized entry of villagers into dangerous working areas	Contractor will be required to: • Consult with affected households and disseminate information on community health and safety	Contractor	US$4,800	Approved CEMP

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost	Guarantee/ Financial Arrangements
		• Emergency response and preparedness procedures • Provision of communication systems and protocols • Coordination with local and regional emergency and health authorities • Provision of emergency equipment and facilities • Fencing of the construction area at substations • Posting of warning signs in dangerous work areas in Burmese language.			

Table 29 Environmental Management Plan during Operational Phase

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
Cutting or trimming of trees and vegetation	Removal of vegetation may result in continuous replacement of successional species and an increased likelihood of growth of invasive species.	• Minimize tree cutting through selective tree cutting or bush clearing. • Only trees affecting conductor clearance will be trimmed or removed as necessary. • Avoid use of herbicides and maintain naturally low-growing vegetation in ROW.	PIUs	Part of the operational cost	Approval of land owner for trees in private land and from Forest Department for roadside trees
Occupational health and safety	Exposure of workers to hazards due to exposure to live power lines and high	• All workers will be required to undergo orientation on security and EHS procedures and to strictly follow these	PIUs	US$40,800	Health and safety guidelines

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
	voltage systems, working in heights, fires, explosion	guidelines when inside the premises of the substations. • Only authorized and trained personnel will be allowed to work or have access to electrical equipment. • Adhere to electrical safety standards. • Provide proper grounding and deactivation of live power equipment during maintenance work or if working in close proximity to equipment. • Provide PPE for workers • Provide adequate number of fire extinguishers at substtions • Observe guidelines to minimum approach distances when working around operational equipment. • Identify potential exposure levels in work area including surveys of exposure levels and establish safety zones at the transmission lines and substations. • Post safety reminders and warning signs.			

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
		• Warn personnel of potential electric arc flash hazards when inspecting or working with energized equipment. • Comply with "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC) • Monitor EMF at substations			
Generation of hazardous waste	Potential oil spill from maintenance or retrofitting of equipment and accidental spills of hazardous waste may contaminate soil and groundwater.	• Provide secondary containment with impervious bund around oil storage areas in substations and maintenance are in region/state warehouses. • Provide a hazardous waste storage area in substations and warehouses. • Undertake labeling of hazardous wastes.	PIUs	US$10,900	Hazardous waste storage area Reports of hazardous waste generated, stored and disposed.
Emergencies and accidents	Possible fire events, explosion of equipment, lighting strikes, damage to cables, and corrosion of equipment may result to emergency situations at the substations	• Ensure security of cables and equipment • Conduct regular inspection of facilities to identify missing or corroded parts • Implement the fire management program that includes adequate fire protection equipment, fire suppressants, fire water tank,	PIUs	US$14,400	Manual on safety and emergency procedures for the substation and distribution line operation

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
		and fire extinguishers within substations. • Conduct training of workers on emergency preparedness and response procedures.			
Community health and safety	Community risks due to exposure to electrocution hazards, direct contact with high voltage electricity	• Regularly check compliance of transmission line with safety clearances • Conduct monitoring of EMF levels along the ROW • Grounding of conducting objects such as fences or other metallic structures near power lines	PIUs	Part of the operational cost	

10.6 Environmental Monitoring Plan

342. The following table presents the proposed environmental monitoring plan of the project during the pre-construction, construction, and operation.

Table 30 Environmental Monitoring Plan

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
PRE-CONSTRUCTION						

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
EMPs based on detailed design	Preparation of EMPs based on final detailed design approved by MOEE/ESE and ADB	At each region/state	Preparation of EMP	During detailed design	PIC	PIUs, ESE (PMU)
	Submission of EMP to ECD for MONREC approval	At each region/state	Submission to ECD	During detailed design	PIC, PIUs	ESE (PMU)
Environmental elements in design of substations	Incorporation of environmental elements in design of substations	At 48 substations	Review of final substation plans	During detailed design	PIC, PIUs	ESE (PMU)
Tender documents and works contracts	Environmental clauses and EMP in tender documents and works contracts	All contract packages in each region/state	Review of tender documents	Bidding and contract award	PIC, PIUs	ESE (PMU)
Survey of roadside trees along the transmission line alignment	Circumference and type of species of affected trees	Project sites along roads	Survey of line alignment along roads	During detailed design	PIC, PIUs in coordination with Forest Department	ESE (PMU)
Survey of affected structures, crops, trees and land at substations and transmission line alignment in private land	Identify affected structures, crops, trees, and identify landowners	All project sites	Survey of substation land and line alignment	During detailed design	PIC, PIUs in coordination with landowner, farmer, and GAD	ESE (PMU)
Screening of construction sites, transmission line alignment for land mine / UXOs	Identified areas as land mine / UXO contaminated	Project sites in Kayin (all 7 townships)	Survey of alignment, demining of identified sites	Prior to start of construction	Land mine / UXO demining entity	ESE, PIUs
Grievance redress mechanism	Established GRM	-	Review and disclosure of GRM	-	PIC, PIUs	ESE (PMU)
Baseline noise	Equivalent continuous sound level, L_{Aeq}, in decibels	At construction near sensitive receptors and compare with NEQEG allowable noise	Use noise meter	During detailed design	PIC, PIUs	ESE (PMU)

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
		levels of 55dBA (daytime) and 45 (nighttime)				
CONSTRUCTION PHASE						
Contractor's EMP	CEMP prepared to address issues at construction camps, borrow areas, and spoils disposal area in addition to the subproject EMP	-	Preparation of CEMP by contractor	Prior to start of construction activities	Contractor	PIC, PIUs and ESE (PMU)
Removal of roadside trees	Compensation of trees to be cut	Transmission line alignment along roads	By observation and inspection	During site clearing	Contractor	PIC, PIUs, ESE (PMU)
Sediment runoff	Check soil erosion events Check damage to rice fields and canals	Construction sites (substations and transmission lines)	By observation and inspection	During heavy rain events	Contractor	PIC, PIUs, ESE (PMU)
	Inspect presence of silt traps, deviation channels, barriers or trenches around stock piles of materials and soil.	Construction sites (substations and transmission lines)	By observation and inspection	During construction	Contractor	PIC, PIUs, ESE (PMU)
Dust emission	Check EMP measures to control dust emission	Construction sites (substations and transmission lines)	By observation and inspection	During construction	Contractor	PIC, PIUs, ESE (PMU)
Noise	Equivalent continuous sound level, L_{Aeq}, in decibels	Construction activities near sensitive receptors such as residential houses, temples, schools, and hospitals	Use noise meter	Everytime noise generating equipment is used	Contractor	PIC, PIUs, ESE (PMU)

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
	Noise complaints	Villages where trucks pass through	Monitor noise during delivery of materials Conduct interviews with villagers on noise nuisance	Weekly, continuous throughout the construction period	Contractor	PIC, PIUs, ESE (PMU)
Waste management	Old equipment and parts Domestic waste Hazardous waste Inert construction waste Presence of leaks/spills	Construction site and at adjacent paddy fields	Inspection and checking of materials and waste management	Daily	Contractor	PIC, PIUs, ESE (PMU)
Traffic management	Traffic congestion, delivery schedule, and complaints	Construction sites and nearby roads	Site inspection and interviews with residents along roadsides	Daily at construction sites	Contractor	PIC, PIUs, ESE (PMU)
Occupational health and safety	Implementation of occupational health and safety plan, wearing of PPEs, safety reminders, sanitation at construction area, training/orientation on safety	Construction sites	Review and audit implementation of health and safety plan and conduct of training activities/orientation on health and safety	Monthly review of Contractor's health and safety plan	Contractor	PIC, PIUs, ESE (PMU)
Damage to crops, land or income loss from temporary use of land for access to tower locations and at construction camps	Monitor restoration of temporary access to pole locations after construction	Access to tower locations Construction camps	By observation and inspection	After completion of construction works	Contractor	PIC, PIUs, ESE (PMU)

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
	Monitor restoration of areas used as construction camps and borrow areas					
Occupational health and safety	Monitor EMP measures to manage occupational health and safety during construction	All project sites	By observation and inspection	During construction	Contractor	PIC, PIUs, ESE (PMU)
Electromagnetic field (EMF)	EMF, kV/m	Inside substatons and at periphery of substations near residential houses	EMF meter and compare results with Table 1 (ICNIRP exposure limits for general public to magnetic fields) and Table 3 (ICNIRP exposure limits for occupational exposure to electric and magnetic fields (EHS Guidelines for electric power transmission system) and NEQEG exposure limits	Every six months	PIUs	PIC, ESE (PMU)
Community health and safety	Monitor EMP measures to manage community health and safety	All project sites	By observation and inspection	During construction	Contractor	PIC, PIUs

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
OPERATIONAL PHASE						
ROW vegetation maintenance	ROW vegetation maintenance to maintain safety clearance	Along ROW of transmission lines	By observation and inspection	Monthly	ESE township engineer	PIUs
ROW permitted activities	Check permitted activitied within the ROW	Along ROW of transmission lines	By observation and inspection	Monthly	ESE township engineer	PIUs
Electromagnetic field (EMF)	EMF, kV/m	Inside substations and at periphery of substations near residential houses Along the ROW of transmission lines with community areas	EMF meter and compare results with Table 1 (ICNIRP exposure limits for general public to magnetic fields) and Table 3 (ICNIRP exposure limits for occupational exposure to electric and magnetic fields (EHS Guidelines for electric power transmission system) and NEQEG exposure limits	Every six months	ESE township engineer	PIUs
Waste management	Waste segregation, presence of leaks/spills, quantity of hazardous waste stored onsite, HW labels	Hazardous waste storage area	Inspection and checking of hazardous waste segregation area;	Daily	ESE township engineer	PIU

Environmental Aspect	Monitoring Parameter	Location of Monitoring	Method of Monitoring	Monitoring Schedule	Implementing Entity	Supervising Entity
			Checking of hazardous waste records			
Occupational health and safety	Implementation of occupational health and safety plan, wearing of PPEs, safety reminders, training/orientation on safety, annual emergency and fire drill, accidents along the transmission lines	Substations and transmission lines	Review and audit of implementation of worker health and safety plan; training activities on health and safety; conduct of emergency and fire drill	Annual review of health and safety plan implementation	ESE township engineer	PIU

343. The following are environmental compliance requirements during the various phases of project implementation.

Table 31 Milestones for Environmental Compliance of the Distribution Component

Project Stage	Environmental Requirement	Approving Entity	Purpose	ADB Loan Requirements
Detailed engineering and design (DED)	MONREC approval letter	ECD, MONREC	In compliance with the EIA Procedures, an approval letter is needed prior to project implementation. According to the EIA Procedures, the distribution component needs to prepare an Environmental Management Plan (EMP) for substations and transmission lines.	MONREC approval of the EMPs secured during DED and prior to project implementation
Bidding	Environmental management plan (EMP) and environmental monitoring plan (EMoP) in bid documents	MOEE/ESE ADB	For reference of bidders	Subproject EMP and EMoP to be prepared by PIC. EMP and EMoP to be included by MOEE/ESE in the bid documents.
Notice to Proceed	Contractor's EMP (CEMP) prepared to address impacts of location of construction camps, borrow areas, and spoils disposal areas in addition to the EMP measures in tender documents	MOEE/ESE ADB	For guidance in the management of environmental impacts	CEMP with budget to be prepared by the Contractor prior to start of construction

Project Stage	Environmental Requirement	Approving Entity	Purpose	ADB Loan Requirements
Construction	Implementation of EMP and CEMP	MOEE/ESE	Ensure that adverse environmental impacts are addressed during construction. Ensure compliance with the EIA Procedures.	Status of compliance with the CEMP and EMP to be reported in the semi-annual environmental monitoring report
Operation	Environmental monitoring	MOEE/ESE	Ensure that adverse environmental impacts are addressed during operation. Ensure compliance with the environmental requirements of ECD and MONREC.	Implementation of the EMP to be reported in the environmental monitoring report

10.6.1 Reporting

10.6.1.1 Construction Phase

344. Throughout the construction period, the Contractor will submit monthly progress reports to ESE (PMU) through the PIC and PIUs. The progress report will contain the summary of the progress of construction, results of site inspections, including the progress made in EMP implementation, status of compliance with the Government's environmental regulatory requirements, record of community complaints, unforeseen environmental impacts and suggested remedial actions for the next monitoring period.

345. The ESE (PMU) and PIUs through the PIC will supervise and validate the implementation of the mitigation measures specified in the EMP and CEMP through site visits once a month or more frequently as necessary and review the EMP and CEMP implementation reports of the Contractor. The ESE (PMU) and PIUs will also coordinate the environmental monitoring in accordance with the monitoring plan and prepare semi-annual environmental monitoring reports to be submitted to ADB.

346. The semi-annual monitoring reports will be disclosed on ADB website upon receipt by ADB following the ADB Publc Communications Policy (2011).

10.6.1.2 Operation Phase

347. The EMP monitoring during the operational phase will continue through the PIUs. The environmental monitoring report shall contain the project's adherence to the EMP, information on project implementation, and environmental compliance.

10.6.2 Environmental Management and Monitoring Costs

348. The estimated cost for the environmental safeguard activities is presented in Table 32.

Table 32 Cost Estimate of Environmental Management and Monitoring Activities

Item	Estimated Cost (US$)	Comment
Mitigation Measures		
Preparation of site-specific and system designed EMPs by PIC (refer to Table 33 for details of PIC budget)	173,400	c/o PIC
Environment monitoring by PIC including air travel and car rental (refer to Table 33 for details of PIC budget)	642,000	c/o PIC
Environmental elements in design of substations	542,400	Includes the improvements in substation design such as oil pits in transformer

Item	Estimated Cost (US$)	Comment
		pads, provision of drainage canals, materials and waste storage areas, etc. Budget will form part of the loan.
Survey of affected trees and replanting	20,000	Budget will be c/o ESE (PMU), PIUs
Survey and demining of land mine/UXO contaminated sites	To be determined	In coordination with recognized demining entity. Budget will form part of the loan.
Construction management (sediments, dust, noise, construction wastes, construction camp, traffic, occupational health and safety, community health and safety)	250,000	c/o Contractor
Restoration of damaged land	96,000	c/o Contractor
Monitoring		
Survey of roadside trees	20,000	Cost c/o ESE in coordination with Forest Department
Noise measurement (acquisition of noise meter)	9100	2 noise meters per PIU @$700 per unit 1 noise meter at PMU
EMF measurement (acquisition of EMF meter)	6500	2 EMF meters per PIU @$500 per unit 1 EMF meter at PMU
Capacity Development and Training	50,000	c/o PIC
TOTAL	**$1,809,400**	

Table 33 Details of Budget of Project Implementation Consultant

Item	Unit	No. of Units	Unit Cost (US$)	Total Cost (US$)
1. Preparation of site-specific and system designed EMPs by PIC (Year 1)				173,400
a. Remuneration and per diem	Person-months			
- International environment specialist (1 consultant)	Person-months	3	20,000	60,000

Item	Unit	No. of Units	Unit Cost (US$)	Total Cost (US$)
- National environment specialists (3 consultants)	Person-months	4	5,000	100,000
b. International air travel	trips	1	5,000	5,000
c. Domestic air travel	trips	1 trip for 3 natl and 1 intl consultant	400	2,400
d. Car rental (for 3 natl consultants)	months	2	600	6,000
2. Environment monitoring by PIC including air travel and car rental (Year 2 - 6)				642,000
a. Remuneration and per diem	Person-months			
- International environment specialist (1 consultant)	Person-months	9	20,000	200,000
- National environment specialist (3 consultants)	Person-months	8	5,000	375,000
b. International air travel	trips	1 trip per year	5,000	25,000
c. Domestic air travel	trips	1 trip for 3 natl and 1 intl consultant	400	12,000
d. Car rental (for 3 natl consultants)	months	2 per year	600	30,000
3. Training and capacity development	lumpsum	1	50,000	50,000
TOTAL				**865,400**

11 Conclusion and Recommendations

349. The distribution component of the project is classified as Category B for environment since there are no components that will traverse environmentally or culturally sensitive areas and that adverse environmental impacts are confined within the project areas and immediate surrounding areas. The footprint of impact of the substations and transmission lines during construction is small and can be reduced to acceptable levels through the implementation of practical mitigation measures normally associated with internationally accepted good engineering practices.

350. The upgrading of substations and construction of new substations will occur within existing substation compound, properties owned by the Government, or in privately-owned land characterized as rural/semi-urban community areas. The transmission lines will generally take place along the roads or in paddy fields. The subprojects will not traverse environmentally sensitive or cultural heritage sites, but, there are a number of sensitive receptors such as temples, health centers, and schools along the alignment of the transmission lines and near substation sites.

351. Environmental impacts that may be generated during the construction of new and expansion of existing substations are primarily due to the generation of old equipment, risks to workers during construction, and equipment installation and commissioning, sourcing of borrow materials to be used for landfilling of substation sites, and temporary disturbance from construction activities such as dust, soil runoff, noise and traffic. However, these impacts are not expected to be significant, given the short duration of the construction phase, i.e. 1 − 2 weeks for pole and line installation within a transmission line span of about 600 meters and about 6 months for new substation construction.

352. There are subprojects which require rehabilitation and upgrading of existing substations and lines, thus, will generate wastes such as old and dismantled equipment and electrical accessories (cables, conductors, switches, etc.). A material management plan will be implemented in coordination with the ESE regional/state warehouses.

353. On the installation of the transmission lines, the identified environmental issues include the removal of roadside trees, temporary disturbance from construction activities such as dust, noise and blockage of narrow roads, risks to workers during construction and equipment installation, and damage to crops and land. Each transmission pole will have a diameter of about 18 inches and will be embedded to a depth of about 7 feet from the ground. During pole installation, agricultural areas, primarily rice paddies, will be affected. The affected area would be about 4-meter radius from the pole area. In addition, access paths to the pole areas will cause damage to rice paddies. To avoid adverse impacts to agricultural crops, the pole and line installation will be undertaken during the dry season when there is no planting being done by farmers. Coordination with the affected farmers, landowners and General Administration Department will be undertaken prior to implementation.

354. There are also transmission line areas which require cutting of roadside trees. The ESE will avoid cutting of large trees to the extent possible. If cutting of large trees cannot be avoided due to technical and safety issues, the ESE will coordinate with the Forest Department with regards to the cutting of roadside trees on Government land and comply with the requirements of the Forestry Law. For trees that will be affected in privately owned land along the transmission line alignment, the ESE will discuss with the land owner about the need to trim or cut the trees to comply with the safety clearance requirements.

355. There are also potential hazards from landmines in subprojects located in Kayin State, Mon State, and Bago Region. Further surveys by a recognized demining entity will be undertaken during detailed design to take into consideration the final alignment of the transmission lines that avoids identified land mine contaminated areas.

356. Environmental Elements in Substation Design. Based on the environmental compliance audit of existing substations, there are areas for improvement in the design of the new substations. The new substations will include environmental elements such as the provision of oil pits at transformer pad area, provision of storage area for new materials and spares, design of drainage canals that drain towards the road canal and not to adjoining paddy fields, provision of sturdy fence to avoid entry of animals and unauthorized persons inside the substation compound, use of SF6 circuit breakers with composite and rubber insulators instead of the ceramic type, procurement of non-PCB containing transformers, waste segregation for hazardous waste and solid wastes, monitoring of electromagnetic field (EMF), and provision of personal protective equipment (PPE) and working and adequate fire extinguishers at substations.

357. Institutional Arrangements for EMP Implementation. The different institutions that will play crucial roles in the implementation and monitoring of environment safeguards of the distribution component are the: (i) ESE under the MOEE (as PMU), (ii) ESE Region/State offices (PIUs), (iii) Project Implementation Consultant (PIC), (iv) Contractor, (v) Ministry of Natural Resources and Environmental Conservation (MONREC), and environmental quality monitoring sub-contractor.

358. The PMU within the ESE will establish an Environment and Social (E&S) Unit composed of a unit head and two staff to handle environmental concerns and social issues of the project. The E&S Unit will be supported by a staff from each PIU to be assigned as environment and social safeguards focal person, concurrent to existing assignment. To strengthen the capacity of the ESE/PMU, PIUs and the E&S staff in environmental management and monitoring, a capacity development program will be developed and implemented by the PIC. The program will focus on community safety, EMP preparation and implementation, inspection and corrective action, and the proper management of waste materials.

359. Conclusion. Overall, the improvement of the power distribution grid is expected to contribute positively to the economic development of Myanmar and in particular in the regions/states of Ayeyarwaddy, Bago, Mon, Kayin, and Rakhine. 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.

360. Based on this assessment, it is concluded that overall, the project will result in significant positive socio-economic benefits. The project will not cause significant adverse environment impacts 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. Assuming that the mitigation measures and monitoring requirements in the Environmental Management Plan (EMP) are effectively implemented, the project is not expected to have significant adverse environmental impacts.

361. An EMP has been developed in this IEE as a guide to the MOEE/ESE in the preparation of EMPs of the various subprojects of the distribution component. The EMP includes: (i) specific mitigation measures formulated to avoid or minimize the adverse impacts of the pre-construction, construction, and operation of the distribution component; (ii) a plan to monitor the implementation of the mitigation measures; (iii) institutional arrangements for EMP implementation, monitoring, and reporting; and (iv) a proposed budget.

362. The subproject EMPs will be prepared with the assistance of the PIC during detailed design and will be included in the tender documents. Each EMP may include substations(s) connected to transmission lines as one system or EMP for stand-alone substation or transmission line.

363. The subproject EMPs should conform to the requirements of the Myanmar EIA Procedures (2015) and ADB SPS (2009). These EMPs will be submitted to the ECD in securing approval from MONREC.

References

Air Quality, Noise and Water Quailty Monitoring in Bago City (Summer Season). Interim Report. Myanmar Environment Institute and MONREC. May 2016

Air Quality, Noise and Water Quailty Monitoring in Pathein City (Summer Season). Interim Report. Myanmar Environment Institute and MONREC. May 2016

Assessing Climate Risk in Myanmar. Technical Report. World Wildlife Fund. 2017

Concept Paper. Proposed Loan Republic of the Union of Myanmar: Power Network Development Project. Project Number 50020-002. ADB. September 2016

Country Partnership Strategy. Myanmar, 2017-2021. Building the Foundations for Inclusive Growth. Asian Development Bank. March 2017

Country Profile Health in Myanmar. 2012

Environmental Impact Assessment Procedure. The Government of the Republic of the Union of Myanmar. Ministry of Environmental Conservation and Forestry Notification No. 616/2015. 29 December 2015

Environmental Safeguards, A Good Practice Sourcebook. Asian Development Bank. 2012

Feasibility Study TA 9179-MYA: Power Network Development Project. PPTA Consultant. November 2017

Hazard Profile of Myanmar. July 2009

http://kansasfenceco.com/photo-gallery/5211358

http://www.fao.org/nr/water/aquastat/countries_regions/MMR/

http://www.fencedout.com.au/portfolio/page/7/

https://www.gmtinternational.fr/

https://www.ibatforbusiness.org/

Land uses in project townships. Socio-economic report. PPTA 9179-MYA: Power Network Development Project

Local Governance Mapping in Ayeyarwaddy Region. Highlights. UNDP. December 2014

Local Governance Mapping. The State of Local Governance: Trends in Ayeyarwady. UNDP. December 2014. www.mm.undp.org

Mine Action Group. www.maginternational.org

Mine Action Review. www.mineactionreview.org

Ministry of Foreign Affairs, www.mofa.gov.mm

Myanmar Climate Change Strategy and Action Plan 2016-2030. Myanmar Climate Change Alliance and MONREC. May 2017

Myanmar Country Profile. Banyaneer. September 2013

Myanmar Energy Consumption Surveys Report. Asian Development Bank. September 2017

Myanmar Energy Master Plan. Asian Development Bank, IES Energy Systems, and Myanmar International Consultants. December 2015

Myanmar Energy Sector Initial Assessment. Asian Development Bank. October 2012

Myanmar National Climate Change Policy. Final Draft. Myanmar Climate Change Alliance and MONREC. May 2017

National Environmental Quality (Emission) Guidelines. Unofficial English version

Public Communications Policy. Asian Development Bank. 2011

Ref. 820, Department of Archaeology, 04/10/1996

Ref. 824, Department of Archaeology, 04/10/1996

Safeguard Policy Statement. Asian Development Bank. June 2009

Safety Clearances. Electricity Rules 1985

State and Region Governments in Myanmar. The Asia Foundation. September 2013. www.asiafoundation.org

The 2014 Myanmar Population and Housing Census. The Union Report, Census Report Volume 2. Department of Population. Ministry of Immigration and Population. May 2015

Various maps (state, township, village, flood-prone / disaster risk areas, topographic). Myanmar Information Management Unit (MIMU)

APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENT 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 (SDES) for endorsement by Director, SDES 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 Network Development Project (Distribution Component)

Sector Division: MYRM/SERD

Screening Questions	Yes	No	Remarks
A. PROJECT SITING IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?			
CULTURAL HERITAGE SITE		X	Not applicable
PROTECTED AREA		X	The substations and transmission lines will be in township and village areas and will be located away from any protected or forest areas.
WETLAND		X	Not applicable
MANGROVE		X	Not applicable

Screening Questions	Yes	No	Remarks
ESTUARINE		X	Not applicable
BUFFER ZONE OF PROTECTED AREA		X	Not applicable
SPECIAL AREA FOR PROTECTING BIODIVERSITY		X	Not applicable
B. POTENTIAL ENVIRONMENTAL IMPACTS WILL THE PROJECT CAUSE...			
encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?		X	The transmission lines will only be 12ft – 15ft high and would not cause significant impact on landscape.
encroachment on precious ecosystem (e.g. sensitive or protected areas)?		X	The SS and DL will not traverse any environmentally-sensitive areas, protected areas and forest reserve areas.
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	The project will not alter hydrology of existing rivers, creeks and irrigation canals.
damage to sensitive coastal/marine habitats by construction of submarine cables?		X	Not applicable
deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction?	X		The construction of new substations, transmission lines and extension of existing substations will require backfilling in some areas which are located lower than existing road elevation. This may cause runoff of sediments into adjacent land. Sanitary wastes and solid wastes from construction camps with about 20-40 workers need to be managed with septic tanks and proper solid waste management measures to avoid impacts to the surrounding environment.

Screening Questions	Yes	No	Remarks
increased local air pollution due to rock crushing, cutting and filling?		X	The backfilling of soil onto proposed substation sites will generate airborne dust, particularly during dry and windy conditions. Water sprinkling and other dust control measures will be necessary.
risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	X		Workers will be exposed to hazards such as electrocution risks, working in heights, and ergonomic hazards. Only trained workers should be assigned to work in hazardous areas. Personnel protective equipment (PPE) and warning signs will be necessary.
chemical pollution resulting from chemical clearing of vegetation for construction site?		X	Manual clearing of vegetation will be undertaken.
noise and vibration due to blasting and other civil works?		X	Not applicable
dislocation or involuntary resettlement of people?	X		Land for the substations are mostly within Government-owned land or in private land with owners who are willing to sell or donate the land. Land that will be traversed by the transmission lines will either run through paddy fields or will be parallel to existing roads.
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	The provision of electricity to currently un-electrified villages will provide positive impacts to the community, including Indigenous Peoples, poor, women and children and other vulnerable groups.

Screening Questions	Yes	No	Remarks
social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?	X		Some of the subproject sites are located near narrow roads. Heavy equipment and delivery trucks during construction of the SS and installation of transmission lines will use these existing roads and will cause obstruction and temporary inconvenience to the public. Traffic control and coordination with the local community through the village authorities will be necessary.
hazardous driving conditions where construction interferes with pre-existing roads?	X		Motorbikes and some cars use the existing roads. There is no heavy vehicle traffic in existing roads but parking of heavy equipment and delivery trucks during construction may be hazardous, particularly at night.
creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?	X		Backfilling of substation sites may cause stagnant water or ponding in some areas. This may become breeding habitats for mosquitoes. Adequate drainage leading to the main drainage canal should form part of the design of the substations.
dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?	X		The transmission lines will be either parallel to existing roads or traverse paddy fields. An assessment of the resettlement impacts is being undertaken separately.
environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?		X	Vegetation control using manual trimming of trees and vegetation will be undertaken. There will be no anticipated major environmental disturbances.
facilitation of access to protected areas in case corridors traverse protected areas?		X	Not applicable

Screening Questions	Yes	No	Remarks
disturbances (e.g. noise and chemical pollutants) if herbicides are used to control vegetative height?		X	Only manual trimming of vegetation will be undertaken.
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	There will be about 20 – 30 workers for the substation and 30 – 40 workers for the line construction per subproject. Construction camps with clean water and sanitation systems will be necessary.
social conflicts if workers from other regions or countries are hired?		X	Local human resources will be prioritized
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 operation of construction camps may cause the discharge of wastewater and disposal of garbage into surrounding areas. Presence of workers may also cause possible transmission of communicable and sexually transmitted diseases. This will be mitigated through good practices in construction camp management.
risks to community safety associated with maintenance of lines and related facilities?	X		During the operational phase, fire hazards, electrocution and other community hazards may occur without regular vegetation clearing, inspection and maintenance of the transmission lines and related facilities.
community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?		X	The distribution components will operate on low voltage and EMF is not a primary concern.

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		During the operation of the substations and transmission lines, old equipment and materials such as damaged transformers, old batteries, capacitors, conductors, and other installations will need proper handling, storage and disposal. The procurement of non-PCB containing transformers and non-ceramic type circuit breakers will be included in the EMP and procurement plan of the project.
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		Regular inspection and maintenance of the transmission lines will be included in the EMP to avoid community safety risks.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: Myanmar: Power Network Development Project (Distribution Component)

Sector : Energy

Subsector:

Division/Department: MYRM/SERD

Screening Questions		Score	Remarks[27]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Some of the substations and transmission lines will be located in areas prone to flooding and soil liquefaction.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Design of the subprojects need to take into consideration the flood level conditions and wind speed.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	1	High temperatures may affect cable and equipment condition.
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) \?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	1	Power interruption may occur as a result of damaged transmission lines and substations due to extreme weather conditions

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

[27] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium (score 4)

Other Comments: A Climate Risk and Vulnerability Assessment is to be prepared.

_____

Prepared by:

APPENDIX B: DOCUMENTATION OF PUBLIC CONSULTATIONS

A. Stakeholder Interviews and Meetings

16 August – 13 September 2017

Ayeyarwaddy Region

1. U Min Zaw Nyi - Township Engineer, Phyarpone

There are 12,467 households that are connected with electricity in the township. These are Phyarpone township which includes the Phyarpone town and Amar town. Source of income of the community is from paddy cultivation and fisheries business. Areas which have no electricity use solar, battery or diesel engine. The township engineer said that the proposed project will expand the service area.

2. U Aung Zaw Min – Township Engineer, Maubin

U Tin Htun – Village Administrator

U Aung Myint Thein – Township Administrator

There are 16,148 households with electricity connection after the upgrading of the transmission line in 2014. However, not all of the villages in the township have electricity. The proposal to expand the service area will benefit the people. The Wati Paing Co. Ltd. donated the land for the substation to ESE to help improve electrification in the township. The site is a nominated industrial zone but is not officially owned by the government.

People in the community rely on rice plantation, beans business, shoes and garments manufacturing for income. The proposed project will help the town and also the businesses of the people. Those without electricity rely on solar and diesel engine generators. Electricity is available only for a few hours. With the proposed project, they hope to improve business and economy in the community.

3. U Nyein Htay – Township Engineer, Danuphyu Township

U Kyaw Soe – Township Elder

U Aung Htun Win – District Engineer

There are 5,558 households that have electricity in the township. The proposed project will benefit additional 3,086 households and 35 villages. People in the community are engaged in rice milling, cutting timber, technical workshops, and mainly in the cultivation of rice paddy and beans. There is a rural solar electrification facility which was initiated by the village leaders. However, this is not enough to provide electricity for a greater number of people. People without access to electricity use solar, diesel generators and batteries. They see the project as a welcome development for the community. They only hope that construction of the lines will be done during the dry season.

4. U Than Khin – Ward Administrator

U Kyaw Naing Htun – Township Administrator, Zalun Township

U Win Kyaw Ko – Township Engineer

There are 6,016 households with access to electricity. The project will benefit additional 158 villages without electricity at the moment. According to the stakeholders, frequent power interruption occurs. With the proposed project, they hope to improve the electricity service to the community and increase service coverage. When asked about environmental issues on the project, they said that these are just temporary during construction. However, damage to crops (rice paddies) should be avoided.

5. U Win Hlaing – Township Engineer, Laymyatnar

   U Htoo Htet

   U Win Thu Phyo

The proposed site of the substation is owned by three farmers and ESE already had an agreement with the farmers on the acquisition of the land once the project is confirmed. The community without access to electricity from ESE use solar and diesel engine generators. They hope that with the project, more villages will get connected to electricity.

6. U Ye Yint Hlaing – Township Administrator, Ingapu (Htoogyi)

   U Aye Tun Mg – Township Officer, ESE

   U Tun Lin Khaing

The proposed site of the substation is owned by U Thein Win and ESE will get an agreement from the owner to buy the land once the project is confirmed. There are 1,980 households with electricity connection. People without access to electricity use solar or diesel generators but the supply is not stable. The township administrator hopes that the project will be implemented soon for the benefit of the people.

7. U Win Htein – Township Administrator, Myanaung (Ingpin)

   U Aung Than – Township Engineer

   U Paw Htun – Line in-charge

The former owner of the land was U Htwar Mg. The township electricity committee bought the land from the owner and then donated the land to ESE as a way to improve access of the community to electricity. Currently, there are 11,441 households with electricity connection. There are more villages without access to electricity and the proposed project is expected to increase service coverage in the township.

8. U Khin Zaw – Township Officer, Pathein (Nga Yoke Kaung)

   U Thant Sin

The community needs the proposed project because people only rely on solar rural electrification or diesel generators. Communities get electricity for two hours per day only from 7pm to 9pm. The people anticipate that with the project electricity supply will improve.

<u>Bago Region</u>

1. U Thit Lwin Htoo – Township Engineer, Kawa Township, Bago East

   U Moe – Ward Administrator, Ward 1, Kawa Township, Bago East

   U Aung Myint Kyaing – Township Administration, Kawa Township

The former owner of the land was U Aye Thwin from Ward 1, Kawa township. The ESE department bought the land from the owner since 2011 when the existing substation was built. There are no protected areas or culturally significant areas in the vicinity. People rely on paddy fields and beans plantation as a means of living. The people welcome the proposed project because currently the source is only from solar and diesel engine generators.

2. U Tun Min Latt − Ward Administrator, Oktwin, Bago East

   U Aung Min Thein − Township Administrator, Oktwin

The land to be occupied by the substation is currently being planted by the former owner. The Government took the land in 2005. The people use solar or battery where electricity is not available. Flooding is not common in the area. There are no environmental issues brought up by the respondents. They said that there are no forests in the area that will be affected by the project.

3. U Pyae Hmmu Paing − Township Administrator, Pyontazar Township

   U Nay Aung Soe Moe − Ward Administrator, Myoma (1) ward, Pyontazar Township

   U San Htun − Township Engineer, Pyontazar

The proposed project will not have potential adverse impacts to the surrounding community. The land is owned by ESE since 1960. The people rely on solar and diesel engine generator for electricity. They said that the village will get a lot of benefits from the proposed project because of convenience and better business.

4. U Thet Naing Oo − Township Engineer, Swar Township

   U Apar Lwin − Township Officer

   U Htun Htun Linn − Township Officer

There are about 10 teak trees and a sacred building in the property. The ESE will avoid the sacred building when the project is implemented. Some of the teak trees may be cut but permission from the Forest Department will first be secured. The alignment of the transmission line will pass through paddy fields. People in the vicinity who were interviewed said that damage to their crops is alright as long as they have electricity.

5. U Zaw Min − Sub-township Administrator, Aung Myin township

   U Aung Lwin − Township officer

   U Win Naing Oo − District Engineer

The proposed project will extend electricity to about 7,384 households and 26 villages. If the transmission line will be along the road, there are shops and a monastery and a church along the road which may be affected. The people use solar or diesel engine for electricity and wood and charcoal for cooking. The project will be beneficial to the community because of the convenience it will bring.

<u>Mon State</u>

1. U Mg Mg Soe - Township Engineer, Kyaikhto

   U Win Min Htun − District Engineer

There are 28 villages and 6 wards with access to electricity. With the proposed project, additional villages will get electricity. There are no environmental issues at the site. The nearest forest is located about 15 miles away from the substation. There are also no culturally important areas.

People rely on solar and diesel generator for power supply. The proposed project is much needed in the community.

2. U Win Min Htun − District Engineer, Bilin (Melan)

A monk owns the land who is willing to donate the property so that the community can get electricity. There are 7 villages with electricity while 10 villages do not have access to electricity. People without electricity use solar and diesel generators.

3. U Sai Aung Nay Htun − Township Engineer, Paung Township

U Tun Aung − Village Administrator

U Zaw Myo Aung − Township Administrator

There are 12,580 households with access to electricity. People are engaged in paddy cultivation, rubber plantation, and planting of fruits such as mangosteen and durian. Source of electricity of the community who do not have electricity are solar and diesel generators. According to the respondents, the proposed project is much needed by the community.

4. U Mg Mg Thant Zin − District Engineer

U Hlaing Myo Kyaw − Township Engineer, Thanphuzayat

U Aung Kyaw Than Oo − Village Administrator

The site of the substation is owned by the village administrator, U Aung Kyaw Than Oo. He said that he is much willing to sell his land because they want electricity for their community seriously. He added that the head monk from Wekame village will buy the land and will donate the land to ESE.

There are 11,866 households, 10 wards and 17 villages in Thanphuzayat with electricity connection. However, there are still a number of wards and villages without electricity. Also, electricity supply suffers from frequent power interruption.

5. U Tint Htay − Ward Administrator, Nantay Ward

U Myint Oo − Township Administrator, Mawlamyine

U Ye Aung Soe − Township Engineer

The stakeholders said that the community wants the project because of the benefits and convenience that it will bring. There are no environmental issues at the site of the substation.

<u>Kayin State</u>

1. U Myo Aung − Township Administrator, Kyainseikgyi Township

U Ohn Tin − Ward (2) Administrator

U Ouhn Tun − Township Officer

The new substation will be built in a government land which his being used as an area for temporary parking and repair of government vehicles. The stakeholders said that there are no concerns regarding the project because it will be beneficial to the community. People in the town are engaged in paddy and farm cultivation. They rely on ministry-owned diesel generating sets which electrify about 600 households for 3 hours per day at Ks35 per unit. There are also other private companies which offer electricity for Ks 550 per unit. Rural electrification is also programmed by big diesel generating sets and solar power supply. The current electricity supply suffers from power interruption and is not continuous. This causes damage to equipment, machines and computers. They hope that with the project, the people will experience better and stable electricity supply.

2. U Nay Soe − District Engineer

U Myo Swe − Township Engineer, Zarthapyin Township

U Khin Aung − Ward Administrator

There are 8,873 households and 39 villages with access to electricity in Zarthapyin. There are villages with no access to electricity. Some households buy their own diesel generators to get electricity. The proposed project will help improve the lives of the people if they will have access to electricity.

3. U Win Shwe − Village Administrator, Paung village

U Htun Maung − Township Officer, Paingkyone Township

There are only 123 households and one ward with electricity. They can get electricity for only 2 hours per day. They welcome the proposed project. They do not think that the project will cause any adverse effects but more positive benefits to the community.

4. U Aung Myint Kyaing − Village Administrator, Mae Tha Lut village

U Naing Win − Township Engineer, Hpa-An

There are four wards and one village with electricity connection. They get electricity from a diesel generator for 5 hours per day from 6pm to 11pm. They hope that the project will be implemented soon for the benefit of the village.

5. U Saw Ba Aye − Village Administrator, Kataingti Village

The village do not have access to electricity. If the project will provide electricity to the village, then they have no objection since they have been waiting for electricity for a long time.

6. U Hla Kyi − Ward 3 Administrator

U Chin Gyi − Township Land Records Officer, Kamamaung

U Myo Chit − CBO

There are 296 households with access to electricity that is supplied by a ministry-owned diesel generator set. They hope that the project can improve the supply of electricity because they get electricity for a few hours only.

Rakhine State

1. U Thet Tin Zaw – Township Engineer, Kyeintali Town

   U Tin Zaw Moe – District Engineer

There is an existing diesel generator that serves 802 households in the township. The project plans to provide electricity to 47 villages. There are also some households using battery for electrification. The project is much needed by the community.

2. U Thein Zaw Win – sub-village administrator

   U Kaung Myat Tun – Township Engineer, Thabyuchaing

   U Than Zaw Han – Township Administrator

There are no households with electricity connection in the township. The sub-village administrator said that they have been clamoring for the project for a long time. When asked about the environmental issues at the site and about the project, the sub-village administrator said that there are no protected areas or culturally significant areas in the vicinity. They also do not experience flooding. They think that the need for electricity outweigh any issues on dust during construction.

3. U Thaung Tun – villager, Magyuchaung village

   U Wai Yan Win – villager, Magyichaung village

The ShwelHway village tract owns the land to be occupied by the substation. The village administrator said that they will donate the land to ESE so that the community will have access to electricity. Currently, there are no villages with electricity connection in the village. The plan to connect 50 villages to electricity is much welcome.

4. U Aung Kyaw Naing – villager, Kyauk Nagar village

The villagers are engaged in fishing, cashew nut and coconut plantation. They do not have access to electricity but there are some households with solar and diesel generators. When asked about environmental issues in the area, the villager said that there are no protected areas and culturally significant areas or temples in the area. The site is also not prone to flooding. The villager does not have objection to the project because of the benefits of electrification to the community.

Photos of Stakeholder Interviews During the Site Reconnaissance

		
Maubin Township, Ayeyarwaddy	Danuphyu, Ayeyarwaddy	Laymyanatnar, Ayeyarwaddy

 Zalun, Ayeyarwaddy	 Nga Yoat Kaung, Ayeyarwaddy	 Kanyuktwin, Bago East
 Pyontazar, Bago East	 Taw Kywe Inn, Bago East	 Bilin, Mon State
 Thanbyuzayat, Mon State	 Hpa-pun, Mon State	 Naungkone, Mon State

B. Public Consultations

Stakeholder	Stakeholder Comments and Suggestions	Response of MOEE/ESE
A. Public Consultation held on 30 September 2017 in Thegon Township, Bago West		
U Myo Htut Divisional Senator of Thegon	The Power Network Development Project will assist the national electrification plan of the MOEE. We therefore welcome the proposed project.	Noted
U Than Htaik Aung Township Youth Association	Who will compensate the land, cultivate crops?	The compensation rate for various land and crops will be determined according to the state and division government.
	Can the community work even under the transmission lines?	The community can still continue planting rice under the transmission lines.
	How will you take care of the tree branches? How will you dispose of the cuttings? What are the chances for the community to have work from the project?	The cuttings can be given to the community as fire wood for free. Workers from the community can be hired during construction.

	New substations should be constructed where there are few houses.	This will depend on the technical design.
Dwa Tin Tin Aye Ward (1), Thegon Red Cross	Are there safety rules? There should be workshops and trainings for the community on safety of electrical lines.	The ESE gives pamphlets to households with measures on electrical safety. The measures are according to the electricity rules and regulations.
U Than Htaik Aung Administrator, Township Youth Association	If there is power interruption, it often takes time for ESE to remedy the situation. ESE staff should have training and be qualified.	ESE conducts training for staff every year.
U Thein Htun Community member	The implementation of project should be done during the summer season to avoid damage to crops.	Noted
U Thein Lwin Community member	We welcome and thank ESE for the project. We are happy because our village will be electrified soon.	Noted
Daw Pyone Mother and Child Care Association	We urge ESE to immediately implement the project.	Noted
U Win Khaing Community member, Thegon	How much is compensation for crops?	If the pole is in the paddy field, the ESE usually does not provide compensation because the area of the pole is very small. If there is a new substation, the affected land will be compensated.
B. Public Consultation held on 9 October 2017 in Bago City, Bago Region		
U Myat Oo Htun Pyontazar community leader	I appreciate the plan to manage the social and environmental impacts based on the impact assessment. If there are issues, the ESE, community leaders and the community will need to cooperate.	Noted
Daw Tin Nandar Win Volunteer, Red Cross, Bago	We are using fire wood and charcoal for cooking so we spend a lot of money. This will have an impact on the environment. If we get electricity, we will cook using electricity if this is not so expensive. In such way, we can also protect the environment.	Noted
U Khon Win Aung Pa-O Ethnic, Tawkyweinn	We fully support the project.	Noted
U Nay Mainda Shan Ethnic, Tawkyweinn	We fully support the project.	Noted
C. Public Consultation held on 11 October 2017 in Pathein Township, Ayeyarwaddy Region		
U Htun Shwe Delta Area Protection and Development Organization	How much is the land and crop compensation?	The compensation shall be given according to the rate approved by the committee organized by the state and divisional government.

U Thein Htun Community member, Phyapone	What is the rate of return of the project?	This is still being studied.
U Aung Khaing Win Community member, Phyapone	We would like to have electricity as soon as possible. We want the project to materialize as soon as possible.	Noted
D. Public Consultation held on 12 October 2017 in Zalun Township, Ayeyarwaddy Region		
U Soe Paing Community member	The community will benefit 100% from the project. The community will give its full support to the project.	Noted
U Soe Lwin Retired Divisional Engineer	The project will support the social and economic development of the community. However, during implementation, the project should prioritize safety first.	Noted
U Kyaw Soe Community member, Danuphyu	We are very happy because the project includes our community. We also appreciate that the project is also protecting the environment.	Noted
U Aung Naing Zalun Senate Representative	We are happy to know that the project will be coordnated with the village community. Prior coordination with the village is very good. We also appreciate that compensation will be given to affected land or property based on discussion with the community.	Noted
U Kyaw Soe Ethnic representative	The line should be 100 feet away from the petrol station.	Noted
E. Public Consultation held on 16 October 2017 in Kyeiktho Township, Mon State		
U Maung Win Community Leader	We are very happy with the proposed project. The existing substation at Kyeiktho is very small and undated so we want to upgrade this substation. There should also be staff housing.	Noted
U Than Lwin Saung Naing Gyi Village Tract, Village Administrator	We are happy with the proposed project and we will support in case ESE needs out help.	Saung Naing Gyi substation is a JICA project. When ESE needs help, we will let the community know. We appreciate your help to ESE.
U Haung Lwan Officer, Forest Department, Kyeiktho	In case there are trees that will be cut along the alignment, please let the Forest Department know about this as early as possible so that we can conduct the survey first. Some areas for the elecrtric lines and posts may have problems about landslide which is dangerous. When ESE chooses the area for the posts, please consider the trees to be cut and landslide prone areas.	When the proposed project is confirmed by ESE, we will conduct the survey of the lines and the post before implementation.

U Aung Zin Latt Civil Society Organization, Kyeiktho	When the transmission line is constructed, are there impacts on social and environment?	We will avoid the impacts on the people and the environment. If there are some impacts, we will discuss this and implement measures to avoid adverse impacts.
U Min Min Aung Kantkaw Ward Administrator, Kyeiktho	Before the project is implemented, ESE needs to coordinate and discuss first with the land records department and the general administration department with regards to the right-of-way.	We will do this first before implementing the project.
F. Public Consultation held on 17 October 2017 at the State Electrical Office, Mon State		
U Ban Moe Thanbyuzayat community	When the project is confirmed and before construction of the transmission line, ESE needs to conduct survey first of the alignment. In the past, there was no survey and so many trees were taken off and caused severe impact to the environment.	Everytime ESE constructs the lines and installs the posts, we conduct the survey first. There are rules and regulations for the constrution of lines and posts because we need to make sure that the alignment will meet electrical safety and clearance requirements.
U Aung Min Mawlamyine	How much is the loan from ADB? When will the Government get the loan? How about the interest rate? We want the project to be implemented as soon as possible.	The total loan is about 400 million for the five states/regions in Kayin, Mon, Ayeyarwaddy, Rakhine and Bago. Maybe by next year, after the confirmation of the project project, we can implement the project. We do not know yet the interest rate.
U Aung Zin Deputy Chairman of Rubber Plantation and Production Association	In some projects, the compensation requested by the owner of rubber plantation was too much. For example, the market price at for one acre for rubber is 50000 or 60000 but they want 100000. In this project, how will you handle the compensation in such case?	We will choose the alignment of the lines and posts where there is no impact. If we cannot avoid, we will choose the alignment with the least impact. When the project is confirmed, we will request the help of the community to give us the best alignment or route. If there is compensation, ESE will coordinate with the community to discuss the fair price, agreeable to both the affected households and ESE.
G. Public Consultation held on 19 October 2017 at the State Electrical Office, Hpa-An township		
U Win Shwe Paingkyone Village Administrator	How much is the price of land for one acre? The land owner wants 80 lakhs for one acre. On the land there are mango trees and palms.	We cannot determine at this time the price of land because the project is still in the proposal and study phase. When the project is confirmed, the price will be the market price agreed with the owner and ESE. This will depend on the government price, what is planted on the land, for example, rubber or teak, etc.?

Daw Sandar Hlaing Mother and Child Care Association, Hpa-Pun	The local people warmly welcome the project and we want it to proceed as soon as possible.	Noted
Daw Shwe Hnin Paung Village	We warmly welcome the project because it has many advantages in terms of economic, education, and health.	Noted
U Win Swe Paingkone Village Administrator	When will the project start?	We cannot say the exact date but maybe in 2018.
H. Public Consultation held on 20 October 2017 at the Community Hall in the Monastery, Kyonephe village, Zarthapyin, Hpa-An		
U Than Win Kyonephe village	What are the advantages of the new substation? Will the project have impacts on crops? What is the quality of electricity?	When there is a new substation, the quality of electricity will be better and more reliable than before. For the crops, the ESE will avoid and reduce impacts to crops, the community, and the environment as much as we can. But if there are high trees near the transmission line, the ESE will need to cut or trim the trees because of safety clearance requirements.
U Thein Myint Kyonephe village	For the construction of the substation, are there any safety issues? How will this be managed? Will there be danger of thunder because of substation near the village?	ESE will take precautionary measures to ensure safety. MOEE will make sure that safety of the community is a priority. There is no impact on the environment and community because of the substation. There will be lightning arresters and management system at every substation so there is no need to worry about this.
Daw Win Shein Kyonephe village	Can villagers build a house and how many feet away from the substation?	There are guidelines under the electricity rules on the safe clearance from lines depaneding on the voltage of the line.
Daw Ngwe Wint Kyonephe villahe	Will there be involuntary acquisition of land?	ESE will buy the land for the substation at fair price.
U Aung Naing Oo Thanhle village administrator	We want the project as soon as possible.	Noted
U Htun Myint Kyonephe village	We want the project to be implemented very soon.	Noted
Daw Hla Than Kyonephe village	We support the project and we hope that this will be implemented soon.	Noted
U Tin Ohn Than Khatar atwin village	We hope the project will provide good quality voltage.	Noted
U Soe Tun	The project should provide good and reliable voltage.	Noted

Khatar atwin village administrator		
U Ngwe Tun Zarthapyin West	When will the project start?	If the project is confirmed, maybe the project will operate in 2019.
U Hlaing Htwe Office of Fire Department, Zarthapyin	Is there any skills training for electrical safety?	Skills training are provided for staff but there is also basic training on electrical safety which is held for one week. ESE just completed four trainings at the office.

Photos of the Public Consultations

1. Public Consultation held on 30 September 2017 in Thegon Township, Bago West




2. Public Consultation held on 9 October 2017 in Bago City, Bago Region




3. Public Consultation held on 11 October 2017 in Pathein Township, Ayeyarwaddy Region




4. Public Consultation held on 12 October 2017 in Zalun Township, Ayeyarwaddy Region




5. Public Consultation held on 16 October 2017 in Kyeiktho Township, Mon State


6. Public Consultation held on 17 October 2017 at the State Electrical Office, Mon State


7. Public Consultation held on 19 October 2017 at the State Electrical Office, Hpa-An Township



8. Public Consultation held on 20 October 2017 at the Community Center in the Monastery, Kyonephe village, Zarthapyin, Hpa-An




APPENDIX C: ENVIRONMENTAL DUE DILIGENCE OF SUBPROJECTS PER REGION/STATE

1. DISTRIBUTION COMPONENT AT AYEYARWADDY REGION

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
1	Nga Yoke Kaung	33/11 kV 10 MVA substation at existing Nga Yoke Kaung 66/33/11kV 10MVA substation	Nga Yoke Kaung Taung Village, Nga Yoke Kaung Town, Nga Putaw Township, Pathein Disrict	The existing SS was built in 2015. It has an office with a 160kVA generator that supplies electricity to the Wards 1 and 2 of the village for 2 hours per day, from 7-9PM. The site occupies an area of 4,000 sq.ft. Road going to the SS is characterized as narrow, earth road but existing SS has enough area for parking of vehicles. The surrounding area is sparsely populated.	There are no major environmental issues at the site, except on health and safety concerns for workers. There are also no oil pits in existing transformers and no area for storage of equipment and wastes.	 Existing substation. The new 33/11kV 10MVA substation will be installed within the compound.
2	Laymyatnar	• 66 kV transmission line (15 Miles) from Hinthada 66kV Substation to Leymyetha Township • 66/11 kV 5 MVA new substation at Leymyetha Township	SS: Sidyaekwin Village, Leymyethna Township, Hinthada District DL: Konegyi Sidyaekwin, Leymyethna Township, Hinthada District	The new SS will be located in an existing paddy field with an area of 2 acres. The site is beside the road and is surrounded by paddy field. Drainage in the vicinity leads to the Mayin creek and Yele Nyaung Creek located in Aing Thabyu village. There	The construction of the SS will require backfilling of about 1 meter to level with road. Project will cause construction-related impacts such as runoff to adjacent paddy fields and creeks, damage to crops during	 The proposed site is adjacent to the road and surrounded by paddy fields.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				are no houses and other structures in the immediate area that may be affected by the construction of the substation. The DL will primarily traverse paddy fields and areas along the side of the Mayin creek and Yele Nyaung creek.	pole installation and blocking of adjacent road due to parking/movement of construction vehicles.	
3	Ingapu (Htoo Kyi)	• New construction of 66 kV Transmission line 0.5 miles double circuit from Myanaung - Hinthada 66 kV line to HtooKyi (Ingapu) and • 66/11 kV 5 MVA new substation at HtooKyi (Ingapu)	SS: Nyaung Gone village, Htoo Kyi Town, Ingapu Township DL: Nyaung Gone village	The new SS in a property with a land area of 6 acres. The site is beside an earth road and small entrance gate to the Mayathiwa temple but the temple itself is located about 1 km away. The site is currently being used as paddy field. There are no houses and temples in the immediate vicinity. The site and immediate vicinity is not prone to flooding. The DL will tap to the Myanaung-Hinthada transmission line. The line will pass	Project will cause construction-related impacts such as runoff to adjacent paddy fields, damage to crops during pole installation and blocking of adjacent narrow road. DL will pass through paddy field and only one village. DL installation could cause damage to crops.	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				through paddy field and Nyaung Gone village.		
4	Myanaung	• New construction of 66 kV Transmission line 0.1 miles double circuit from Myanaung - Hinthada 66 kV line to Inpin village (Myanaung) and • 66/11 kV 5 MVA new substation at Inpin village (Myanaung)	Ashay Kone Road, Inpyin Town (Inpyin same as Myanaung)	The new SS equipment and DL will be placed inside the existing SS compound which has a land area of 1 acre. The site is adjacent to a narrow road in Ingpin village, however, there is enough parking area in the compound. The site has an existing small building that houses a diesel generator that supplies electricity to 11 wards. The SS area is surrounded by paddy field. There are some trees inside the compound which could be avoided or trimmed. Area is not prone to flooding. Across the SS site is a communication tower. The DL will be within the SS site and is relatively short (0.2 miles in-out), purposely to just tap into the Myanaung-Hinthada	There are no major environmental issues at the site, except on health and safety concerns for workers and absence of oil pits in transformers.	 The site of the new substation at existing SS compound. The short connection line of the DL will be the SS to Myanaung-Hinthada line.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				line going to the new substation.		
5	Dedaye	• 66 kV transmission line (15 Miles) from Kyaiklat 230kV substation to Dedaye • 66/11 kV 10 MVA Substation at Dedaye Township	DL: parallel to Kyaiklat-Dedaye Road SS: Chaung Phyar Village, Dedaye Township	The existing Dedaye SS in Chaung Phyar Village has 33/11KV with plans to upgrade to 66/11kV. The SS covers a land area of 0.26 acre. The site is surrounded by paddy fields. There are 3 sites being considered. Site 1 is near existing SS; Site 2 is about 5,000ft away from existing SS; and Site 3 is near the township. Site 1 is prone to flooding; Site 2 is owned by government, and Site 3 is privately owned. Flooding occurs in the vicinity of the site of the existing SS. There are no trees and land use is primarily paddy field. Nearest water body is the Chaung Phyar creek which drains into the Ayeyarwaddy River.	The sites being considered are prone to flooding. There is a need to backfill the site. SS construction may cause blocking of adjacent road due to parking of construction vehicles. DL is parallel to the road (about 0.5 mile from the road). DL will pass through paddy field which could cause damage to crops.	  The surrounding paddy fields get flooded in the rainy season.

No	Township	Project Scope	Location	Description of Site / Surroundings	Environmental Issues	Photographs of the site
				The DL will also be located in Chaung Phyar Village and will traverse paddy fields that are parallel to the existing road.		
6	Maubin	• 33 kV transmission line (9 Miles) from Maubin 33/11kV substation to Yelwe village • 33/11 kV 5 MVA substation at Maubin (Yelwe) • 33kV Outgoing Switch Bay 2 sets at Maubin substation	Maubin-Maw Kyun Street, Ye Lae Kalay Village, Maubin Townhip, Maubin District	Site is within an industrial zone in Ye Lae Kalay village. Site is level and beside the Maubin-Shwedaung Mwo road. Area has been demarcated by trees. The SS site is not prone to flooding. However, there is a need to backfill the site to level with the existing road. The site has soft soil condition. The nearest waterbodies to the site are the Yelae creek and Yarsu Taing River. The surrounding area is characterized as paddy fields. There is no ongoing planting at the site itself. The DL will be parallel to the existing 11kV line and	The alignment of the DL will affect paddy fields, fishponds and waterways which could cause damage to crops and fish production and runoff to rivers/creek during pole and line installation. The site of the substation is prone to flooding. There is a need to backfill the site. The construction of the substation may also cause blocking of adjacent road due to parking of construction vehicles.	 The site of the proposed substation

No	Township	Project Scope	Location	Description of Site / Surroundings	Environmental Issues	Photographs of the site
				Maubin-Shwedaung Mwo Road (about 0.5 mile from the road). The line will pass through paddy field, fishponds and Ye Lae creek and Yarsu Taing River. The DL will be located within Ye Lae Kalay ward.		
7	Pyarpon	66/33kV 10MVA substation at Pyarpon Township	Phyar Phone Tamann village, Pyarpon Township	The 66/33kV 10 MVA SS will be located at vacant area at the existing SS, near Taman Village.	There are no major environmental issues at the site, except on health and safety concerns for workers. There are also no oil pits in existing transformers and no area for storage of equipment and wastes.	 Existing Pyarpon substation
8	Bogale	66/33 kV 10MVA Substation at Bogale Township	Pho She Lone Village, Bogale Township	The new 66/33kV 10 MVA substation will be located at the vacant area of the existing SS. The site is located about 1.5 miles from Bogale Town.	The proposed site is surrounded by paddy field which could cause damage to crops due to soil runoff. There is a need to backfill the site. The construction of the substation may also cause blocking of adjacent road due to parking of construction vehicles.	 Proposed site of new substation

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
9	Pyarpon	• 66 kV transmission line (15 Miles) from Kyaiklat 230kV Main Substation to Pyarpon • 66/11 kV 20MVA substation at Pyarpon Township	DL: Thar Lake kyi Village & Kyonetar Village SS: Phyar Phone Tamann VIllage	The site of the SS is in Phyar Phone Tamann, at the vacant area of the existing SS. The DL will traverse the Thar Lake Lyi village and Kyonetar Village and paddy fields. The line will be parallel to the Kyaiklat-Pyarpon road. There are no structures along the line; mostly paddy field. The line will cross the Pyarpon River.	The alignment of the DL will affect paddy fields which could cause damage to crops and soil runoff to Pyarpon river and paddy fields during pole and line installation. The site of the substation is prone to flooding. There is a need to backfill the site.	 The existing substation where the 66/11kV 20MVA will be installed. Site is the same as no. 7.
10	Bogale	• 66 kV transmission line (21 Miles) from Pyarpon 66/11kV substation to Bogale Township • 66/11 kV 10 MVA substation at Bogale Township	DL: Ma Sein Village & Tha Kan Wa Village SS: Pho She Lone Village (same location as no. 8)	The new 66/11kV 10 MVA substation will be located in an area of 2.38 acre. The site is about 0.8 km from the Bogale town. The site is characterized as a paddy field. Based on information from villagers, the site is prone to flooding. The site and vicinity drains into the Nat Chaung Creek, near the Bogale bridge.	The substation site will require backfilling to elevate the ground. However, earthworks may affect adjacent rice paddy field. The installation of transmission poles will affect paddy fields and may cause damage to crops. The palm trees may be avoided.	 The proposed site of Bogale substation. The DL will be parallel to the road but will traverse paddy fields.

No	Township	Project Scope	Location	Description of Site / Surroundings	Environmental Issues	Photographs of the site
				The DL will be parallel to the Phyarpon-Bogale Road and will traverse paddy field. There are also areas with palm trees. The DL alignment is within a flood-prone area.		
11	Zalun	• 66 kV transmission line (13.5 Miles) from Yekyi-Hinthada line to Zalun Township • 66/11 kV 5 MVA substation at Zalun (Nyaungpin market)	Zalun-Pyinma Gone Shar Khe Road, Ngaung Bin Zay Ward, Zalun Township, Hinthada District	The proposed site of the substation is near the road while the DL will run through paddy field. The substation will occupy an area of about 2 acre (235 ft x 400 ft). The site is adjacent to a road on the north and paddy fields on the surrounding areas. The area is sparsely populated. The school is located about 1 mile from the site while the Maung Htaung village and hospital are located in Nyaungbin Zay Ward in Zalun town center. The water body nearest to the site is the Pyinma Kone creek, a tributary of Ayeyarwaddy River.	There is need to elevate the site of the substation through backfilling to align with the elevation of the adjacent road. Earthworks at the substation may cause soil runoff into adjacent paddy fields. The installation of transmission line will affect paddy fields and cause damage to crops.	 The site of the proposed Zalun substation. The DL will traverse paddy fields.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
12	Danubyu	• 66 kV transmission line (16 Miles) from Zulun substation to Danubyu • 66/11 kV 10 MVA substation at Danubyu	Danubyu No. 17 Ward/1 Road, Danuphyu Township, Maubin District	The new substation in Danubyu town will occupy 1.52 acres. The site is adjacent to a cemetery on the east; houses and an earth road on the south; an abattoir on the north; and paddy fields on the west. Municipal garbage is also being dumped near the cemetery site and incinerated. There is no paddy planting at the site itself but the area is swampy. The site has soft soil condition and sand bags are being placed by villagers at the site inorder for them to reach their paddy fields. The nearest body of water to the site is the Ayeyarwaddy River. The DL will pass Kyone Sha village, Thabaw Thapyu village and Yae Twin Kone village. The land use along the line is mostly paddy field.	The project will cause temporary impacts during construction. The substation site will require backfilling to stabilize the soil condition. This may cause soil erosion into adjacent paddy field. Design of poles would require more stable foundation to ensure integrity of the line. Installation of poles may cause damage to crops.	 The site of the proposed substation. The DL will traverse paddy fields.

No	Township	Project Scope	Location	Description of Site / Surroundings	Environmental Issues	Photographs of the site
				There is an existing 33kV Yekyi DL at the paddy field wherein poles and towers were noted in unstable condition because of soft soil in the area.		

2. DISTRIBUTION COMPONENT AT BAGO REGION

BAGO EAST

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
1	Pyontazar	New construction of 33 kV Transmission line 2 miles double circuit from from existing Nyaunglay-pin - Daik U 33 kV line to Pyontazar, 33/11 kV 10 MVA new substation at Pyontazar	Myoma 1 St. Minte ward, Pyontazar Tsp, beside Yangon-Mandalay Road	The land for the new substation has an area of 0.9356 acre (2283x170ft). The property is owned by ESE since 1960s. The site is within the town center and is adjacent to an existing substation with office and staff house. The site for the new substation is swampy, prone to flooding and is adjacent to residential houses and shops. Backfilling of the site will necessary to elevate the area up to the level of the adjacent road. Open wires were noted hanging on the fence which may pose	• There are health and safety concerns at the existing substation site that may pose risks to workers and community. • Backfilling of the site may result to runoff of soil into adjacent properties as well as block drainage. • Flooding of adjacent properties may occur when the substation is elevated up to road level. • Adequate safety clearance is necessary when the transmission line pass above the railway line and run along settlement areas - Aye village and streets/lane (small roads).	 The proposed site of the substation within the existing substation compound. 

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				health and safety hazards to workers and the community. The proposed new transmission line will be along a small village road (lane). The alignment will pass through a railway line, Aye village (settlements), and village streets/lanes.		Open wires hanging of the fence of existing substation which poses safety issues for the workers and community.
2	Taw Kywe Inn	New construction of 33 kV Transmission line 5.1 miles single circuit from Penewgone - Kannyutkwin 33 kV line to Taw Kywe Inn, 33/11 kV 10 MVA new substation at Taw Kywe Inn (Kyauk Ta Khar)	4 Aungmyin Vilage tract, Aungmyin Tsp, beside Yangon-Mandalay Road	The proposed site of the new substation covers an area of about 0.92 acre (136ft x 296 ft.). The land is owned by the regional government. The area is characterized as open grassland used for grazing cows and buffaloes. The proposed site of the substation is surrounded by paddy field on the northeast, by the road on	• The substation site will require backfilling to elevate the land up to the level of the adjacent road. This may cause soil runoff into the paddy fields on the eastern and northern sides of the property and on the houses and shops on the south. • Trees may be affected during installation of the transmission line. • Residential houses and shops along the road may be exposed to health and safety risks during pole in-	 Proposed site of the substation. The transmission line will be on the side of the road.

No	Town-ship	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				the west, and by houses and shops on the south. Across the road (infront of the project site) is a small bitumen mixing facility of the road construction department. DL will be along the side of the road. There are trees that needs to be avoided or trimmed when the transmission line is installed. There are village areas, a monastery, and a Baptist church along the road that will be affected by the transmission line. The alignment is characterized by residential houses and shops.	stallation and with operation of the new transmission lines.	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
3	Kanyut kwin	Upgrading of existing 33/11Kv 5 MVA Substation to 33/11Kv 10MVA Substation at Kanyutkwin	Yangon-Mandalay Road, Kanyut Kwin, Bago East Region	The site for the upgrading and installation of 10MVA substation is adjacent to the area occupied by the existing Kanyuktwin substation. The site for the proposed 10-MVA substation will be at the back of the existing substation which is characterized as paddy field. The surrounding area is sparsely populated. The area is already owned by ESE but the former owner still continues to plant rice while the area is still not yet being utilized by ESE. Total area of land is 0.79 acre. The small substation building can only house the control panel.	• There is a need to backfill the site including the existing substation site to elevate up to existing road. This may result to soil run-off into adjacent paddy fields. • The existing substation has no area for storage of old equipment as well as for new materials. The design of the substation need to include a storage area for new and old equipment. • There are no oil pits in existing transformer. • The drainage of the existing substation leads to the paddy field. There is a need to provide adequate drainage for the site going to the road drainage.	 The proposed new substation will be at the back of the existing substation which is characterized as paddy field.

No	Town-ship	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				A number of old and damaged transform-ers are left in the open field but no oil leak was noted sur-rounding the old equipment. There are no oil pits in ex-isting and opera-tional transformer, and traces of oil spills were noted surrounding the transformer area. The proposed sub-station site is sur-rounded by paddy fields on the north, west, and south, and by the existing sub-station on the east. The Yangon-Manda-lay Road is located about 50 meters east of the site.		

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
4	Oktwin	Upgrading of existing 33/11Kv 3 MVA Substation to 33/11Kv 10MVA Substation at Oktwin	Golf Resort St., Kyetthonkhin (2) ward, Oaktwin Tsp	The new 10MVA substation will be located adjacent to the existing 33/11kV Oktwin substation that was built in 2011. The site for the new substation is currently characterized as rice paddy which his being planted by the former owner of the land. The site is adjacent to an ESE staff house on the east, a fire brigade on the south, paddy fields on the north, and houses on the west. There is no drainage on the road by runoff water flows into the northside of the paddy fields towards the Nga Zin creek. The existing substation has not experienced flooding in the past. The existing site is elevated	• The construction of the new substation will need backfilling to elevate the land up to the level of the existing substation and road. This may cause soil runoff into adjacent paddy fields. • There are safety issues in the existing substation. • There are no oil pits for transformers. • HF6 circuit breakers are still being utilized. • Storage of new and old equipment such as batteries in adequate as the equipment and wastes are exposed to environmental elements. • There are no safety warning signs and instructions for workers.	 The proposed area of the substation will be at the paddy field next to existing substation. 

No	Town-ship	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				as compared to the adjacent rice paddies. There is a small makeshift storage hut without walls for new and old batteries inside the substation compound. Absence of walls on the hut exposes the batteries to elements. There is a battery charging area inside the SS house. A transformer with open wires was found inside the substation and near the adjacent house. There are no warning signs while some minor oil spills were noted. SF6 circuit breakers are still being used by the substation.		

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
5	Swar	New construction of 33 kV Transmission line 3.9 miles single circuit from Thargaya substation to Swar Township (near graveyard), 33 kV line 0.55 miles double circuit from near graveyard to Swar township office, 33/11 kV 10 MVA new substation at Swar township office and 2 sets of 33 kV outgoing switch bays at Thargaya substation	Swar Factory village tract, beside Yangon-Mandalay Road	The new substation will be beside the existing Swar electricity township office and substation. The site is adjacent to the Yangon-Mandalay Highway on the west. The site of the new substation is characterized with shrubs, bushes and 10 teak trees. According to the ESE District, they have already submitted a request for permission to cut the teak trees from the Ministry of Forestry. A community drainage line cuts through the land for the new substation. The site has a sacred area / small building for praying but the project will avoid the sacred area. There is an altar placed on	• Cutting of teak trees inside the new substation site which need permission from the Forestry Department. • The construction of the substation may affect the existing drainage/creek. Township representatives who were interviewed said that water in the creek only flows during the rainy season but is normally dry. The project needs to ensure that the existing creek will not be affected. • The substation site is located below the road elevation and may need to be backfilled. This will result to soil runoff into the creek and adjacent land. • The sacred area for praying will be avoided. In addition, the new substation should be adequately fenced to protect against intrusion by unauthorized persons.	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				a tree beside the road and infront of the substation. This altar will not be affected by the project and people can still access the praying area thru the road. The new transmission line will traverse rice paddy field.		
6	Kawa	Upgrading of existing 33/11Kv 3 MVA Substation to 33/11Kv 10MVA Substation at Kawa	Ward (1), Kawa Ywar Thit, Kawa Tsp	The substation property is located in a 2.5-acre land that was purchased by ESE in 2011. The site has an existing substation that was built in 2011. The existing substation has a two-storey building and switchyard. There is a paddy field at the back of the existing substation which is being planted by substation staff. In 2017, the substation	• Construction of the substation will not result to significant environmental impacts since this will just involve installation of new equipment at the site. • The design should include oil pits for transformer to manage oil spills. • There are no storage areas for new and old equipment and parts at the substation and waste materials.	 The new equipment will be installed at existing substation compound.

No	Town-ship	Project Scope	Location	Description of Site/Surroundings	Environmental Issues	Photographs of the site
				already upgraded to 5MVA. The project needs to provide new switch bays. The area is fenced and surrounded by paddy field. The project will not clear the paddy land at the back but will use existing developed land area occupied by the existing substation. There are no oil pits in the existing transformers at the substation. The site is adjacent to some houses on the north, paddy fields on the east, a road on the south, and paddy fields and some teak trees on the west.		

BAGO WEST

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
1	Thegon	Upgrading 33/11 kV 3 MVA Present substation to 33/11 kV 10 MVA substation at Thegon and new construction of 33 kV Transmission line 0.5 miles double circuit from Pyay-Paungde line	Corner of Phayar Gyi Road and Moe Gaung Road, Thegon Township, Pyay District	A new transformer will be installed within the existing compound of the Thegon substation. The substation has an area 3.37 acres and is owned by ESE since 1958. The substation is adjoined by the Phayar Gyi road; houses and a monastery on the southeast; and a school on the east. There is a safe clearance area of about 100 ft. between the switchyard and the nearest house, but only wires and wooden poles serve as fence of the substation. In general, the area is within the town center but the houses	• There are no warning signs and secure fence that would deter unauthorized persons from entering the substation compound. • There are oil spills near the transformer area. • Worker health and safety issues need to be reinforced.	 The site of existing substation. The new transformer and other equipment will be installed at the existing compound.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				and other establishments are not closely located. The site is not prone to flooding. The existing substation was constructed sometime in 1996. There were noted oil spills near the transformer area. The existing transformer was manufactured in 1998. There is no oil pit in the transformer pad.		
2	Pateegon	Upgrading 33/11 kV 1.25x2 MVA Present substation to 33/11 kV 10 MVA substation at Pateegon and new construction of 33kV Transmission line 0.8 miles double circuit from Pyay-Paungde 33 kV line	Ywama Road, Ywama Ward, Pateegon township, Pyay District	The new 10MVA substation transformer and equipment will be installed within the existing Pateegon substation. The existing substation has a land area of 0.63 acre which is owned	• The installation of the new transformer at the existing Pateegon substation will not pose significant environmental impacts. • Measures are necessary to address impacts on worker health and safety during equipment installation and operation.	 Existing Pateegon substation and surrounding community areas.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				by ESE. The substation area is fenced and the switchyard has about 20-meter setback from the fence and the nearest house. The substation is within the town center. It is adjacent to the Pateegon-Thegon Road on the north; by houses on the eastern and western sections; and by a road on the south. The site is not prone to flooding. The road drainage leads into the Shan Taw creek which is located about 15 miles from the site. There were oil spills noted. There was no segregation of waste materials and no safety warning signs. Old and damaged	• Though there are no oil spills noted at the site, the substation should be provided with oil pits to address potential oil spill in case of breakdown of transformer. • Although there is a fence that would restrict entry of community or unauthorized people to the substation compound, warning signs are necessary to deter people from entering dangerous electrified areas in the substation. • There are no waste storage areas for old equipment at the substation.	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				equipment are brought to the regional warehouse while the municipal solid waste is collected through the township waste collection system.		
3	Shwedaung	New construction of 66 kV Transmission line 30 miles single circuit from 230/66 kV Shwedaung Gas Turbine to existing 33/11 kV Paungde substation and 66/33 kV 20 MVA new substation at Paungde substation		Project is cancelled. Location changed to Paungde (Hmattaing).		
4	Monyo	New construction of 33 kV Transmission line 15 miles single circuit from Monyo 33/11 kV substation to Hteintaw (Monyo), 33/11 kV 10 MVA new substation at	Existing: Bo Tayza Road, Moe Nyo Township, Thar Yar Waddy District New SS: Ta Nin Lar ward, Htein Taw Group, Moe Nyo	The existing 33/11kV Monyo substation was built in 2015 in a property with a land area of 2.8 acres. The said property is located at Bo Tayza	• The construction of the new substation is not expected to result to significant environmental impacts to surrounding areas except for construction-related issues on dust and runoff. • The installation of the transmission line may cause	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
		Hteintaw (Monyo) and 2 sets of 33kV switch bays at Monyo substation	Township, Thar-yarwaddy District	Road, Moe Nyo Township, Thar Yar Waddy District. The 15-mile transmission line will connect from the existing substation to the proposed new 33/11kV substation in Monyo (Hteintaw) while the 2 sets switchbay will be installed at the existing substation. The new substation in Monyo (Hteintaw) will be managed by the same staff of the existing Monyo substation. There are oil leaks at the existing substation and no oil pits are provided. The new substation site will be in a farm land with an area of 0.77 acres. The area has been cleared and demarcated. The site	damage to crops and paddy fields. It will also cause temporary blocking of the narrow Moe Nyo Road due to parking of construction vehicles and crane to carry and lift the poles.	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				is adjacent to paddy fields and the Moe Nyo Road. There are no houses located next to the new site. The site is not prone to flooding. Runoff in the area drains into the Myit Ma Kha creek, a tributary of the Ayeyarwaddy River. The creek is about 4 miles away from the new substation site. The transmission line will be parallel to the existing Moe Nyo Road which is narrow and has a width of about 3 meters only. The transmission line will traverse the paddy fields.		

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
5	Innma	New construction of 33 kV Transmission line 12 miles single circuit from Paungde substation to Innma and 33/11 kV 10 MVA new substation at Innma Township	Yangon-Pyay Road, Thayet Taung Yar Town, Thae Kone Township	The land to be occupied by the new 33/11kV 10 MVA substation has an area of 1.24 acre. The property is owned by ESE since March 2015. There is no ESE office at the site but only an existing operating transformer (manufactured in 1980). The site is adjacent to the Yangon-Pyay Road which is higher in elevation than the proposed site, thus, causing containment of rainwater at the project site. Runoff leads to the adjacent paddy fields and then to the Myit Makha creek, located about 0.15 miles away. The property is fenced. The transmission line will run parallel to the	• The construction of the new substation is not expected to result to significant environmental impacts to surrounding areas expect for construction-related issues on dust and runoff. • There is a need to backfill the site up to level to road, about 1 meter. This could result to soil runoff into adjacent paddy fields. • The installation of the transmission line may cause damage to crops and paddy fields. It will also cause temporary blocking of one lane of road due to parking of construction vehicles and crane to carry and lift the poles.	 The existing transformer at the site of the substation.  The road adjacent to the substation. The DL will be on the side of the road.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				existing road and will traverse paddy fields.		
6	Hmattaing	New construction of 33 kV Transmission line 8 miles single circuit from Paungde substation to Hmattaing township office and 33/11 kV 10 MVA new substation at Hmattaing (Paungde)	New SS: Paungde-Hmattaing Road, Sub-township of Hmattaing Town, Hmattaing Township, Pyay District (back of township office) Existing SS: Yangon-Pyay Road (asphalt), Paungde	The new 10MVA sub-station will be constructed at the back of the Hmattaing township office, near an existing transformer. The land (1.1 acre) at the back of the township office is owned by ESE. Access to the new sub-station site will be through the entrance of the township office compound from Paungde-Hmattaing Road. The proposed site is within the town center. It is surrounded by grazing land and paddy fields . The nearest house is located about 100 feet away. The site is not prone to flooding.	• The construction of the new substation is not expected to result to significant environmental impacts to surrounding areas expect for construction-related issues on dust and runoff. • There is a need to backfill the site up to level to road, about 1 meter. This could result to soil runoff into adjacent paddy fields. • The installation of the transmission line may cause damage to crops and paddy fields. It will also cause temporary blocking of one lane of road due to parking of construction vehicles and crane to carry and lift the poles.	 The township office compound. The substation will be located at the back of the township office.  The site of the proposed substation at the back of the township office.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				The transmission line will connect from the Pateegon substation to the Hmattaing sub-station. The line will run parallel to the Yangon-Pyay road and will traverse paddy fields. DL: along the Yan-gon-Pyay Road; set-tlements surrounding the existing SS; there is staff house inside the SS; no oil pit; at the back is paddy field. There is drain-age along the road. Transformer manu-factured in 2015. SS was built in 2005. With enough setback from adjacent prop-erty. Nearest house is about 50 meters away.		

3. DISTRIBUTION COMPONENT AT MON STATE

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
1	Thanbyuzayat	New 33 kV transmission line 19 Miles from Thanbyuzayat 66/33kV substation to Wekame village 33/11 kV 10 MVA new Substation at Thanbyuzayat (wekame)	Wekame Village, Thanbyuzayat Township	The proposed site of the substation is characterized with a rubber tree plantation and has a house and two temporary shops inside the property. The site is adjacent to the Thanbyuzayat-Ye Road. The transmission line (19 miles) will be along the Thanbyuzayat-Ye Road.	• The construction of the new substation will result to the cutting of rubber trees, removal of a house and two temporary shops. significant environmental impacts to surrounding areas expect for construction-related issues on dust and runoff. • The installation of the transmission line may cause temporary blocking of one lane of road due to parking of construction vehicles and crane to carry and lift the poles.	 The site of the proposed substation with a house, two shops and rubber plantation at the back.
2	Bilin	New construction of 66 kV Transmission line 40 miles single circuit from 230 kV	Thaton GT factory, Naungbo village			

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
		Thahton substation to Bilin and 66/33 kV 20 MVA new substation at Bilin.				
3	Bilin	New 33 kV transmission line 12.5 Miles from Bilin 33/11kV Office Substation to Melan village 33/11 kV 5 MVA new Substation at Bilin (Melan) and 33kV Switch Bay 2 Sets at Bilin Township Office Substation	Maelan Village, Belin Township, Thaton District	The substation site will be located in a hilly area with secondary forest. The site is adjacent to a road and about 14 miles from the village settlement area. The land is owned by a monk who is willing to donate the land to ESE. New SS in Melan is about 14 miles from existing SS in Bilin. The alignment of the transmission line will be through the secondary forest area going to the Naungbo village area. The alignment	The project will result to the cutting of trees and removal of shrubs. Prior approval from the Forest Department is needed for the cutting of trees on Government land and agreement of the land owner if on privately-owned land. The installation of the transmission line may cause damage to crops and paddy fields. There is a need to cut or excavate the soil to result to a level substation area. Appro-	 The proposed site of the new 33/11kV substation (on the left) which near the road.  The existing substation in Bilin town where the new Bilin (Melan) substation will connect.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				will traverse open land, paddy fields, river, and forest area.	priate disposal of excavated soil will be necessary. There are also no oil pits in existing transformers and no area for storage of equipment and wastes. This should be considered in the design of the new substation.	
4	Kyaikhto	New construction of 33 kV Transmission line 6 miles single circuit from Kyaikhto (Saungnainggyi) 33/11 kV substation to Kim Pun Sakham and 33/11 kV 10 MVA new substation at Kyaikhto Township	Taung Thusu Ward, Kyaikhto Township, Thaton District	The proposed new substation will be at the vacant land at the compound of the existing substation. The transmission line will traverse shrubs and trees.	The project will result to the cutting of trees and removal of shrubs. Prior approval from the Forest Department is needed for the cutting of trees on Government land and agreement of the land owner if on privately-owned land. There are also no oil pits in existing transformers and no area for storage of equipment and wastes. This	 The site of the existing substation. The proposed site will be at the back.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
					should be considered in the design of the new substation.	 Area for the new equipment inside the substation compound
5	Paung	New construction of 33 kV Transmission line 0.14 miles double circuit from existing Thahton - Paung 33kV line to Pankone village, 33/11 kV 10 MVA new substation at Pankone (Paung)	Pan Kone village, Paung Township, Thaton District	The proposed site of the new substation is being used as disposal area of rice husk. The site is beside a road. The proposed site is surrounded by open land and paddy field. There are also houses in the vicinity. The alignment of the transmission line will be along the road in Pan Kone village.	There is a need to clean-up and remove the rice husks at the site. Appropriate disposal (not burning of the rice husks) will be necessary. The transmission line will be along the road and may affect houses, trees, and paddy fields.	 The proposed site of the substation.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
6	Maw-lamyine	Upgrading of existing Nantay 66/11kV 10 MVA Substation to 66/11kV 20MVA Substation at Maw-lamyine	Nyan Tae Ward, Kyaik Mayaw Road	The site of the existing substation is within the town center in Maw-lamyine. The property is adjacent to a road and some houses. The site is not prone to flooding.	There are also no oil pits in existing transformers, no safety signs, and no area for storage of equipment and wastes. These should be considered in the design of the new substation.	 The existing substation. The new equipment will be installed inside the substation compound.

4. DISTRIBUTION COMPONENT AT KAYIN STATE

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
1	Hpa-An	New construction of 66 kV Transmission line 0.5 miles double circuit from Thaton – Warboetaw - Kanmamaung 66 kV line to Nyaung Gone	Nyaung Gone Village, Pha-An Township	The site of the new substation is located beside a narrow road junction and a cashew plantation. From the main road,	The design of the substation may avoid the cutting of the trees in the periphery. However, the transmission line may affect some trees. In	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
		and 66/11 kV 10 MVA new substation at Nyaung Gone (Hpa-An)		the site is approximately 800 ft away. The site is on a hilly terrain. Trees demarcate the boundary of the property. The area is generally on open area used for grazing of animals such as goats. There are no settlement areas in the immediate vicinity. The transmission line will just tap to the Thaton-Warboetaw-Kanmamaung line. The alignment will be on the eastern side of the road. The transmission line alignment is characterized as grazing area for animals.	this case, prior approval from the Forest Department is needed for the cutting of trees on Government land such as along road ROW and agreement of the land owner if on privately-owned land. The construction of the new substation may result to dust and runoff. The narrow roads adjacent to the substation site and at the alignment of the transmission may be temporarily blocked during construction due to parking of crane and truck.	The narrow road leading to the site.  The proposed site of the substation.

No	Township	Project Scope	Location	Description of Site / Surroundings	Environmental Issues at Project Location	Photographs of the site
2	Hpa-An	New construction of 66 kV Transmissionlline 0.5 miles double circuit from Thaton - Warboetaw - Kanmamaung 66 kV line to Warboetaw (Hpa-An) and 66/11 kV 5 MVA new substation at Warboetaw (Hpa-An)	Ward 3, Phapon-Kamamaung Road, Kamamaung Township	The new 66/11kV 5MVA substation is near the road. The site was formerly used as a teak plantation area of the government. Regrowth of teak trees were noted at the site. The vicinity is sparsely populated. There are some houses on the southern side of the proposed substation site, along the road. The site is not prone to flooding. The site is currently characterized with a number of small trees, bushes, and shrubs.	The construction of the substation may result to the cutting of teak trees and clearing of shrubs and bushes. Construction-related impacts such as dust, soil runoff, and noise may be generated during construction. The transmission line may affect trees and a few houses and shops along the road. The installation of the transmission poles may result to temporary blocking of one lane of the road.	 The site of the proposed substation adjacent to a road.  Some houses on one side of the substation site.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				The transmission line will be along the road.		
3	Paingkyon	New 33 kV transmission line 11 Miles from Paingkyon 33/11kV Substation to Paung village 33/11 kV 5 MVA new Substation at Paingkyon (Paung village)	Thae Kone Paung Road, Naung Lone East Village Group, Kyawk Village, Pha-An Township	The proposed site of the new substation will be in an open grassland area. The transmission line will be parallel to the Thae Kone Paung Road which is a narrow one lane earth road going to Paung village. The transmission line that will connect to the substation will traverse paddy fields.	The construction of the substation will cause removal of trees. There is a need for permanent access road going to the substation from the Thae Kong Paung Road. The construction of the substation may cause impacts on dust, noise, and run-off to the nearby areas. Appropriate mitigation measures should be implemented.	 The site of the proposed Paingkyon substation. The transmission line will be along the road and will traverse paddy fields.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
4	Hpapon	New 33 kV transmission line 34 Miles from Kataingti 66/33kV Substation to Hpapon 33/11 kV 10 MVA new substation at Hpapon Township	Mae Tha Lout Village, Phapon Township, Phapon District	The site of the proposed substation is characterized with teak trees and shrubs. About 20 meters from the site is the district hospital. The alignment of the transmission line will be along the narrow earth road. Some sections of the alignment will traverse areas with shrubs, grasses and trees.	The construction of the substation and transmission lines may cause the cutting of trees. At the substation, there will be teak trees that will be removed. Appropriate clearance from the Department of Forestry will be necessary. The adjacent district hospital may be affected by noise, dust, and soil runoff during construction of the substation.	 The proposed site of the substation with teak trees and shrubs.
5	Hpa-An	New 66 kV transmission line 12 Miles from Hpa-Ann (Hpa Yar Kone Substation) to Eaindu 66/11 kV 5 MVA new Substation at Hpann (Eaindu) and 66kV Switch Bay	East Naung Lone Village Group, Kyawk Village, Pha-an Township	The site of the substation is currently characterized as grazing land. The site is near an earth road leading to the Naunglone Village. There are no houses in the vicinity of the	There is a need to backfill the site to level the proposed substation with the existing road. This may result to soil runoff that may the adjacent paddy fields.	

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
		(1)Set at Hpa Yar Kone Substation		substation but the site is surrounded by paddy fields. The transmission line will be installed along the road.	The transmission line may cause damage to paddy fields.	The site of the proposed substation.
6	Zarthapyin	New construction of 66 kV Transmission line 0.3 miles double circuit from Mawlamyine - Payargoneline 66 kV line to Zarthapyin and 66/11 kV 5 MVA new substation at Zarthapyin	Zarthapyin Kyar Kalay Road, Kyone Phae Village, Zarthapyin Township, Pa-an District	The site of the proposed substation and immediate vicinity is characterized as open grassland. There are no trees at the site. The transmission line will be along the Zarthapyin Kyar Kalay road. There are trees and paddy fields in some areas along the alignment.	There is a need to backfill the site to level the substation with the adjacent road. This may cause soil runoff into adjacent land. The transmission line may affect trees along the road and some paddy fields. Aside from soil runoff, the construction activities may result to dust, noise, and temporary blocking of the existing road.	 The site of the proposed Zarthapyin substation.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
7	Kyainseikgyi	New 66 kV transmission line 41 Miles from Mudon Substation to Kyainseikgyi 66/11 kV 10 MVA new Substation at Kyainseikgyi	Cemetery Road No. 2 Ward, No. 2 Site, Pyo Ye Main Road	The proposed site of the substation is across the cemetery. The site is being temporarily used as an open dump and truck parking area. Land area is 1.5 acre. The site was formerly used by the army as a plane landing site. The transmission line will primarily traverse open land and rice paddies. The alignment will cross the Zami River and a creek.	The construction of the substation will require the clean-up and removal the solid wastes that were dumped at the site. These wastes should be hauled in a Government-approved disposal area for solid wastes.	 The condition of the site of the proposed substation that is being used as an open dump of garbage and parking area of trucks.
8	Kan Ma Maung	New 66 kV transmission line 35 Miles from Thaton GT plant to Warboetaw - Kanmamaung 66/11 kV 5 MVA new Substation at Kanmamaung	Warboetaw Village, Hpa-An township	The site of the proposed substation is adjacent to an earth road. The site is near the Frontier Army Compound. The area is characterized as an open	Construction of the substation and transmission line may affect the adjacent earth road and cause temporary blockage of the road due to parking of the crane and truck.	

No	Township	Project Scope	Location	Description of Site / Surroundings	Environmental Issues at Project Location	Photographs of the site
9	Kan Ma Maung	New 66 kV transmission line 23 Miles from Kanmamaung to Kataingti 66/33 kV 10 MVA new Substation at Kataingti	Kataingti Village, Ka Ma Maung Town, Pha-nn District	grassland with some trees. The alignment of the transmission line will be along the road.	Construction activities may result to cutting of trees, generate noise, dust and soil runoff.	 The site of the proposed substation in Kataingti.

5. DISTRIBUTION COMPONENT AT RAKHINE STATE

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
1	Gwa	New 66 kV transmission line 42.8 Miles from Thandwe to Kyain Ta Li 66/11 kV 5 MVA new Substation at Gwa (Kyain Ta Li)	Nga Thaing Chaung-Gwa-Yangon-Thandwe Main Road, Chi Kwin Village Kyain Ta Li Sub-township, Thandwe District	The proposed substation is about 2.5 miles from Kyain Ta Li township and about 1.5 miles from the coast. The site is characterized as a paddy field. There is a sign at the property informing the community about the proposed site of the SS. Land area is 3.67 acre. The substation site is surrounded by paddy field.		 The site of the proposed new substation in Gwa.
2	Kyauk Taw	New construction of 66 kV Transmission line 0.5 miles double circuit from Ponnagyun - Kyauk Taw 66 kV line to ApaukWavillage, 66/11 kV 5 MVA	Ponnagyun, Kyauk Taw	Not visited due to ongoing unrest and peace and order problems.		

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
		new substation at ApaukWa (Kyauk Taw) and 1 set of 66kV outgoing switch bays at Ponnagyun substation				
3	Thandwe	New construction of 66 kV Transmission line 1.2 miles double circuit from Taungkote - Thandwe 66 kV line to ShewHlay village and 66/11 kV 5 MVA new substation at ShewHlay (Thandwe)	Thandwe-Taung Goat Highway Road, Shewlwe Village Group, Ma Gyi Chaung Village	The site of the proposed substation is about 2.5 miles from Thandwe town. The area available for the substation is about 10 acres but the ESE may not need entire area. The site is surrounded by trees that serve as boundary of the property but the site itself is grass land. The property has a signpost informing the people about the proposal of ESE to	The construction of the substation and transmission line may result to construction-related impact such as dust, noise, and soil runoff. There may also be some trees that will be cut at the substation site and along the alignment of the transmission line. The adjacent road may be blocked during pole installation by crane and trucks carrying the poles.	 Site of the proposed substation.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
				use the land for sub-station. The site is adjacent to a road, about 12 ft wide. There are no settlements in the immediate vicinity. The transmission line will just connect/tap to the existing line.		
4	Ponnagyun	New construction of 66 kV Transmission line 0.7 miles double circuit from Ponnagyun - Kyauktaw 66 kV line to Yoetayoak village and 66/11 kV 5 MVA new substation at Yoetayoak (Ponnagyun)	Ponnagyun	Not visited due to ongoing unrest and peace and order problems.		

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
5	Youngpye	New construction of 66 kV transmission line 25.2 Miles from Youngpye 66kV substation to Kyauk Ni Maw Village 66/11 kV 5 MVA new Substation at Youngpye (Kyauk Ni Maw) and 66kV Switch Bay 1 Set at Youngpye Substation	Houngwa village group, Yangbye	The substation site will have an area of 3 acres. The site is characterized as rice paddy with a small hut for rest area. The site is not prone to flooding. The alignment of the transmission line will be along paddy fields.	The construction of the substation and transmission will affect paddy fields from soil runoff.	 The site of the proposed Youngpye substation.
6	Yangbye (Aunghlapyin)	New construction of 66 kV Transmission Line 13.2 Miles from Yangbye substation to Aunghlapyin village 66/11 kV 5 MVA new Substation at Yangbye (Aunghlapyin) and 66kV Switch Bay 1Set at Youngpye Substation	Kyauk Naga Village, Yangbye Township, Kyauk Phyu District	The site of the substation is a cashew plantation. The site is about 150 ft form the main road (Kyauk Shoung Lay Htaug Road). Site is about 150 ft from the main road.	There is a need for an access road going to the site from the main road. The project will affect the cashew plantation.	 The site of the substation which is characterized as a cashew plantation.

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
7	Minpya	New construction of 33 kV Transmission line 0.5 miles double circuit from Minpya - Myaypone 33 kV line to Kyauk Khoke village and 33/11 kV 5 MVA new substation at Kyauk Khoke (Minpya)	Minpya-Myaypone	Not visited due to ongoing unrest and peace and order problems.		
8	Mrauk U District	New construction of 66 kV transmission line 12 Miles from Mrauk U substation to Tainnyo Village 66/11 kV 5 MVA new Substation at Mrauk U (Tainnyo) and 66kV Switch Bay 1Set at Mrauk U Substation		Not visited due to ongoing unrest and peace and order problems.		

No	Township	Project Scope	Location	Description of Site/Surroundings	Environmental Issues at Project Location	Photographs of the site
9	Thandwe	New construction of 66 kV transmission line 10 Miles from Kyaukgyi substation to Thaphuchine Village 66/11 kV 5 MVA new substation at Thandwe (Thaphuchine) and 66 kV Switch Bay 1Set at Kyaukgyi Substation	Kyauk Ka Latt group, Ye Phyu Aing Village, Thandwe Township, Thandwe District	The site of the substation is adjacent to an earth road. Access to the site is difficult and will take about 1 hour through the earth road from the Kyauk Gyi junction. The area is sparsely populated. Area is elevated by about 1 meter from the existing earth road. The adjacent area is similarly characterized with bushes and trees. The alignment of the transmission line will be along paddy fields and open land.	The project will require clearing of shrubs and cutting of trees. The construction of the substation will require cutting or removal of portion of the soil. This will result to soil runoff into adjacent land.	 The site of the proposed substation.

APPENDIX D: ENVIRONMENTAL COMPLIANCE AUDIT OF EXISTING SUBSTATIONS

A. INTRODUCTION

The Ministry of Energy and Electricity (MOEE) has an expansion plan for the Myanmar power grid that consists of reinforcement of transmission lines to increase interconnection capacity between main cities of the country. The development of the transmission system is combined with the progressive expansion of the distribution system which includes the construction of new 66kV substations and transmission lines. The expansion of the system will include the upgrade of existing substations or construction of new substations in areas where currently the deployment of the distribution system is very low or where the existing system is overloaded.

The Electricity Supply Enterprise (ESE) has identified areas in Ayeyarwaddy Region, Bago Region, Mon State, Kayin State, and Rakhine State that are without electricity. The upgrade of old substations will help support the expansion of the distribution system in new areas.

Of the 48 subprojects that have been identified by ESE, a total of 42 subprojects will involve construction of new substations and 6 upgrades of existing substations. The upgrades of existing substations will be in Kanyuktwin, Oktwin, and Kawa in Bago East; Thegon and Pateegon in Bago West; and Nantay (Mawlamyine) in Mon State.

B. OBJECTIVES

This report presents the results of the environmental compliance audit conducted on the existing substations in accordance with ADB's safeguard principles and requirements for borrowers/clients as embodied in ADB Safeguard Policy Statement (2009).

The objectives of the environmental compliance audit are:

a) To determine existence of any areas where the existing substations may cause or is causing environmental impacts or risks;
b) To assess compliance with environmental requirements of the Government of Myanmar;
c) To determine whether activities are in accordance with ADB's safeguard principles;
d) To evaluate the adequacy of mitigation measures, monitoring plan, and institutional arrangements to manage environmental impacts;
e) To develop measures on how to address identified environmental issues and to ensure that these issues are avoided and addressed in the ADB-financed project.

C. METHODOLOGY FOR ENVIRONMENTAL AUDIT

The environmental compliance audit was conducted through on-site assessment and inspection of substation facilities and premises, interview with ESE staff and substation personnel, and validation of substation records and reports.

An environmental due diligence checklist was developed that contains the following elements:

A. Substation data • Location/address • Land area • Date substation was established/constructed • Geographic coordinates and site elevation • Number of workers/staff • Major equipment/components at the substation
B. Surrounding area • Description of surrounding/neighboring areas • Land uses • Observations on presence of sensitive receptors (houses, temples, schools, etc.) • Occurrence of flood at substation and nearby areas
C. Environmental measures being implemented at the substation • Practices on worker safety • Practices to protect community safety • Measures to prevent oil spill • Presence of transformers older than 1980 • Measures on disposal of old batteries, transformers and other equipment • Presence of storage area for new equipment and old or damaged equipment • Presence of safety signs, warning signs • Environmental clearance • Staff handling environmental matters

The environmental compliance audit was undertaken on the following dates:

a) Kanyuktwin Substation − 11 and 17 September 2017
b) Oktwin Substation − 11 and 17 August 2017
c) Kawa Substation − 19 August 2017
d) Thegon Substation − 04 September 2017
e) Pateegon Substation − 04 September 2017
f) Nantay (Mawlamyine) Substation − 29 August 2017.

D. FINDINGS AND AREAS OF CONCERN

1. Kanyuktwin Substation

Yangon-Mandalay Road, Kanyutkwin, Bago East

The existing substation in Kanyuktwin is located at geographic coordinates 18.3560 and 96.4836. The site is surrounded by paddy fields on the north, west, and south, and by the Yangon-Mandalay Road on the east. The site for the upgrading and installation of the 10MVA substation is adjacent to the area occupied by the existing substation.

The substation currently has a 33/11kV 5MVA transformer which will be upgraded to 33/11kV 10 MVA substation. There were traces of oil leak surrounding the base of the existing transformer. The existing transformer pad is not provided with an oil pit.

There is a damaged transformer left in the open field near the substation compound. Another damaged transformer which was manufactured in 1887 and suspected to contain PCB was found inside the compound. According to the substation staff, the existing substation has no area for storage of old equipment as well as for new materials and that they are just waiting for the ESE regional office to haul the old transformers for storage and disposal.

The small substation building is being used for the control panel and battery charging area. It is also the rest area of substation staff. The substation is manned by three staff. There are boots and helmets for the staff but these are not being worn inside the substation premises. There are no warning signs in hazardous areas at the substation.

There is no drainage canal at the substation compound and runoff from the substation leads to the paddy field located on the northwestern side of the property.

Figure 1: Photos showing the condition at Kanyuktwin Substation

The site of the existing Kanyuktwin substation.

Traces of oil spill from the existing transformer

Battery area inside the substation house/office

A damaged transformer left at the open field.

Damaged transformer inside the substation compound suspected to contain PCB.

Substation building

2. Oktwin Substation

Golf Resort St., Kyetthonkhin (2) ward, Oaktwin Township, Bago East

The existing substation in Oktwin is located at geographic coordinates 18.8349 and 96.4010. The substation was built sometime in 2011. The site is surrounded by paddy

fields on the north and west, a fire brigade on the south, and the Golf Resort Street on the east.

The substation building serves as the control room, substation office, and staff house. There is no drainage on the road and runoff from the substation flows into the northside of the paddy fields towards the Nga Zin creek. The existing site is elevated as compared to the adjacent paddy fields.

There is a small makeshift storage hut without walls at the northern side of the substation compound for storage of new and old batteries. Absence of walls on the hut exposes the batteries to environmental elements.

A small transformer with open wires was found inside the substation and next to a residential house. There is only a wire fence and about 1.5-meter space separating the house from the substation and the transformer. There are no safety warning signs at the substation.

Some minor oil spills were noted at the transformer area. Traces of oil can be found at the canal leading to the paddy fields.

The existing substation has an existing 33/11MVA 3MVA transformer that was manufactured in 2011 by Soe Electric and Machinery Co. in Myanmar. The project plans to construct a new substation beside the existing compound by installing a new 33/11kV 10 MVA substation. Sulfur hexafluoride gas (SF_6) circuit breakers are being used at the substation.

The existing transformer and SF6 circuit breakers at the substation.

The substation building which is being used for the control room, battery charging area, office, and rest area of staff.

There is very limited space and protection between the adjacent house and the transformer with open wires.

Traces of oil were noted at the canal leading to the paddy fields.

Battery charging area inside the substation building.

New and old batteries at the makeshift hut being used for storage of materials

3. Kawa Substation

Ward (1), Kawa Ywar Thit, Kawa Township, Bago East

The existing substation in Kawa is located at geographic coordinates 17.0939 and 96.4740. The substation property is located in a 2.5-acre land that was purchased by ESE in 2011. The existing substation was built in July 2011. The substation has five staff.

The substation compound is fenced by barbed wire. The site is adjacent to some houses on the north, paddy fields on the east, a road on the south, and paddy fields and vacant area on the west. The substation has a two-storey building and switchyard. There are paddy fields at the back of the substation which is being planted by substation staff.

The existing substation has a 33/11kV 3 MVA transformer. The project will upgrade the substation to 33/11kV 10 MVA by constructing a new substation area for the new transformers and switchyard in the vacant area adjacent to the existing substation building. The facilities at the substation are relatively new and no old equipment were found. According to the substation staff, old batteries were collected by the ESE regional warehouse office for replacement.

The two-storey substation building

Traces of oil spill at the transformer area

The control room and office at the substation building.

The switchyard with SF6 circuit breakers.

4. Thegon Substation

Phayar Gyi Road corner Moe Gaung Road, Thegon Township, Pyay District, Bago West

The existing substation in Thegon is located at geographic coordinates 18.6522 and 95.4142. The substation has an area of 3.37 acres and is owned by ESE since 1958. The existing substation was constructed in 1996. The substation is adjacent to the Phayar Gyi road, houses on the southeast, and a school further to the east. There is safe clearance area of about 100 ft. between the switchyard and the nearest house but only wires and wooden poles serve as fence of the substation.

There were noted oil spills near the transformer area. The existing transformer was manufactured in 1998. There is no oil pit in the transformer pad.

The existing Thegon substation.

The switchyard at Thegon substation

Only barbed wire is used as fence of the substation.

5. Pateegon Substation

Ywama Road, Ywama Ward, Pateegon Township, Pyay District, Bago West

The existing substation in Pateegon is located at geographic coordinates 18.5777 and 95.4585. The substation is within the town center of Pateegon. It is adjacent to the Pateegon-Thegon Road on the north, by houses on the eastern and western sections, and by a road on the south.

The new 10 MVA substation transformer and associated equipment will be installed at the open area within the existing Pateegon substation. The existing substation has a land area of 0.63 acre which is owned by ESE. The substation area is fenced and the switchyard has about 2 meters setback from the fence and the nearest house. There are no warning signs to deter people from entering dangerous electrified areas.

According to the ESE substation staff, the site is not prone to flooding. The road drainage leads into the Shan Taw creek which is located about 15 miles from the site.

There were oil spills noted at the transformer area. There are no old or damaged equipment at the site. According to the staff, any damaged equipment is brought to the ESE regional warehouse for repair by a transformer company or for replacement.

There are hard hats and helmets but the staff are not using the personal protective equipment (PPE) while inside the substation premises. The substation staff are just wearing bare slippers.

The existing Thegon substation.

Traces of oil spill at the transformer area.

Substation staff wearing only bare slippers while walking at substation premises with wires.

The drainage canal infront of the substation.

6. Nantay Substation

Nyan Tae Ward, Kyaik Mayaw Road, Mawlamyine, Mon State

The existing substation in Nantay (Mawlamyine) is located at geographic coordinates 16.4642 and 97.6507. The area has a high demand for electricity for housing, business and industry. The project will increase the capacity to 66/11kV 20 MVA substation by constructing an extension of the existing substation and installing the new 20 MVA transformer and associated equipment.

The existing substation compound has an area of 1.24 acres. The site is adjacent to the Kyaik Mayaw Road on the west. The substation has a two storey building for the control room, office, and staff rest area.

There are nine workers assigned at the substation. Hard hats and safety boots are provided for workers but these are not being worn as observed during the site visit.

There are four bays at the substation, alkaline battery bank and charger, a 66/33kV 30 MVA transformer and 66/11kV 10 MVA transformer. There were noted traces of oil at the transformer area.

The existing substation

The switchyard within the substation compound

E. RECOMMENDATIONS AND CORRECTIVE ACTION PLAN

The following are the recommended improvements in the existing substations that need to be considered in the design and operation of the proposed ADB-financed project:

1. Management of oil spill at transformer area

In all the substations that were visited, there was no repair of transformers or units that are being undertaken by ESE. This is considered good practice in view of the possibility of oil spills from repair activities and the lack of facilities to manage oil spill at the substations. All damaged units are collected by a transformer servicing company for repair or brought to the ESE regional warehouse for testing.

Although there are no repair activities at the substations, oil spills were noted in areas surrounding the transformers. The transformer pads do not include oil pits to contain potential spill in case of breakdown of a transformer. According to information from ESE staff and PPTA technical consultants, the transformers are inspected every 2 – 5 years to check the quality of the oil. Only minimal amount of oil is needed to analyze oil quality, however, in the process of getting oil samples, there is a tendency to accidentally spill oil. Replenishment of oil is also undertaken on the transformer during this procedure which create possibility of accidental oil spill. A more serious situation is when there is explosion of the transformer unit that would cause more oil spill on the ground.

For the proposed project, the design of the transformer pad area must include an oil pit to ensure that any leak from the transformer can be collected, thus, avoiding any spill to the ground and the surrounding areas.

2. Management of hazardous wastes

The management of hazardous wastes such as old batteries need to be incorporated in the operation of the substations. Based on information provided by the substation staff, the old batteries are sent to the ESE regional warehouse for replacement. There needs to be an assurance that the manner of final disposal of old batteries are done in an environmentally safe manner.

3. Management of new materials and equipment

The substations have limited area for the control room, office, and staff house. In the case of Oktwin substation, new batteries are temporarily stored in a makeshift hut which exposes the new batteries to environmental elements. It is recommended to allocate an area within the substation for the storage of new equipment and parts to avoid damage to these new units.

4. Design of drainage canals at substations and soil erosion control measures during construction

There are substations which will require backfilling to elevate the land up to the level of the existing substation and road such as in the case of Oktwin and Kanyuktwin substations. Backfilling would result to soil runoff into adjacent paddy fields since the canals of the substations lead to the paddy fields. There is a need to provide adequate drainage for the site that leads to the road drainage instead of directing runoff into the paddy fields.

5. Provision of sturdy fence and warning signs at substations to ensure community safety

In the substations, most of the concrete fence are provided infront, facing a road. However, at the side and rear portions of the substation property, the fence only consists of barbed wire. This system would not restrict the entry of unauthorized persons and animals to the substation compound. Warning signs are also not available that would deter people from entering dangerous electrified areas in the substation.

Concrete fence should be provided around the substation compound. Likewise, warning signs should be posted in dangerous areas. Conducting objects should also be grounded.

5. Measures to address worker health and safety

Annual safety training is being conducted by ESE for its staff (mostly engineers and linemen). The training includes aspects on health, safety, and fire prevention.

At the substations, there are hard hats and safety shoes that are provided for workers. Despite this, the workers were still not wearing the PPEs while roaming around the substation premises. There is a need to strengthen the safety training program of ESE substation staff to reinforce the wearing of PPEs. Safety training and orientation will form part of the institutional and capacity building plan of the ADB project.

6. Monitoring of electromagnetic field (EMF)

EMF levels have not been measured at the substations. To safeguard the health and wellness of workers and the immediate community, EMF monitoring is recommended as part of the environmental monitoring plan of the ADB project.

7. Alternatives to Sulfur Hexafluoride (SF_6)

The existing and proposed substations will use SF_6 circuit breakers. SF_6 is widely used in the market because of its technical and economical advantages. However, SF_6 is a potent greenhouse gas that was evaluated by the Intergovernmental Panel on Climate Change (IPCC) with a global warming potential of 23,900 times more than carbon dioxide (CO_2). There are alternatives to SF_6 such as air blast, oil, vacuum and CO_2 insulating medium. The old models use oil for the insulation.

To avoid damage in case of explosion that would cause the release of SF6 gas, the project will use insulators made of composite and rubber instead of ceramic insulators. Special circuit breakers with defined breaking point that protects against explosion are considered safer.

8. Institutional plan for implementation of environmental mitigation measures

In all the substations, there is no staff who is in-charge of environmental management and monitoring. An institutional plan will be developed to strengthen the capacity of ESE on the aspect of environmental compliance with Myanmar's environmental laws and in ensuring that all environmental issues related to substation construction and operation are properly addressed in the future. This will include concerns related to solid and hazardous waste management, preventing oil spills/leaks, oil containment, fire prevention, and ensuring occupational and community health and safety.

9. Compliance with environmental laws of Myanmar

All of the substations do not hold any environmental permit or clearance from MONREC-since the substations started operating prior to the issuance of the Environmental Impact Assessment (EIA) Procedures in 2015.

Since the EIA Procedures is now in effect, the ADB-funded project will ensure compliance with the EIA Rules and that an IEE/EMP will be submitted to the Environmental Conservation Department (ECD) for the distribution component of the project.

In general, the EIA system of the Government of Myanmar substantially conforms to the ADB Safeguard Policy Statement (SPS 2009). The system under the draft EIA Procedure requires projects to complete the EIA process prior to implementation.

The following environmental compliance milestones need to be considered during the design, construction, and operation of the project.

Table 1: Milestones for Environmental Compliance of the Distribution Component

Project Stage	Environmental Requirement	Approving Entity	Purpose	ADB Loan Requirements
Detailed engineering and design (DED)	Environmental Compliance Certificate (ECC)	ECD, MONREC	In compliance with the EIA Procedures, an ECC is needed prior to project implementation. According to the EIA	MONREC approval of the EMP secured during DED and prior to project implementation

Project Stage	Environmental Requirement	Approving Entity	Purpose	ADB Loan Requirements
			Procedures, the distribution component needs to prepare an Environmental Management Plan (EMP).	
Bidding	Environmental management plan (EMP) and environmental monitoring plan (EMoP) in bid documents	MOEE/ESE ADB	For reference of bidders	EMP and EMoP to be prepared as part of the project's IEE. EMP and EMoP to be included by MOEE/ESE in the bid documents.
Notice to Proceed	Contractor's EMP (CEMP) prepared with necessary budget	MOEE/ESE ADB	For guidance in the management of environmental impacts	CEMP with budget to be prepared by the Contractor prior to start of construction
Construction	Implementation of CEMP	MOEE/ESE	Ensure that adverse environmental impacts are addressed during construction. Ensure compliance with the EIA Procedures.	Status of compliance with the CEMP to be reported in the semi-annual environmental monitoring report
Operation	Environmental monitoring	MOEE/ESE	Ensure that adverse environmental impacts are addressed during operation. Ensure compliance with the EIA Procedures.	Implementation of the EMP to be reported in the environmental monitoring report

APPENDIX E: ENVIRONMENTAL DUE DILIGENCE OF EXISTING WASTE MANAGEMENT SYSTEM of ESE

A. INTRODUCTION

The Distribution Component of the Myanmar: Power Network Development Project will involve the construction of new and upgrade of existing substations and transmission lines in areas where the distribution system is low or overloaded. The Electricity Supply Enterprise (ESE) has identified areas in Ayeyarwaddy Region, Bago Region, Mon State, Kayin State, and Rakhine State that are without electricity.

The proposed project will involve the following activities:

a) Construction of new substations
b) Upgrade of existing substations
c) Rehabilitation and upgrade of transmission lines
d) Installation of new transmission lines.

According to the ADB Safeguard Policy Statement (2009) when a project involves existing activities or facilities, environmental audits will be performed to determine the existence of any areas where the project may cause or is causing environmental risks or impacts.

As presented in Appendix D, environmental compliance audit was conducted in existing substations to determine areas where the existing substations and current practices are causing environmental impacts and risks. The ESE substation staff disclosed during the environmental compliance audits that old equipment and damaged materials are brought to the ESE warehouses for disposal.

Old equipment and waste materials from upgrading of substations include damaged transformers, capacitors, meters, batteries, used oil, and other electrical equipment. Transformers contain mineral oil while batteries contain lead, nickel, cadmium and other metals that may be considered as hazardous waste materials. Because of the potential environmental risks caused by disposal of waste materials and old equipment, the current waste management practices at ESE warehouses was conducted in accordance with the requirements of ADB SPS (2009).

B. OBJECTIVES

The objectives of the environmental due diligence are to:

a) Determine whether the activities at the warehouses are environmentally sound and in accordance with ADB's safeguard principles;
b) Assess compliance with the environmental requirements of the Government of Myanmar;
c) Evaluate the mitigation measures, monitoring plan and institutional arrangements to manage environmental impacts of waste disposal; and
d) Develop corrective action plan on how to address identified environmental issues and to ensure that these issues are avoided and addressed in the ADB-financed project.

C. METHODOLOGY FOR ENVIRONMENTAL DUE DILIGENCE

The environmental due diligence was conducted through on-site assessment and inspection of the regional warehouses and premises, interview with ESE staff and warehouse personnel, and validation of records and reports. The schedule of the site visits was coordinated by ESE in Naypyitaw with the central warehouse in Naypyitaw and regional warehouses in Yele and Bago East. The site inspection was undertaken on the following dates:

a) ESE Central Warehouse in Naypyitaw – 20 September 2017
b) ESE Regional Warehouse in Lewe – 20 September 2017
c) ESE Regional Warehouse in Bago East – 25 September 2017

An environmental due diligence checklist was developed that contains the following elements:

A. Basic information on the warehouse • Location/address • Land area • Date warehouse was established • Number of staff
B. Site observations and interview • Manner of receiving and storing new equipment and spares • Manner of receiving and storing old equipment and spares • Inventory of equipment and spares • Any repair of equipment on site • Recycling and reuse of equipment • Final disposal of unusable equipment and spares (batteries, meters, transformers, used oil)

D. FINDINGS AND AREAS OF CONCERN

All the warehouses are under the Material Planning Department (MPD) of the Ministry of Electricity and Energy (MOEE). The MPD is in-charge of procurement, storage and inventory of materials. Each regional / state ESE office has a warehouse to store new and old equipment.

1. ESE Central Warehouse in Naypyitaw

The Central Warehouse of ESE in Naypyitaw occupies a land area of 5 acres. The warehouse consists of six buildings which systematically segregates new equipment according to type. The Central Warehouse is relatively new and mostly accommodates new and large equipment such as transformers. There are only a few old spares such as tires but these are properly segregated in one area.

The warehouse has stocks of new transformer oil, new transformers, capacitors, batteries, tires, and other electrical equipment.

According to the Director, U Yan Naung, the central warehouse implements a computerized system for the in and out of materials. The storage of old transformers and

equipment are with the regional warehouses. U Yan Naung added that they are not procuring PCB containing transformers since this is already banned in the market.

2. ESE Regional Warehouse, Lewe Township, Naypyitaw

The regional warehouse in Lewe Township in Naypyitaw occupies a land area of about 2.5 acres. The compound has three warehouse buildings. There are new and old transformers outside the warehouse building.

Old equipment that were found at the warehouse building include old batteries, damaged meters, line materials, and other electrical accessories. The old equipment and mateials are placed in one area at the warehouse. According to the store officer, the old equipment and accessories will be disposed through bidding by lot. Bidding is done almost every 3 years, depending the amount of old materials that they accumulate.

There are no traces of oil that were noted in the area. The old and new equipment were properly segregated. There are fire extinguishers but these were found to be no longer functional. According to the store officer, the fire extinguishers are very old and never replaced since these were installed.

The regional warehouse in Lewe.

Piles of old cables in one area of the warehouse.

A fire extinguisher at the warehouse which appears to be very old and not functional.

3. ESE Regional Warehouse, Ahloe Township, Bago East

The regional warehouse in Bago East occupies a land area of 10 acres. The warehouse was established in 1960. It has two warehouse buildings, an office building, a staff house, and a car parking area. The ESE regional warehouse in Bago East stores old and damaged equipment consisting of transformers, cables, and meters.

The warehouse conducts minor repair of damaged transformers in one of the warehouse buildings. The minor repairs involve removal and replacement of oil in the transformer, refining of oil using an oil purifier, replacement of loose bushing, repair of small leak, replacement of insulation, and testing of transformer. Once minor maintenance work is completed, the transformer is sent back to the substation. Units requiring major repairs are brought to the private servicing company in Yangon (Soe Electric and AG Factory).

4. Oil spills were noted at the transformer repair area.

There are about 12 old transformer units outside of the warehouse building area. According to the ESE staff, some of the units can still be used by other substations while others will be collected by the transformer servicing company for major repair works.

There were no damaged batteries stored at the warehouse. According to the ESE staff, when a battery is damaged, the battery unit is brought to the vendor and replaced by a new unit. Old batteries do not accumulate at the substation or at the warehouses because replacement for the damaged battery can be immediately procured.

The ESE regional warehouse in Bago East.

Transformer repair area in one of the warehouse buildings.

Damaged transformers outside the warehouse building.

Pile of damaged meters to be bidded out.

E. RECOMMENDATIONS AND CORRECTIVE ACTION PLAN

Based on the site inspection, the warehouses have a good system of managing the in and out of new and damaged materials. The buy back system for old batteries is also good practice since this will avoid accumulation of old batteries at the substations or at the warehouses.

There are, however, some lapses which were noted. The following are the noted lapses and proposed corrective measures:

a) At the warehouse in Bago East that is conducting minor repairs on transformers, the oil spill that was noted at the warehouse building needs to be property contained within the service area. There is possibility of the oil from flowing outside of the warehouse building since the repair area is not bunded and do not have any containment system to collect oil spill.

b) During the upgrade of substations and transmission lines of the proposed project, it is anticipated that old equipment and materials such as cables, conductors, switches, and other electrical accessories will be generated. The Contractor will be required to coordinate with the MOEE/ESE prior to disposal of these waste materials which are still considered as assets of MOEE. A material management plan will be required prior to construction of the project.

c) Fire protection system such as provision of working fire extinguishers should be in place in the warehouses.

d) There is no concern so long as there are no leaks on the old transformers outside the warehouse buildings. However, the system for storage of old transformers at the warehouses can be improved by placing these equipment in a building with concrete flooring, an adequate roof and walls to protect against possibility of oil leak.

e) The Government of Myanmar is still drafting the regulations for hazardous waste management. In anticipation of future implementation of this regulation by the MONREC, the MOEE/ESE is advised to undertake pro-active improvement in the management of hazardous wastes particularly used oil and equipment containing PCBs and other hazardous components. Hazardous waste segregation areas should be designated and waste materials should be properly labelled using international standards to identify hazards.

f) An institutional capacity building program on the inventory of transformers and managemenent and segregation of hazardous wastes from operation of substations and distribution lines is recommended for MOEE/ESE. The program will include personnel training on proper hazardous waste management and emergency procedures for wastes handled at the substations and warehouses.

APPENDIX F: EMP FRAMEWORK

This framework and template of the Environmental Management Plan (EMP) is prepared for the proposed substations and transmission lines based on the requirements of the EIA Procedures (2015) of the Government of Myanmar. The EMP framework that will be adopted for PNDP's Distribution Component ensures that subprojects are not only technically, economically and financially viable, but are also environmentally and socially sound.

1.0 Rationale

The Distribution Component of the Power Network Development Project has been screened by ECD under the Myanmar EIA Procedure (2015). ECD requires that an EMP be prepared for each distribution line and for each substation. As it was not possible to prepare all the necessary EMPs during project preparation due to limited time and financial resources, the EMPs will be prepared during project implementation. This standardized Environmental Management Framework will be used as a guide to preparation of all the necessary EMP reports.

2.0 Subproject Definition

For purposes of this EMP Framework, a subproject is defined as:

> "One of more substations and/or one or more distribution lines."

Specific subprojects wil be defined based on the Project Procurement packages and lots for substations and distribution lines. Individual contracts will be prepared for each lot. Currently there are six lots (Ayeyarwaddy, Bago East, Bago West, Mon, Kayin, and Rakhine) for substations and six lots (Ayeyarwaddym Bago East, Bago West, Mon, Kayin, and Rakhine) for distribution lines.

An EMP will be prepared for each subproject. This approach has been adopted to align the EMPs with the scope of civil works of the Contractors. Each contractor will be required to prepare a Contractors Environmental Management Plan.

3.0 Applicability

The EMP Framework does not apply to:

a) Subprojects with activities listed on the Prohibited Investment Activities List in Appendix 5 of the ADB Safeguard Policy Statement (ADB SPS, 2009); or
b) Subprojects that do not comply with national environment, health, and safety laws and regulations; or
c) Subprojects that have potential to cause significant irreversible, diverse, or unprecedented adverse environmental impacts and are considered as Category A under ADB SPS (2009).

4.0 Environmental safeguards systems

The PNDP will provide layers of environment safeguards to the project through (i) adoption of environmental criteria for selecting sites for substations and distribution lines that will avoid or minimize environmental impacts; (ii) screening and identification of adverse environmental impacts and preparation of the environmental management plan

(EMP); and (iii) preparation of EMP of individual subprojects in compliance with the requirements of the 2015 EIA procedures.[28]

4.1 Environmental Criteria for Site Selection

The ESE will use the following criteria in selecting sites for substations and distribution lines:

a) The substation and distribution line alignment will not be located in protected areas, national parks, wildlife sanctuaries, nature reserves, wetlands and other environmentally sensitive areas.
b) The subproject will avoid monuments of cultural or historical importance such as temples, pagodas, and mosques.
c) The subproject will not adversely affect the population in the vicinity of substations and distribution lines and will not adversely affect public utility services such as schools, hospitals, and community centers.
d) Subprojects will not be located in land mine / UXO contaminated areas until survey and clearing by a Government-recognized demining entity has been undertaken. Alternatives to the alignment of distribution lines will be considered to avoid identified land mine contaminated areas. No construction works will be allowed until sites of substations and distribution poles have been cleared of land mine / UXO.
e) The subproject will not involve the procurement and use of equipment and transformers containing polychlorinated biphenyls (PCB) and other hazardous chemicals that are banned under Myanmar's laws and regulations and international conventions.
f) The subproject will not involve the use of pesticides and herbicides for vegetation clearing in distribution lines.

4.2 Identification of environmental impacts of subprojects

Based on the assessment of each subproject, most of the activities are small-scale with localized, manageable and temporary environmental impacts. The identified environmental impacts include the removal of roadside trees, temporary disturbance from construction activities such as dust, noise and blockage of narrow roads, risks to workers during construction and equipment installation, sourcing of borrow materials, and soil runoff from landfilling of substation sites. There are also potential hazards from landmines in subprojects located in Kayin State. Further surveys will be undertaken during detailed design to take into consideration the final alignment of the distribution lines.

4.3 Preparation of EMP in compliance to 2015 EIA Procedures

All subprojects under the Distribution Component will be required to prepare an Environmental Management Plan (EMP) following the format prescribed by the 2015 EIA Procedures of Myanmar. The general outline of the EMP will be similar for substations and transmission lines in terms of the project's environmental, socio-economic, health policies and commitments, legal requirements and institutional arrangements, but may vary in terms of the general environmental conditions, identified impacts, proposed mitigation measures, and budget.

In preparing the EMP, the essential processes that should be considered are:

[28] Based on the guidance letter issued by MONREC on 16 October 2017, substations and distributions need to prepare an EMP for submission to ECD, i.e. separate EMP for each 66kV and 33kV substation and separate EMP for each 33kV and 66kV distribution line.

- Understanding the scope and activities of the subproject
- Identify the likely environmental impacts and other environmental considerations that need to be investigated further
- Define the general approach and methodology required to carry out the study
- Identify all affected communities and national and local government agencies to be consulted in implementing the EMP.

General Outline of EMP:

Executive Summary

The Executive Summary will contain the following:

- Information on the project proponent, rationale of the subproject, components and location
- Brief outline of the current environmental conditions, significant anticipated impacts, and proposed mitigation measures
- Proposed measures to enhance institutional capacity.

I. Introduction

The Introduction will contain the following:

- Subproject background, rationale
- Purpose of the report
- Key features of the subproject, location, timeframes and proponent
- Stage of the project, i.e. feasibility study or detailed design
- Scope and extent of the EMP, i.e. scope, magnitude and persons/expertise or agency assisting in preparing the EMP

II. Description of the subproject

This section will present the following:

- Description of subproject location including maps, site layout, aerial photos/satellite images showing the project site and boundaries
- Description of the subproject components including area to be occupied by the substation or length of the transmission line, capacity (kVA), transformers and other major equipment to be installed
- Construction/installation methods and activities including equipment to be used, manual methods, working hours, and approximate duration of the construction period

III. Subproject's environmental, socio-economic, health policies and commitments, legal requirements and institutional arrangements

This section will contain the commitment of MOEE/ESE to comply with the following Government regulations and requirements:

- Environmental Conservation Law (2012)
- Environmental Conservation Law Rules (2014)
- EIA Procedures (2015)
- National Environmental Quality (Emissions) Guidelines (2015), i.e. effluent limits, electric and magnetic fields exposure limits, and allowable noise levels
- Electricity Law (2014)
- Forest Law (1992)
- Protection and Wildlife and Conservation of Natural Areas Law, 1004
- Protection and Preservation of Cultural Heritage Regions Law, 1998
- Conservation of Water Resources and Rivers Law, 2006.

This section will also discuss about the roles and responsibilities of the MOEE, ESE (PMU), ESE regions/states (PIUs), Project implementation consultant (PIC), contrac-

tor, environmental quality monitoring sub-contractor, ADB, and MONREC in the implementation and monitoring of environment safeguards. The discussion may refer to Section 10.1 of the IEE.

IV. Summary of impacts and mitigation measures

This section will discuss the following:

- Characteristics of environmental impacts based on subproject's expected impacts due to location, design, construction activities, regular operation, and decommissioning works.
- Mitigation measures during project design, construction, operation and decommissioning/abandonment/rehabilitation activities
- Matrix of management and monitoring plans by project phase (pre-construction, construction, operation, decommissioning, closure and post-closure) that will include management and monitoring to address and satisfy all relevant environmental and social management and monitoring issues such as but not limited to noise, vibration, waste, hazardous waste, wastewater and storm water, air quality, odor, chemicals, water quality, erosion and sedimentation, biodiversity, occupational and community health and safety, cultural heritage, employment and training and emergency response.

  The sample templates of the EMP matrices for substations and distribution lines are presented in Tables 1 and 2.

V. Implementation Arrangements

This will contain the entities and contact information of the ESE (PMU), PIU, PIC, and contractor to be involved in the management and monitoring of environmental mitigation measures. The discussion should also present the coordination required among these entities. The sample discussion can be found in Section 10.1 of this IEE.

VI. Overall budget for implementation

The budget includes the expenses to be incurred for the implementation and monitoring of the EMP. A sample of the EMP budget can be found in Section 10.6.2.

VII. Conclusion

This will include a brief summary of the identified impacts and mitigation measures.

4.4 Environmental Management Plan Review and Approval

The Project Implementation Consultant (PIC) of the PNDP Distribution Component will be responsible for preparing all the EMPs needed for the distribution systems.

The EMP reports will be reviewed and endorsed by the Project Management Unit (PMU) of the Distribution Component and then these EMP reports will be submitted to the ECD of MONREC for review and approval.

These EMP reports must be prepared and approved prior to tendering as the EMPs must be included in the bidding documents for contracts.

The ESE and PIC may conduct follow-up or presentation of the EMP with ECD to facilitate the issuance of the environmental clearance for each subproject. The flowchart in securing the environmental clearance for the distribution component is presented in Figure 1:

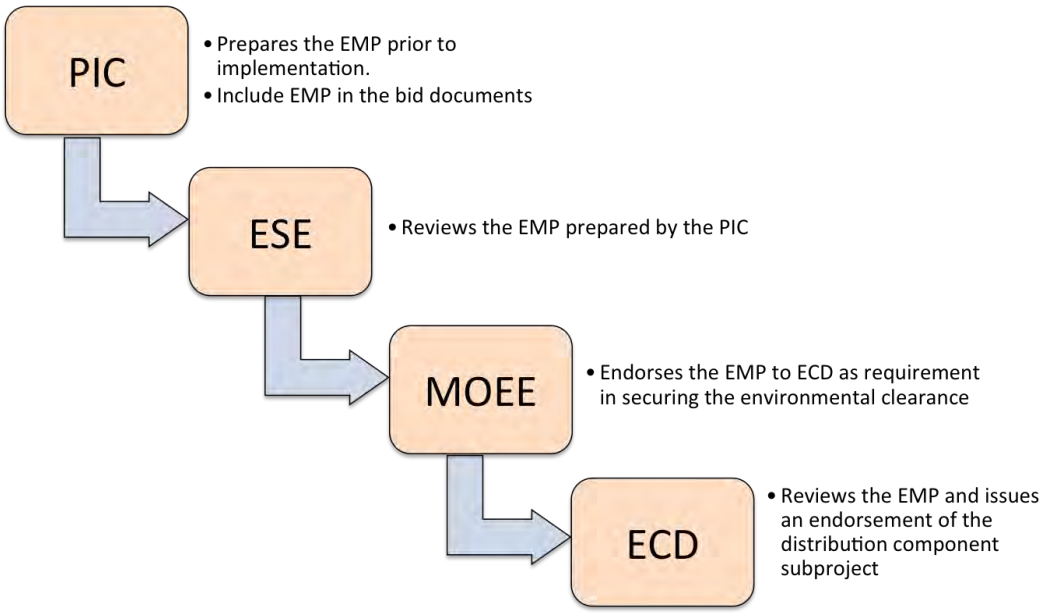


FIGURE 1: FLOWCHART IN SECURING ECD ENDORSEMENT

4.5 Environmental Supervision and Compliance Monitoring

The environmental supervision and monitoring of the EMP implementation by ESE will be undertaken using the institutional arrangements outlined in the Environmental Management Plan for Power Network Development Project's Distribution Component.

Compliance with the safeguards requirements and EMP measures by each substation or distribution line subproject and any actual environmental issues associated with the subproject that may crop up during the course of EMP preparation, construction, and operation will be periodically monitored. The ESE is required to submit every six months an environmental monitoring report to ECD and ADB.

TABLE 1: MATRIX OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR SUBSTATIONS

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
PRE-CONSTRUCTION				
Subproject EMP	EMP does not reflect final substation design	- Develop subproject EMP that includes mitigation measures defined in this IEE, updates reflecting detailed design including use of borrow materials from permitted sources, management of construction camps, water/air/noise quality, waste management, occupational and community health and safety plans, chance find procedures of artifacts, and procedures on discovery of land mine/UXO. - Assist ESE (PMU) in submitting EMP of the substation to ECD in compliance with the requirements in seeking the approval from MONREC.	PIC in coordination with ESE (PMU)	US$38,448 (Part of PIC cost)
Tender documents and works contracts	Lack of environmental clauses in tender documents and contracts	- Include environmental clauses and the EMP in tender documents and works contracts	ESE	Part of above cost
Screening of substation sites for landmine/UXO	Land mine/UXO contamination	Survey and demining of suspected land mine/UXO contaminated sites prior to start of construction	Demining entity	US$14,400
CONSTRUCTION				
Contractor's EMP	EMP do not reflect issues at construction camps, borrow areas and spoils disposal area	Require the contractor to provide measures that addresses issues at construction camps, borrow areas and spoils disposal area for approval of ESE and ADB. The CEMPs should be reviewed and approved by PIC, PIUs and PMU prior to start of construction works.	Contractor	US$4,000

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Removal of trees within substation site	Loss of vegetation	Compensation of trees to be cut Coordination with landowner	Contractor	US$3,574
Sediment runoff	Soil erosion Damage to rice fields and canals	Inspect if runoff of soil flows into nearby rice fields, cropland and canals. Schedule excavation work during the dry season. Install silt traps, deviation channels, barriers or trenches around the stock piles of materials and soil.	Contractor	US$13,100
Dust emission from the earthworks and move-ment of vehicles.	Air pollution	• Water spinkling of areas prone to dust emission • Cover and keep excavated soil and stockpile of aggregates moist • Regularly maintain vehicles and equipment to ensure emissions comply with standards • Prohibit burning of waste materials. Unauthorized burning of construction materials and refuse shall be subject to penalties against the Contractor. • Cover materials with tarpaulin or other suitable materials while in transit. • Impose speed limits on construction vehicles	Contractor	US$5,960

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Noise	Noise from vehicles and construction activities	• Noise levels from equipment and machinery shall conform to the "Environmental, Health, and Safety Guidelines" (IFC) • Property maintain machinery to minimize noise • No construction shall be allowed between nighttime hours of 22:00 to 06:00 • Require drivers of construction vehicles to minimize blowing of horn and limit speed when passing through residential areas.	Contractor	Part of construction management cost
Generation of wastes	Old equipment and parts, Domestic solid wastes, domestic wastewater, inert construction wastes, and hazardous wastes during construction may result to pollution of land.	• Implement a material management plan that includes safe and organized storage of dismantled equipment and parts in a safe area at the substation for later hauling by ESE regional/state warehouses • Undertake waste reuse and recycling, where possible, and dispose only in approved sites. • Provide temporary storage of hazardous wastes • Undertake segregation of hazardous and non-hazardous wastes in properly labeled waste disposal bins. • Instruct workers not to indiscriminately dispose wastes particularly at surrounding areas • Store hazardous wastes on leak-proof containers with proper label and place on areas with concrete surface and secondary containment. • Prohibit burning of wastes • Conduct refueling and equipment servicing only in designated areas with impervious surface.	Contractor in coordination with PIUs	US$6,600

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
		• Provide oil and grease traps and other spill containment measures. • Provision of adequate onsite sanitation facilities to prevent untreated sewage from being channeled into drainage canals, river and on land.		
Traffic hazard and blocking of road access	Risks to community health and safety and blocking of road access due to temporary parking of trucks during transport of materials and equipment to the sites.	• Manage traffic by posting warning signs and assigning flag persons to direct traffic on affected roads. • Impose speed limits to hauling vehicles particularly when passing through settlement areas.	Contractor	Part of construction cost
Occupational health and safety	Workers may be exposed to dangers of live power lines/equipment, chemicals, fire and explosion, physical hazards, exposure to dust and noise, falling objects, and ergonomic injuries	• Implementation of electrical safety plan, fire prevention, safety and management plan, education and awareness plan for HIV/AIDS, malaria and other diseases • Cover energized parts and hardware • Ensure live-wire work is conducted by trained and certified workers with strict adherence to specific safety and insulation standards. • Implement fall protection systems that includes provision of hoisting equipment, safety belts, second (backup) safety strap for workers • Provision of first-aid facilities readily accessible by workers • Posting of safety signs, reminders or warning notices • Hire only trained and certified workers on electrical works	Contractor	Part of construction cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
		• Provide appropriate and accessible fire fighting equipment • Ensure unobstructed access of fire responders and egress of vehicles • Strictly implement a "No Alcohol and Drug Policy" • Prohibit illegal activities including gambling • Inform and educate workers on the Health and Safety Plan.		
Community health and safety	Nuisances and hazards due to construction traffic, transport of materials, fires, emergency spill of materials, and unauthorized entry of villagers into dangerous working areas	Contractor will be required to: • Consult with affected households and disseminate information on community health and safety • Emergency response and preparedness procedures • Provision of communication systems and protocols • Coordination with local and regional emergency and health authorities • Provision of emergency equipment and facilities • Fencing of the construction area at substations • Posting of warning signs in dangerous work areas in Burmese language.	Contractor	Part of construction cost
OPERATION				
Occupational health and safety	Exposure of workers to hazards due to exposure to live power lines and high voltage systems, working in heights, fires, explosion	• All workers will be required to undergo orientation on security and EHS procedures and to strictly follow these guidelines when inside the premises of the substations.	PIUs	Part of the operational cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
		• Only authorized and trained personnel will be allowed to work or have access to electrical equipment. • Adhere to electrical safety standards. • Provide proper grounding and deactivation of live power equipment during maintenance work or if working in close proximity to equipment. • Provide PPE for workers • Provide adequate number of fire extinguishers at substtions • Observe guidelines to minimum approach distances when working around operational equipment. • Identify potential exposure levels in work area including surveys of exposure levels and establish safety zones at the transmission lines and substations. • Post safety reminders and warning signs. • Warn personnel of potential electric arc flash hazards when inspecting or working with energized equipment. • Comply with "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC) • Monitor EMF levels at substation.		
Generation of hazardous waste	Potential oil spill from maintenance or retrofit-ting of equipment and accidental spills of haz-	• Provide secondary containment with impervious bund around oil storage areas in substations and maintenance areas in region/state warehouses.	PIUs	Part of the operational cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
	ardous waste may contaminate soil and groundwater.	• Provide a hazardous waste storage area in substations and warehouses. • Undertake labeling of hazardous wastes.		
Emergencies and accidents	Possible fire events, explosion of equipment, lighting strikes, damage to cables, and corrosion of equipment may result to emergency situations at the substations	• Ensure security of cables and equipment • Conduct regular inspection of facilities to identify missing or corroded parts • Implement the fire management program that includes adequate fire protection equipment, fire suppressants, fire water tank, and fire extinguishers within substations. • Conduct training of workers on emergency preparedness and response procedures.	PIUs	Part of the operational cost
Community health and safety	Community risks due to exposure to electrocution hazards, direct contact with high voltage electricity	• Conduct monitoring of EMF levels along the ROW • Grounding of conducting objects such as fences or other metallic structures near power lines	PIUs	Part of the operational cost

TABLE 2: MATRIX OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES FOR DISTRIBUTION LINE

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
PRE-CONSTRUCTION				
EMP	EMP does not reflect final transmission line alignment	- Develop EMP that includes mitigation measures defined in this IEE, updates reflecting detailed design including management of construction camps, water/air/noise quality, waste management, occupational and community health and safety plans, chance find procedures of artifacts, and procedures on discovery of land mine/UXO. - Assist ESE (PMU) in submitting site-specific EMP of the transmission line to ECD in compliance with the requirements in seeking the approval from MONREC.	PIC in coordination with ESE (PMU)	US$38,448 (Part of PIC cost)
Tender documents and works contracts	Lack of environmental clauses in tender documents and contracts	- Include environmental clauses and the EMP in tender documents and works contracts	ESE	Part of above cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Screening of transmission line alignment for landmine/ UXO	Land mine/UXO contamination	- Survey of suspected land mine/UXO contaminated sites in Kayin state: all seven townships (Hpa-An, Paingkyon, Hpapon, Zarthapyin, Kyainsekgyi, Kan Ma Maung, and Kataingti) - Demining of areas identified as landmine/UXO contaminated prior to start of construction	Demining entity	US$21,600
CONSTRUCTION				
Contractor's EMP	EMP do not reflect issues at construction camps, borrow areas and spoils disposal area	Require the contractor to provide measures that addresses issues at construction camps and spoils disposal area for approval of ESE and ADB. The CEMPs should be reviewd and approved by PIC, PIUs and PMU prior to start of construction works.	Contractor	US$5,000
Removal of roadside trees	Loss of vegetation	Compensation of trees to be cut Replanting of trees in areas identified by the Forest Department	Contractor	US$8,160
Sediment runoff	Soil erosion Damage to rice fields and canals	Inspect if runoff of soil flows into nearby rice fields, cropland and canals. Schedule excavation work during the dry season. Install silt traps, deviation channels, barriers or trenches around the stock piles of materials and soil.	Contractor	US$7,900
Dust emission from the earthworks and movement of vehicles.	Air pollution	• Water spinkling of areas prone to dust emission • Cover and keep excavated soil and stockpile of aggregates moist • Regularly maintain vehicles and equipment to ensure emissions comply with standards	Contractor	US$3,640

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
		• Prohibit burning of waste materials. Unauthorized burning of construction materials and refuse shall be subject to penalties against the Contractor. • Cover materials with tarpaulin or other suitable materials while in transit. • Impose speed limits on construction vehicles		
Noise	Noise from vehicles and construction activities	• Noise levels from equipment and machinery shall conform to the "Environmental, Health, and Safety Guidelines" (IFC) • Property maintain machinery to minimize noise • No construction shall be allowed between nighttime hours of 22:00 to 06:00 • Require drivers of construction vehicles to minimize blowing of horn and limit speed when passing through residential areas.	Contractor	Part of construction management cost
Generation of wastes	Domestic solid wastes, domestic wastewater, inert construction wastes, and hazardous wastes during construction may result to pollution of land.	• Undertake segregation of hazardous and non-hazardous wastes in properly labeled waste disposal bins. • Instruct workers not to indiscriminately dispose wastes particularly at surrounding areas • Store hazardous wastes on leak-proof containers with proper label and place on areas with concrete surface and secondary containment. • Prohibit burning of wastes • Provision of adequate onsite sanitation facilities to prevent untreated sewage from being channeled into drainage canals, river and on land.	Contractor	US$3,000

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Traffic hazard and blocking of road access	Risks to community health and safety and blocking of road access due to temporary parking of trucks during transport of materials and equipment to the sites.	• Manage traffic by posting warning signs and assigning flag persons to direct traffic on affected roads. • Impose speed limits to hauling vehicles particularly when passing through settlement areas.	Contractor	Part of construction cost
Damage to crops, land or income loss from temporary use of land for access to tower locations	Transport of materials to pole sites may damage crops and land.	• Contractor will discuss with affected person to reach a consensus on renting land or compensating crops. • Contractor will be required to restore to original condition the affected land after construction is completed and before it is returned to the affected person. • Any damaged crops or income loss during the temporary use of land will be compensated by the civil works contractor.	Contractor	Part of construction cost
Occupational health and safety	Workers may be exposed to dangers of live power lines/equipment, chemicals, fire and explosion, physical hazards, exposure to dust and noise, falling objects, and ergonomic injuries	• Implementation of electrical safety plan, fire prevention, safety and management plan, education and awareness plan for HIV/AIDS, malaria and other diseases • Ensure live-wire work is conducted by trained and certified workers with strict adherence to specific safety and insulation standards. • Require workers to adhere to local legislation, standards and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities in the ROW. • Implement fall protection systems that includes provision of hoisting equipment,	Contractor	Part of construction cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
		safety belts, second (backup) safety strap for workers • Provision of first-aid facilities readily accessible by workers • Posting of safety signs, reminders or warning notices • Hire only trained and certified workers on electrical works • Provide appropriate and accessible fire fighting equipment • Ensure unobstructed access of fire responders and egress of vehicles • Strictly implement a "No Alcohol and Drug Policy" • Prohibit illegal activities including gambling • Inform and educate workers on the Health and Safety Plan.		
Community health and safety	Nuisances and hazards due to construction traffic, transport of materials, fires, emergency spill of materials, and unauthorized entry of villagers into dangerous working areas	Contractor will be required to: • Consult with affected households and disseminate information on community health and safety • Emergency response and preparedness procedures • Provision of communication systems and protocols • Coordination with local and regional emergency and health authorities • Provision of emergency equipment and facilities • Fencing of the construction area at substations • Posting of warning signs in dangerous work areas in Burmese language.	Contractor	Part of construction cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
OPERATION				
Cutting or trimming of trees and vegetation	Removal of vegetation may result in continuous replacement of successional species and an increased likelihood of growth of invasive species.	• Minimize tree cutting through selective tree cutting or bush clearing. • Only trees affecting conductor clearance will be trimmed or removed as necessary. • Avoid use of herbicides and maintain naturally low-growing vegetation in ROW.	PIUs	Part of the operational cost
Occupational health and safety	Exposure of workers to hazards due to exposure to live power lines and high voltage systems, working in heights, fires, explosion	• Only authorized and trained personnel will be allowed to work or have access to electrical equipment. • Adhere to electrical safety standards. • Provide proper grounding and deactivation of live power equipment during maintenance work or if working in close proximity to equipment. • Provide PPE for workers • Observe guidelines to minimum approach distances when working around operational equipment. • Identify potential exposure levels in work area including surveys of exposure levels and establish safety zones at the transmission lines and substations. • Post safety reminders and warning signs. • Warn personnel of potential electric arc flash hazards when inspecting or working with energized equipment. • Comply with "Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution" (IFC)	PIUs	Part of the operational cost

Environmental Aspect	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Estimated Cost
Emergencies and accidents	Possible fire events, explosion of equipment, lighting strikes, damage to cables, and corrosion of equipment	• Ensure security of cables and equipment • Conduct regular inspection of facilities to identify missing or corroded parts • Conduct training of workers on emergency preparedness and response procedures.	PIUs	Part of the operational cost
Community health and safety	Community risks due to exposure to electrocution hazards, direct contact with high voltage electricity	• Regularly check compliance of transmission line with safety clearances • Conduct monitoring of EMF levels along the alignment particularly near community areas • Grounding of conducting objects such as fences or other metallic structures near power lines	PIUs	Part of the operational cost