CHAPTER 16

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

Chapter 16 Environmental and Social Considerations

16.1 Legal Frameworks and Organization for Environmental and Social Considerations in Myanmar

16.1.1 Laws, Rules and Regulations related to Environmental and Social Consideration

(1) General

ECL (Environmental Conservation Law) (2012) and ECR (Environmental Conservation Rules) (2014) are recently enacted laws to determine the comprehensive environmental conservation and management in Myanmar. Following laws, rules and regulations are related to environmental and social consideration in Myanmar.

Table 16.1-1 Major Laws and Regulations relevant to Environment

Name of Laws, Rules etc.		Year
1. Constitution and Environmental Policy		
	Constitution of the Republic of the Union of Myanmar	2008
	Myanmar National Environmental Policy	1994
	National Sustainable Development Strategy 2009	2009
2. Environmental Conservation		
	Myanmar Environmental Conservation Law 2012	2012
	Environmental Conservation Rules 2014	2014
	Environmental Impact Assessment Procedures 2015	2015
3. Biodiversity and Natural Conservation		
	Wildlife Protection Act 1936	1936
	Myanmar Marine Fisheries Law 1990	1990
	Fresh Water Fisheries Law 1991	1991
	The Law Relating to Aquaculture	1989
	Forest Law 1992	1992
	Animal Health and Development Law 1993	1993
	Protection of Wildlife and Conservation of Natural Area Law 1994	1994
	Conservation of Water Resources and River Law 2006	2006
	National Biodiversity Strategy Action Plan in Myanmar	2012
4. Development and Management of Economic Activities		
	Irrigation Laws and Regulations	1982
	Factory Act	1951
	Mines Law	1994
	Electricity Law 1984 (amended 2014)	2014
	Electricity Act 1948 (amended in 1967)	1967
	Petroleum Act	1934
	Petroleum Rules of 1937 (amended in 1946	1946
	Law on Aquaculture (1989)	1990
	Freshwater Fisheries Law	1991

Name of Laws, Rules etc.	Year
5. Land Acquisition and Resettlement	
The Upper Burma Land and Revenue Regulation	1889
The Land Acquisition Act 1894	1894
Transfer of Immovable Property Restriction Act	1947
Land Nationalization Act	1953
Disposal of Land Tenancies Law	1963
Transfer of Immovable Property Restriction Law	1987
Wasteland Instruction	1991
Farmland Law 2012	2012
Farmland Rules 2012	2012
Vacant, Fallow, Virgin Land Management Law 2012	2012
Vacant, Fallow, Virgin Land Management Rules 2012	2012
6. Pollution Control and Occupational Health	
Factory Act	1951
Standing Order 2_95 Occupational Health Plan 1995	1995
Standing Order 3_95 Water and Air Pollution Control Plan 1995	1995
Occupational Safety and Health Law (Draft)	2012
The Science and Technology Development Law 1994	1994
Myanmar Mines Law 1994	1994
National Environmental Quality (Emissions) Guidelines	2015

Source: JICA Survey Team

(2) Environmental Conservation Law (2012)

The principal law governing environmental management in Myanmar is the ECL, which was issued in March, 2012 (The Pyidaungsu Hluttaw Law No.9/2012).

Composition of the ECL is shown in Table 16.1-2.

The law stipulates that government bodies are in charge of environmental conservation as well as their relevant roles and responsibilities. It touches on water, noise, vibration and solid waste qualities but does not provide specific standards to be met.

It also mentions that any new development project must perform a system of EIA (Environmental Impact Assessment) and SIA (Social Impact Assessment) in order to find out whether or not a project or activity to be undertaken by any government department, organization or person may cause a significant impact on the environment or not. In the context of project development, it is important to note that the law adopts the notion of 'Polluter Pays Principle' as it implies that the project proponents are responsible for covering all environmental and social costs generated by the project.

The law serves as the basis for founding of ECD (Environmental Conservation Department) under the MONREC (Ministry of Natural Resources and Environmental Conservation)*

* In May of 2016 former MOECAF (Ministry of Environmental Conservation and Forestry) was changed to the MONREC adding with function of natural resources management.

Following the ECL are two legal instruments: ECR (2014); and EIA Procedures (2015).

Table 16.1-2 Composition of the ECL

Chapter		Section
I	Title and Definition	1-2
II	Objective	3
III	Formation of the Environmental Conservation Committee	4-6
IV	Duties and Powers relating to the Environmental Conservation of the Ministry	7-8
V	Environmental Emergency	9
VI	Environmental Quality Standards	10-12
VII	Environmental Conservation	13-16
VIII	Management of Urban Environment	17
IX	Conservation of Natural Resources and Cultural Heritages	18-20
X	Prior Permission	21-25
XI	Insurance	26-27
XII	Prohibitions	28-30
XIII	Offences and Penalties	31-34
XIV	Miscellaneous	35-42

Source: ECL 2012

(3) Environmental Conservation Rules (June, 2014)

ECR No. 59/2014 emphasizes the importance of conservation of cultural heritage areas, natural heritage areas, cultural monuments, buildings and natural area and to set up the method to mitigate the impact of polluted waste during destruction, storage, placement and transportation of such waste.

ECR is detailed enforcement regulations of the ECL and enacted on 5 June, 2014. Composition of ECR is shown in Table 16.1-3.

Table 16.1-3 Composition of the ECR

Chapter		Section
I	Title and Definition	1-2
II	Adopting Policy Relating to Environmental Conservation	3-6
III	Environmental Conservation	7-26
IV	International, Regional and Bi-lateral Cooperation Relating to Environmental Conservation	27-28
V	Environmental Management Fund	29-35
VI	Environmental Emergency	36-37
VII	Environmental Quality Standards	38-39
VIII	Management of Urban Environment	40
IX	Waste Management	41-46
X	Conservation of Natural Resources and Cultural Heritages	47-50
XI	Environmental Impact Assessment	51-61
XII	Prior Permission	62-68
XIII	Prohibitions	69
XIV	Miscellaneous	70-74

Source: ECR 2014

ECR stipulates basic policy and concept of EIA application in developing Projects in Section 55 of Chapter XI) as follows:

Section 55. The Government department, organization or person which carry out the plan, business service or activity which are responsible to carry out the environmental impact assessment or initial environmental examination which is established before the issue of these rules;

(a) shall submit to the Ministry, after drawing environment management plan in accord with the procedure relating to the environmental impact assessment.

(b) shall implement and carry out the environment management plan which approved and scrutinized by the Ministry and matters stipulated by the Ministry within the time stipulated by the Ministry.

As described below, according to the EIA Procedure 2015, Prior Permission is required for economic activities including certain types of business, work-site or factory, workshops which may cause an impact on the environmental quality.

16.1.2 EIA Procedure

(1) General

In December 2015 EIA Procedure, which was long-awaited was enacted by MONREC at last.

The EIA Procedure is composed of eleven Chapters (131 Sections) and three Annexes as shown in Table 16.1-4.

Table 16.1-4 Composition of the EIA Procedure

Chapter		Section
I	Title and Definitions	1-2
II	Establishment of the Environmental Impact Assessment Process	3-22
III	Screening	23-30
IV	Initial Environmental Examination	31-43
V	Environmental Impact Assessment	44-70
VI	Appeal Process	71-75
VII	Environmental Management Plan	76-82
VIII	Environmental Consideration in Project Approval	83-105
IX	Monitoring	106-122
X	Strategic Environmental Assessment	123-124
XI	Administrative Punishment	125-131
Annex 1	Categorization of Economic Activities for Assessment Purposes	-
Annex 2	Environmental Assessment Procedure Flowchart	-
Annex 3	Penalties and Other Administrative Punishment	-

Source: EIA procedure 2015

Major statements stipulated in several Chapters are as follows.

1) Chapter II - Establishment of the EIA Process

a) Section 3

Pursuant to Section 21 of the Law and Articles 52, 53 and 55 of the Rules, all Projects and Project expansions undertaken by any ministry, government department, organization, corporation, board, development committee and organization, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual (and/or all Projects, field sites, factories and businesses including expansions of such Projects, field sites, factories and businesses identified by the Ministry, which may cause impact on environmental quality and are required to obtain Prior Permission in accordance with Section 21 of the Law, and Article 62 of the Rules) having the potential to cause Adverse Impacts, are required to undertake IEE (Initial Environmental Examination) or EIA or to develop an EMP (Environmental Management Plan), and to obtain an ECC (Environmental Compliance Certificate) in accordance with this Procedure.

b) Section 5

In accordance with Article 68 of the Rules, small-scale Projects, field sites, factories or businesses which are not specifically identified by the Ministry, but which may impact on environmental quality and as such are required to obtain Prior Permission in accordance with Section 21 of the Law or Article 62 of the Rules, and which are also not included in Annex 1 'Categorization of Economic Activities for Assessment Purposes', shall obtain the recommendation of the Department as to whether or not such a Project has Environmental Impacts and shall comply with the terms and conditions prescribed by the Department before applying for a permit or license from the relevant ministry or governmental organization.

- EIA procedures describe types of categories of business which are necessary to carry out IEE/EIA studies before the implementation of the project. In the Annex 1 of the EIA Procedure, guidance as to whether an IEE or an EIA is required for 141 types of projects or activities.
- In the Annex 1, economic activities relating to schemes of hydropower development are shown in Table 16.1-5.

c) Section 6

The ECC issued by the Ministry shall reflect any terms and conditions that are contained in any relevant Prior Permission.

d) Section 8

Any Project already in existence prior to the issuance of the Rules, or the construction of which has already commenced prior to the issuance of the Rules, and which, in either case, shall be required to undertake, within the timeframe prescribed by the Department, an environmental compliance audit, including on-site assessment, to identify past and/or present concerns related to that Project's Environmental Impacts, and to:

(a) develop an EIA or IEE or EMP;
(b) obtain an ECC; and
(c) take appropriate actions to mitigate Adverse Impacts in accordance with the Law, the Rules, and other applicable laws.

Table 16.1-5 Categorization of Hydropower Development Schemes

Type of Economic Activity	Criteria for IEE Type Economic Activities	Criteria for EIA Type Economic Activities
(a) Energy Sector Development		
HPPs	a) Installed capacity ≥ 1 MW but < 15 MW	a) Installed capacity ≥ 15 MW
	b) Reservoir volume (full supply level) < 20,000,000 m^3	b) Reservoir volume (full supply level) ≥ 20,000,000 m^3
	c) Reservoir area (full supply level) < 400 ha	c) Reservoir area (full supply level) ≥ 400 ha
Electrical Power Transmission Lines (≥ 115 kV 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
(b) Waste Management		
Non-Hazardous Waste Disposal Facilities	Landfills < 10 t/d and total capacity < 25,000 t	Landfills ≥ 10 t/d or total capacity ≥ 25,000 t
	Others < 50 t/d	Others ≥ 50 t/d
Non-Hazardous Waste Incinerators	< 3 t/h	≥ 3 t/h
Non-Hazardous Waste Recycling, Recovery or Reuse Facilities	< 50 t/d	≥ 50 t/d
Hazardous Waste Disposal Facilities	-	All sizes
Hazardous Waste Recycling, Recovery or Reuse Facilities	< 10 t/d	≥ 10 t/d

Note: Edited from Annex I of EIA Procedure 2015, in which 141 types of economic activities are categorized with respective to types of their economic activities

Source: JICA Survey Team

2) Chapter III - Screening

a) Section 23

(a) The Project Proponent shall submit the Project Proposal to the Ministry for Screening. In accordance with this Procedure, the submission of the Project Proposal for Screening is the same as the submission of an application for Prior Permission.

(b) The Ministry will send the Project Proposal to the Department to determine the need for environmental assessment.

(c) Following the preliminary Screening and verification that the Project Proposal contains all required documents and related materials, subject to Articles 8, 9, 10, 11, 26 and 27 the Department shall make a determination in accordance with Annex 1 'Categorization of Economic Activities for Assessment Purposes', taking into account Article 25 and the additional factors listed in Article 28 in order to designate the Project as one of the following, and then submit their designation to the Ministry:
   i) an EIA Type Project, or
   ii) an IEE Type Project, or
   iii) A Non IEE or EIA Type Project, and therefore not required to undertake any environmental assessment.

b) Section 24

The Ministry shall also make a determination whether an EMP shall be required in respect

of any Project.

3) Chapter IV - Initial Environmental Examination (IEE)

a) Section 36

The IEE Report shall contain the following:

(a) Project description in reasonable detail with description of the project size, installations, technology, infrastructure, production processes, use of materials and resources, generation of waste, emissions and disturbances together with overview maps and site layout maps (using aerial photos and satellite images in proper scale) for each Project phase and, where relevant, project alternatives for each Project phase;

(b) identification of the Project Proponent including (where the Project Proponent is not a natural person but a company or other juridical entity) the identification of the owners, directors (if any) and day to day management and officers of the Project Proponent;

(c) identification of the IEE experts, including which expert is responsible for which part of the IEE Report;

(d) description of applicable laws, decrees, regulations, standards, guidelines and corporate policies related to environmental and social matters of the Project together with the relevant government agencies involved and their roles and responsibilities vis-à-vis the Project.

(e) description of the surrounding environmental and social conditions of the Project including maps of all relevant physical, biological, social, socio-economic and cultural features;

(f) identification and assessment of potential Environmental Impacts including assessment and description of Adverse Impacts and Residual Impacts with presentation of the spatial and temporal characteristics of the impacts using maps, images, aerial photos and satellite images;

(g) results of the public consultation and public participation processes, recommendations received from the public, and the Project Proponent's written responses to comments received during that process;

(h) the environmental protection measures of the Project which are intended to mitigate Adverse Impacts clearly presented together with applicable environmental and social requirements and any Residual Impacts;

(i) the EMP; and

(j) the persons, organizations and budgets needed for implementation of the EMP.

b) Section 39

Upon receipt of the IEE Report from the Project Proponent, the Department shall:

(a) disclose the IEE Report to the public on the Ministry and/or Department website(s), and/or through other appropriate media;

(b) invite comments and suggestions on the IEE Report from all relevant parties

including relevant government organizations, institutions, civil society organizations, and PAPs (Project Affected Persons), as appropriate;

(c) arrange public consultation meetings at the local level, at which the Project Proponent shall present the IEE Report; and

(d) collect and review all comments and recommendations received, and forward the same to the Ministry to enable it to make a final decision on approval of the IEE Report.

4) Chapter V - Environmental Impact Assessment (EIA)

a) Section 47

All EIA Type Projects shall undergo Scoping.

b) Section 48

The Project Proponent shall be responsible to ensure that the Scoping and the preparation of the TOR (Terms of Reference) for the EIA Report are undertaken in a professional manner and in accordance with this Procedure and any applicable guidelines issued or adopted by the Ministry.

c) Section 56

The EIA investigation shall consider all biological, physical, social, economic, health, cultural and visual components of the study area, together with all pertinent legal matters relating to the environment, people and communities (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all Project phases including pre-construction, construction, operation, decommissioning, closure, and post-closure, and shall identify and assess all Adverse Impacts, risks, Cumulative Impacts and Residual Impacts for environment, social and, if relevant, health that potentially could arise from the Project.

In Section 63 it is stipulated that the EIA report shall contain the following contents as shown in Table 16.1-6 with more detailed description than that of the IEE report.

Table 16.1-6 Required Contents of the EIA Report

	Content
1	Executive Summary
2	Introduction
3	Policy, Legal and Institutional Framework
4	Project Description and Alternative Selection
5	Description of Surrounding Environment
6	Impact and Risk Assessment and Mitigation Measures
7	Cumulative Impact Assessment
8	Environmental Management Plan
9	Public Consultation and Disclosure

Source: EIA Procedure 2015

d) Section 67

Upon receipt of the EIA Report from the Project Proponent, the Department shall:

(a) submit the EIA Report to the EIA Report Review Body for comment and recommendations;

(b) invite comments and suggestions on the EIA Report from all relevant parties including involved government organizations, institutions, civil society organizations, and PAPs, as appropriate;

(c) arrange public consultation meetings at national, regional, state, Naypyidaw Union Territory and local levels where the Project Proponent shall present the EIA report; and

(d) collect and review all comments and recommendations received, including those of the EIA Report Review Body, and forward the same to the Ministry to enable it to make a final decision on approval of the EIA Report.

5) Chapter VII - Environmental Management Plan (EMP)

a) Section 76

For Project types which require EMP according to the Article 55 (a) of the Rules or Article 24 of the Procedure, the Project Proponent may prepare an EMP by itself or may appoint a person or organization who/which is registered according to the Article 18.

b) Section 77

The Project Proponent shall issue a letter of endorsement in a format prescribed by the Ministry according to the Article 63. Such letter shall be submitted to the Department prepared either in the Myanmar language, or in the English language or both. The Project Proponent shall submit the EMP to the Department in both digital form and complete paper copies, together with the required service fee as prescribed by the Department, and confirming:

(a) the accuracy and completeness of the EMP;

(b) that the EMP has been prepared in strict compliance with applicable laws including this Procedure; and

(c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EMP.

c) Section 78

Upon Receipt of the EMP from the Project Proponent, the Department shall review and submit to the Ministry to enable it to make a final decision on approval of the EMP.

d) Section 79

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

e) Section 80

Upon completion of its review of the EMP, the Ministry shall;

(a) approve the EMP, subject to any conditions it may prescribe, and issue an ECC; or

(b) require that the Project carry out an IEE or EIA, citing the reasons for this decision and informing the Project Proponent of its decision; and, in either case

(c) publicly disclose its decision.

f) Section 81

The Department shall deliver the final decision of the Ministry within thirty (30) working days of receipt of an EMP. If the Ministry requires an EMP to be amended, then the due date for delivery of the Ministry's decision shall be extended accordingly.

g) Section 82

Any additional costs associated with reaching a determination regarding Project types which require EMP shall be borne by the Project Proponent.

(2) Procedures of EIA

The EIA Procedures are expected to stipulate the conditions under which EIA is required and the steps to be followed in conducting and assessing the EIA. Under the EIA Procedure, the Ministry, as the Executing Agency sets an EIA Review Committee, is to give recommendations from an environmental point of view whether to approve the EIA reports or not. Composition of the EIA Review Committee will be determined by the Minister of MOECAF (Ministry of Environmental Conservation and Forestry) but needs to include persons from the industry, academia, and civil society, as well as government officials. EIA includes an EMP and a SIA report. The Procedures may also include a clause for public participation in implementing the IEE, EIA, and EMP, yet only if deemed necessary by the Ministry.

According to the EIA Procedure, EIA process in Myanmar to be in general consists of the following:

a) All development projects in Myanmar are subject to an environmental screening process through which projects will be judged to determine if they require any environmental review and, if so, at which level (i.e. IEE or EIA).

b) EIA includes an EMP and a SIA report.

c) Public participation is essential for the IEE and EIA, with the inclusion of an EMP

d) EIA Review Committee is formed to give recommendations to the Minister of MOECAF from an environmental point of view on whether to approve the EIA report or not. The Minister makes the final decision based on this recommendation. The review period is 50 days for IEE and 90 days for EIA.

e) Members of the EIA Review Committee will be selected by the Minister of MONREC and will include persons from the industry, academia, and civil society, as well as government officials.

f) Involuntary resettlement is carried out under the responsibility of a Respective Regional Government and hence will not be included in the EIA Procedures.

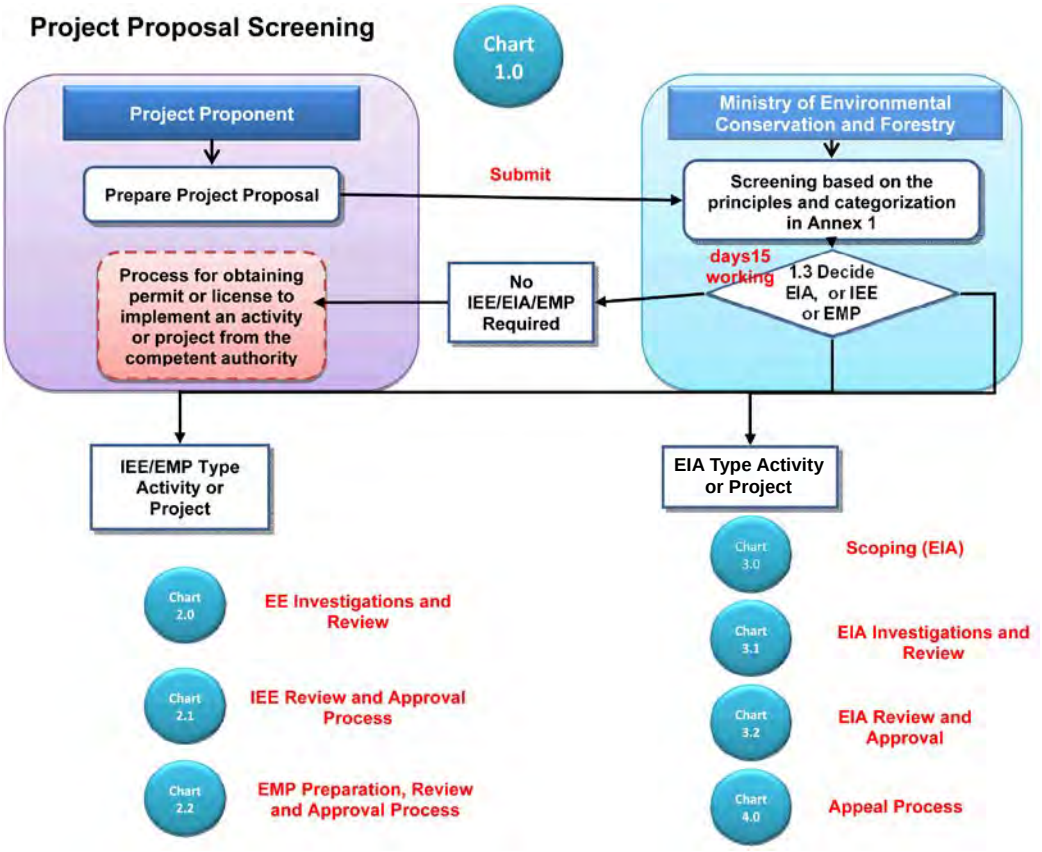
g) Costs involved in conducting EIA are to be covered by the project proponent.

h) EIA can be carried out in Myanmar only by firms that are registered under ECD/ MONREC.

If the proponent intends to obtain ECC for the project implementation from MONREC, a series of procedures described below (i) to (ix), which depend on the type and/or feature of the project, are required to the proponent with incorporating MONREC and other related organizations such as EIA Report Review Body, third person or organization undertaking IEE and EIA:

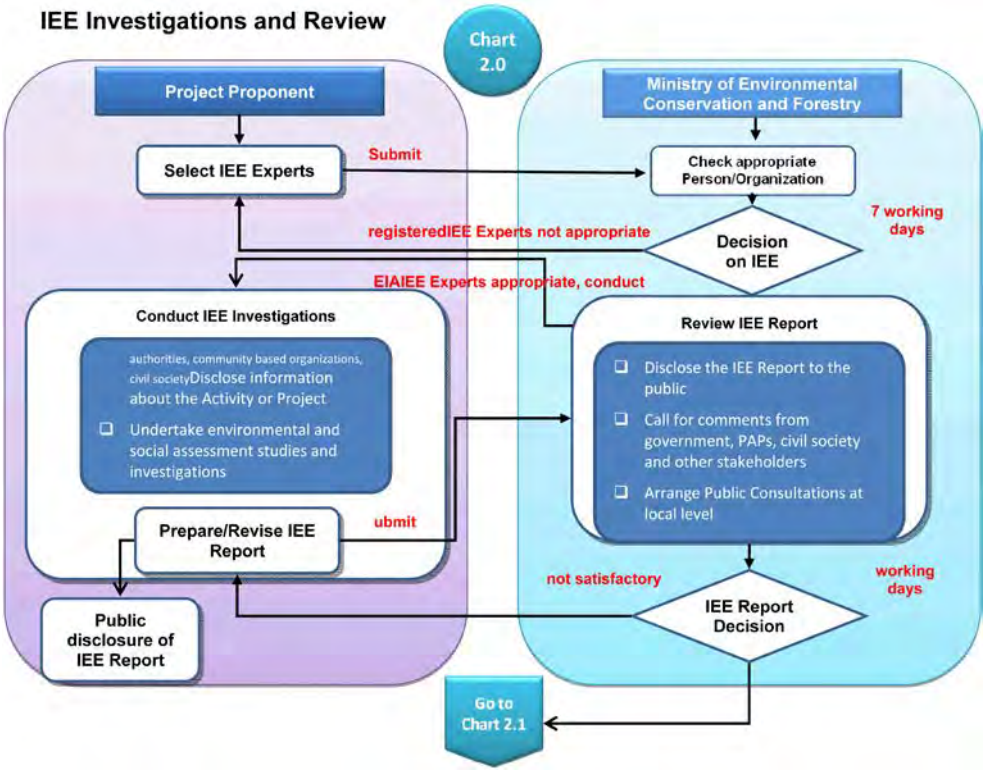
(i) Project proposal screening, (ii) IEE - IEE investigation and review, (iii) IEE - IEE review and approval, (iv) EMP review and approval, (v) Scoping of EIA, (vi) EIA investigation and review, (vii) EIA review and approval(viii) Appeal process.

A series of the procedures are shown in the EIA Procedure Flowchart.



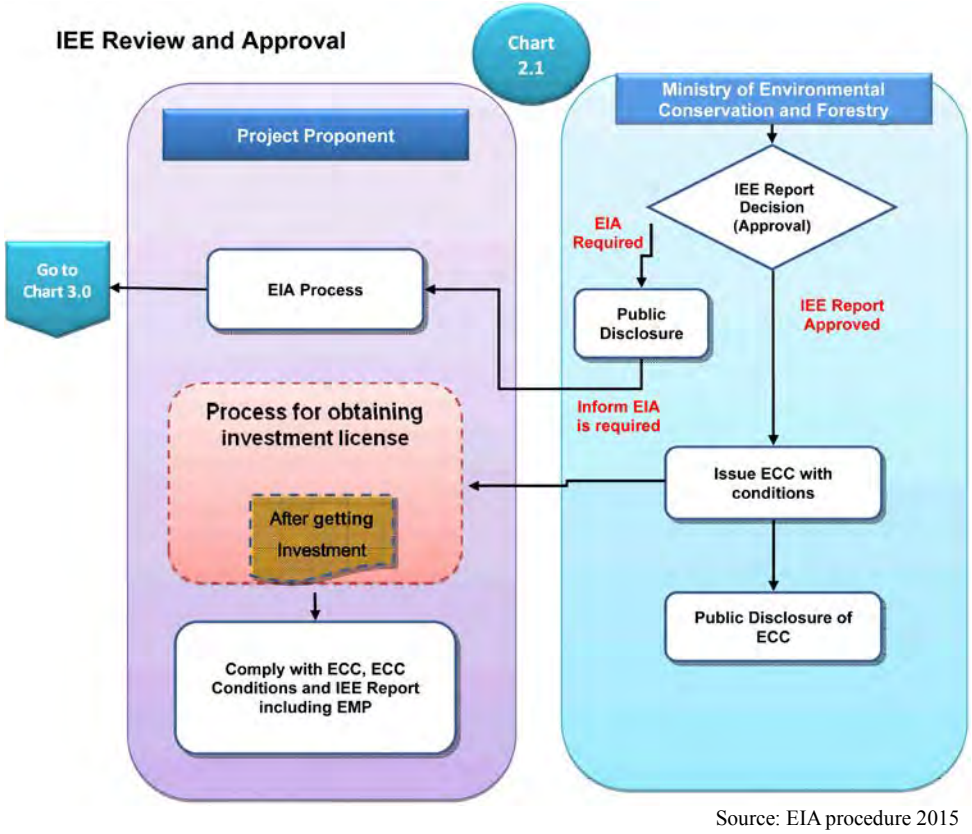
Source: EIA procedure 2015

Fig. 16.1-1 Project Proposal Screening



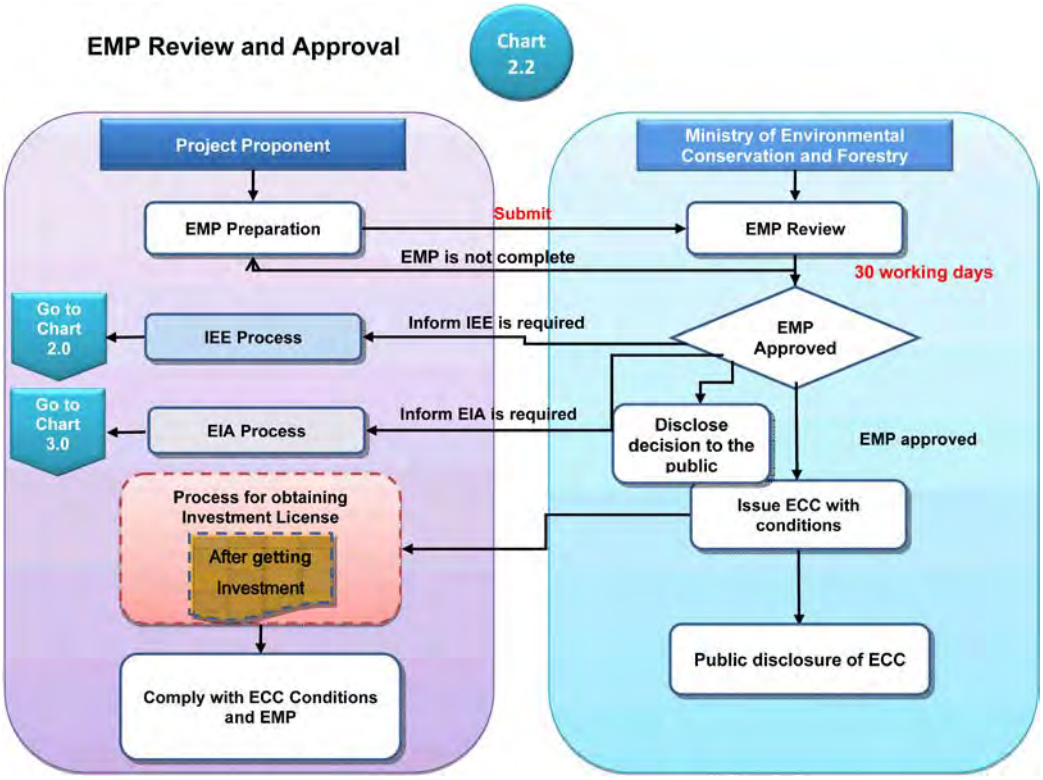
Source: EIA procedure 2015

Fig. 16.1-2 IEE Investigation and Review



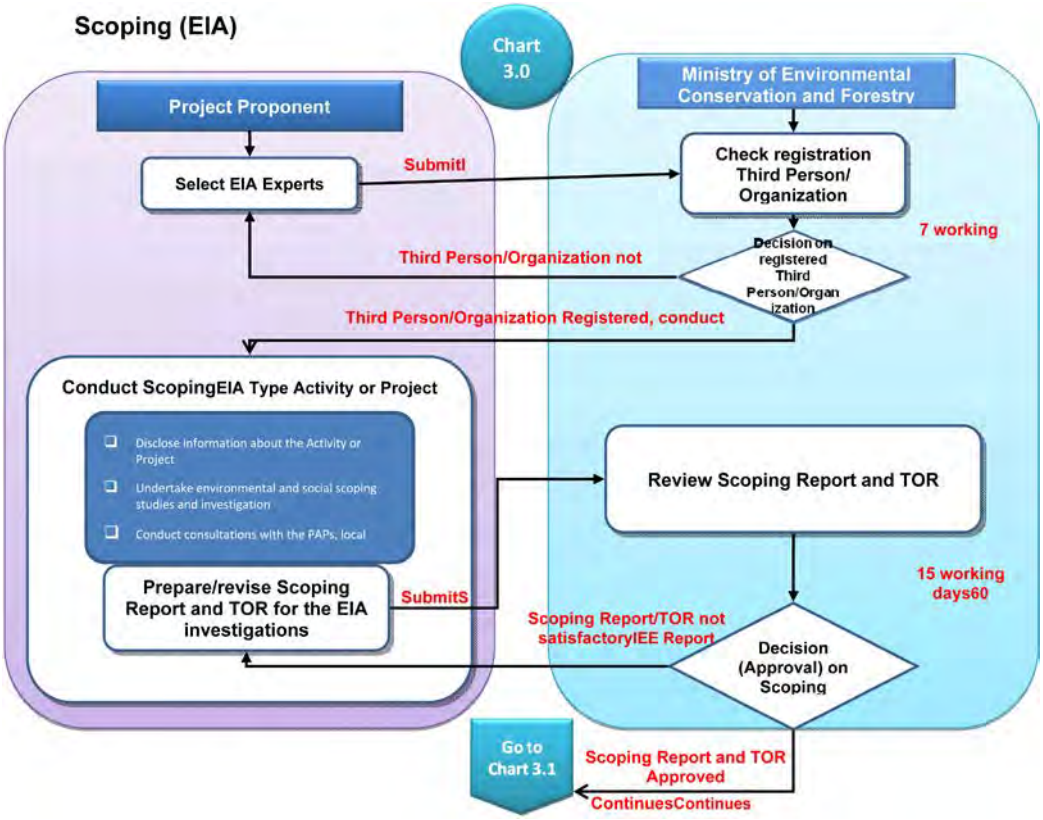
Source: EIA procedure 2015

Fig. 16.1-3 IEE Review and Approval



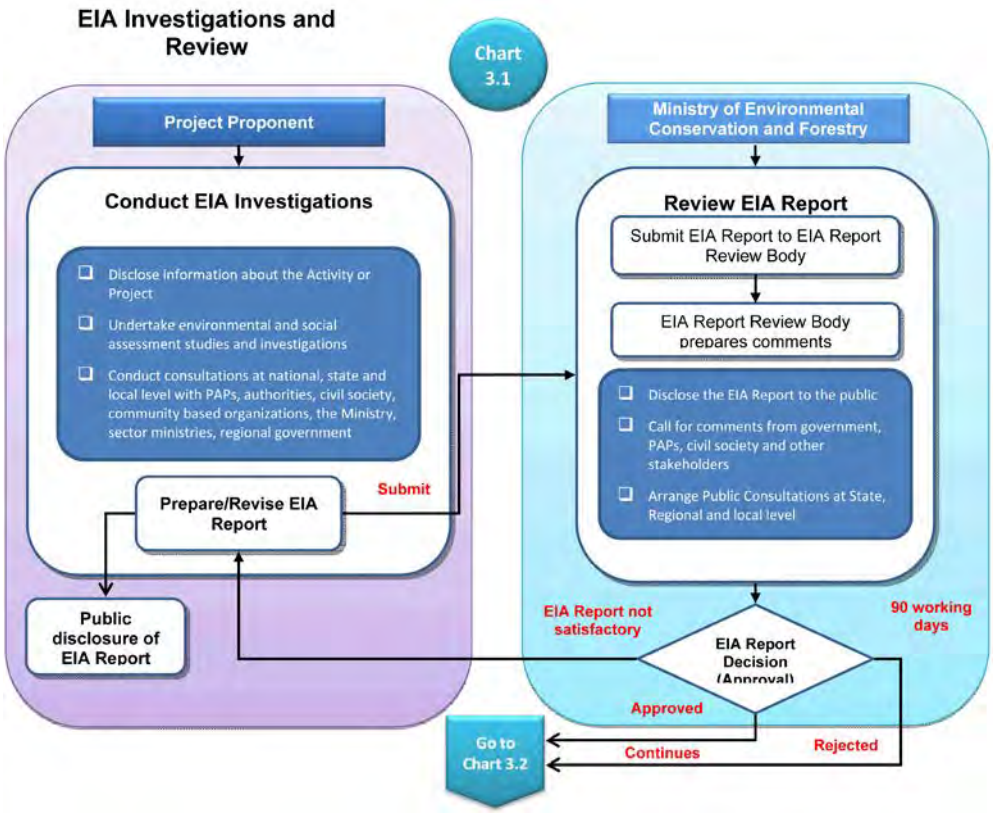
Source: EIA procedure 2015

Fig. 16.1-4 EMP Review and Approval



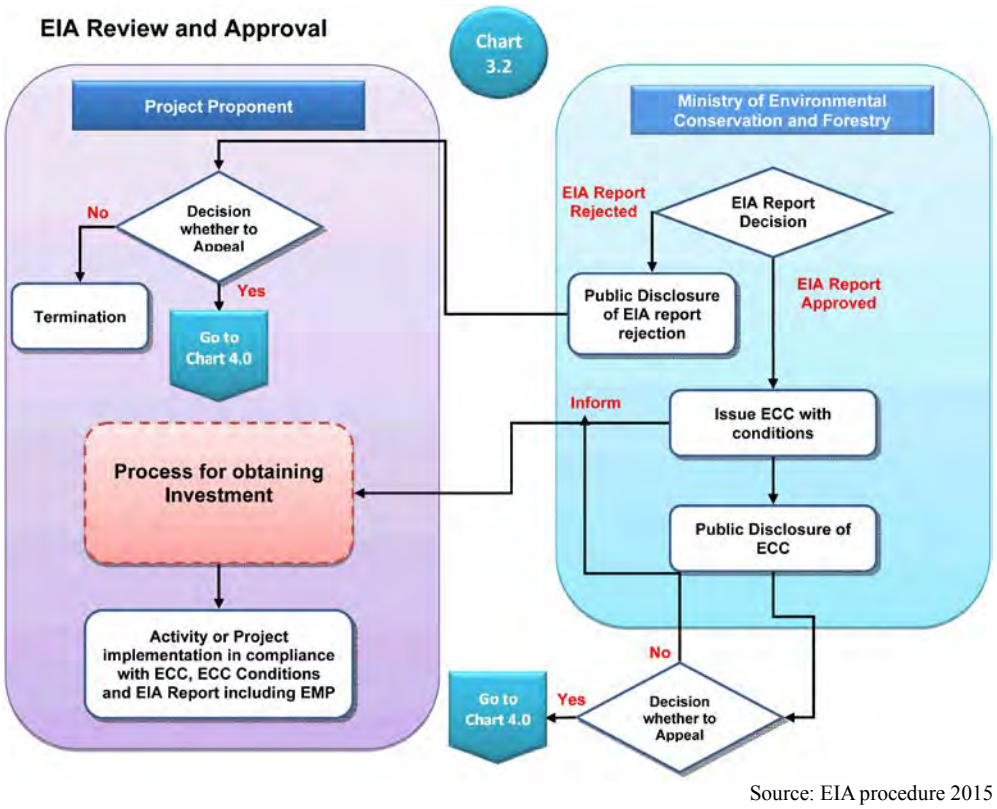
Source: EIA procedure 2015

Fig. 16.1-5 Scoping (EIA)



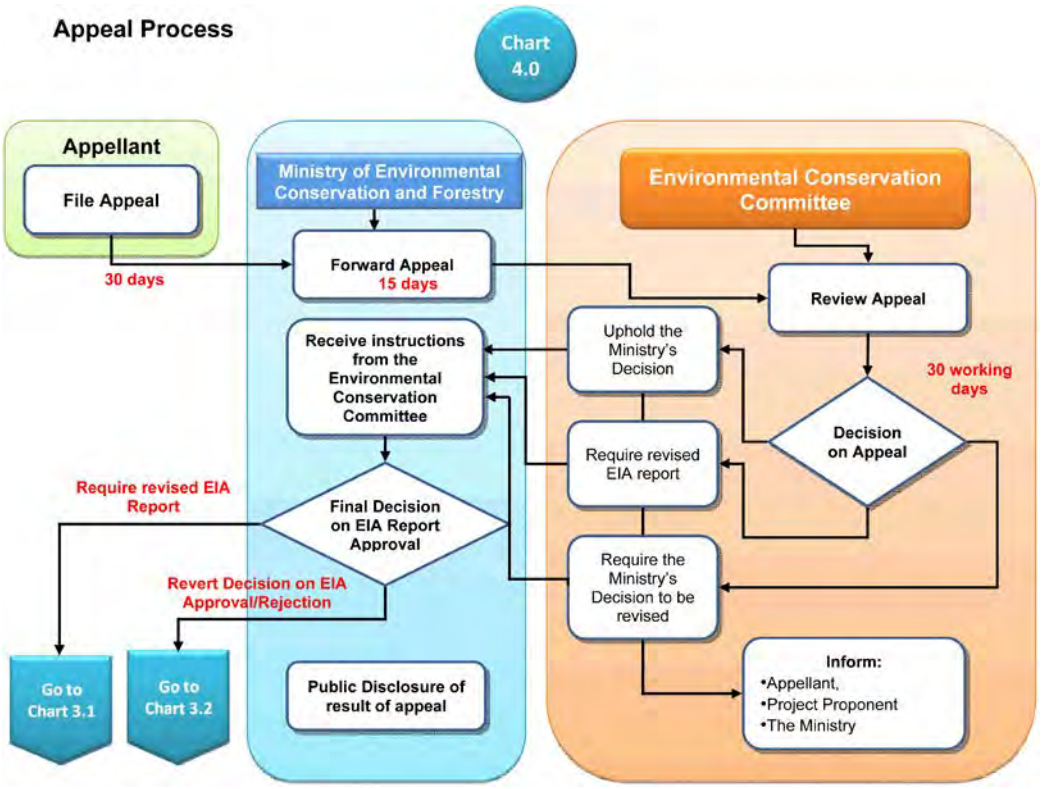
Source: EIA procedure 2015

Fig. 16.1-6 EIA Investigation and Review



Source: EIA procedure 2015

Fig. 16.1-7 EIA Review and Approval



Source: EIA procedure 2015

Fig. 16.1-8 Appeal Process

16.1.3 Environmental Quality Standards

NEQEG (National Environmental Quality (Emissions) Guidelines) 2015 was issued at the end of 2015.

In the NEQEG, major statements relevant to the Project are summarized as follows.

(1) Chapter 1 General Provisions

1) Objective

NEQEG provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health.

2) Definitions

The expressions contained in the NEQEG shall have the same meanings as are assigned to them in the EIA Procedure.

In addition, the following expressions shall have the meanings given hereunder:

(a) "Ambient environmental guideline or standard" means the allowable amount of substances, as a concentration of a contaminant in water or air, set to protect against anticipated adverse effects on the environment or human health.

(b) "Concentration" means the quantity of a physical, chemical, biological or pathogenic substance in air or water with the dimension of mass per volume (or sometimes mass per mass) calculated according to a common measurement unit (e.g. milligram per liter).

(c) "Contaminant" means any physical, chemical, biological, or radiological substance or matter that may pose a potential harm to the environment or human health.

(d) "Effluent" means wastewater, treated or untreated, that is discharged to surface waters from a treatment plant, sewer, or industrial outfall.

(e) "Guideline values" are maximum concentrations or specified ranges of parameters that should not be exceeded in air emissions and liquid discharges.

(f) "Parameter" means indicators used to measure the level or concentration (population density in case of biological pollutants) against guidelines or standards. The result of measurement could be shown in either numeric or textual form.

(g) "Point of compliance" means the location on land or in water at which a given substance concentration must meet the applicable Guideline value.

(h) "Pollution prevention" refers to the use of processes, practices, materials, products, substances or energy to avoid or minimize the creation of pollutants and waste, and reduce overall risk to the environment or human health.

3) Scope of Application

The NEQEG have been primarily excerpted from the IFC (International Finance Corporation) EHS (Environmental Health and Safety) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries. The NEQEG are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of these NEQEG to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

(2) Chapter 2 Implementation Procedures

- As specified in the EIA Procedure, all projects are obliged to use, comply with and refer to applicable national guidelines or standards or international standards adopted by the MONREC. The NEQEG will be applied by the MONREC in satisfying this requirement until otherwise modified or succeeded by other guidelines or standards. Following project approval, a project shall commence implementation strictly in accordance with the project EMP and any additional requirements set out in the project ECC, which will encompass conditions relating to emissions. In this regard, the Ministry will require that projects adhere to general and applicable industry guidelines as set out in Annex 1.

- While the NEQEG generally apply to all projects subject to the EIA Procedure, it is the prerogative of the MONREC to decide how the Guidelines should be applied to existing projects as referred to in the EIA Procedure, as distinguished from new projects. At the Ministry's discretion, less stringent levels or measures than provided for in the NEQEG may be specified as appropriate, and a timeframe agreed for a project to fully comply with these Guidelines.

- Projects shall engage in continuous, proactive and comprehensive self-monitoring of the project and comply with applicable guidelines and standards. For purposes of the NEQEG, projects shall be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC.

(3) Annex I Emission Guidelines – 1.0 General Guidelines

Guidelines regarding air emissions, wastewater, noise level and odor are explained and specified. Among them standards for ambient air quality, wastewater discharge and ambient noise level are respectively shown in Table 16.1-7 to 16.1-10.

Table 16.1-7 Ambient Air Quality Standards

Parameter	Averaging Period	Guideline Value µg/m^3
Nitrogen dioxide	1-year 1-hour	40 200
Ozone	8-hour daily maximum	100
Particulate matter PM_{10}[a]	1-year 24-hour	20 50
Particulate matter $PM_{2.5}$[b]	1-year 24-hour	10 25
Sulfur dioxide	24-hour 10-minute	20 500

Note: a – Particulate matter 10 micrometers or less in diameter, b -Particulate matter 2.5 micrometers or less in diameter

Source: NEQEG 2015

Table 16.1-8 Wastewater, Strom Water Runoff, Effluent and Sanitary Discharge Standards

Parameter	Unit	Guideline Value	Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand (BOD)	mg/l	50	Lead	mg/l	0.1
			Mercury	mg/l	0.01
Ammonia	mg/l	10	Nickel	mg/l	0.5
Arsenic	mg/l	0.1	Oil and grease	mg/l	10
Cadmium	mg/l	0.1	pH	S.U.[a]	6-9
Chemical oxygen demand	mg/l	250	Phenols	mg/l	0.5
Chlorine (total residual)	mg/l	0.2	Selenium	mg/l	0.1
Chromium (hexavalent)	mg/l	0.1	Silver	mg/l	0.5
Chromium (total)	mg/l	0.5	Sulphide	mg/l	1
Copper	mg/l	0.5	Temperature increase	℃	<3[b]
Cyanide (free)	mg/l	0.1	Total coliform bacteria	100 ml	400
Cyanide (total)	mg/l	1	Total phosphorus	mg/l	2
Fluoride	mg/l	20	Total suspended solids	mg/l	50
Heavy metals (total)	mg/l	10	Zinc	mg/l	2
Iron	mg/l	3.5			

Note: Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial Development Organization.

Source: NEQEG 2015

Table 16.1-9 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	-	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 201

Table 16.1-10 Ambient Noise Levels

Receptor	One Hour L Aeq (dBA)*	
	Daytime; 07:00 - 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: *Equivalent continuous sound level in decibels Source: NEQEG 201

(4) Annex I Emission Guidelines - 2.0 Industry Specific Guidelines

For energy sector development such as power generation by thermal power, geothermal power, wind power, onshore oil and gas, offshore oil and gas, specific guidelines of air emission levels and effluent levels are provided.

16.1.4 Hazardous Materials and Solid Waste Management

(1) Hazardous Materials Management

As for hazardous materials management, the following laws, regulation and departmental actions are related to the environmentally sound management of toxic chemicals.

- Chapter 10 of Myanmar Agenda 21: Environmental Quality Management and Enhancement
- The Explosive Act (1887)
- The Oil Field Act (1918)
- The Poison Act (1991 and amended in Feb, 2014)
- The Petroleum Act (1934)
- The Factory Act (1951)
- The Motor Vehicle Law (1964)
- The Private Industrial Enterprise Law (1990)
- The Pesticide Law (1990)
- The Promotion of Cottage Industries Law (1991)
- Myanmar Mines Law (1994)

(2) Persistent Organic Pollutants (POPs)

Regarding POPs (Persistent Organic Pollutants), which are typically halogenated organic compounds such as PCB (Polychlorinated Biphenyl), that are resistant to environmental degradation resulting in bioaccumulation with potential significant impacts on human health and environment. Myanmar became a party to the Stockholm Convention on POPs in 2004. To meet the obligations of the Convention, ECD under MOECAF in cooperation with UNIDO (United Nations Industrial Organization) implements a project by the Global Environment Facility funding on the enabling activities to facilitate early action on the Implementation of the Stockholm Convention on POPs in Myanmar. Raising awareness on POPs related issues is one of the objectives of the project.

The project also gives emphasize how to store transformers containing PCB properly.

(3) Solid Waste Management

In Myanmar, solid waste management is mostly under the control of local government. For example, large cities such as Yangon and Mandalay City, Township Development Committee has a principal function of solid waste management including industrial and hazardous waste as part of pollution control.

On the other hand, in national level ECD is preparing national policy of solid waste management. However, no regulation of solid waste management including hazardous waste has been established in Myanmar until now.

- Chapter 10 of Myanmar Agenda 21: Environmental Quality Management and Enhancement
- The Explosive Act (1887)
- The Oil Field Act (1918)
- The Poison Act (1991 and amended in Feb, 2014)
- The Petroleum Act (1934)
- The Factory Act (1951)
- The Motor Vehicle Law (1964)
- The Private Industrial Enterprise Law (1990)
- The Pesticide Law (1990)
- The Promotion of Cottage Industries Law (1991)
- Myanmar Mines Law (1994)

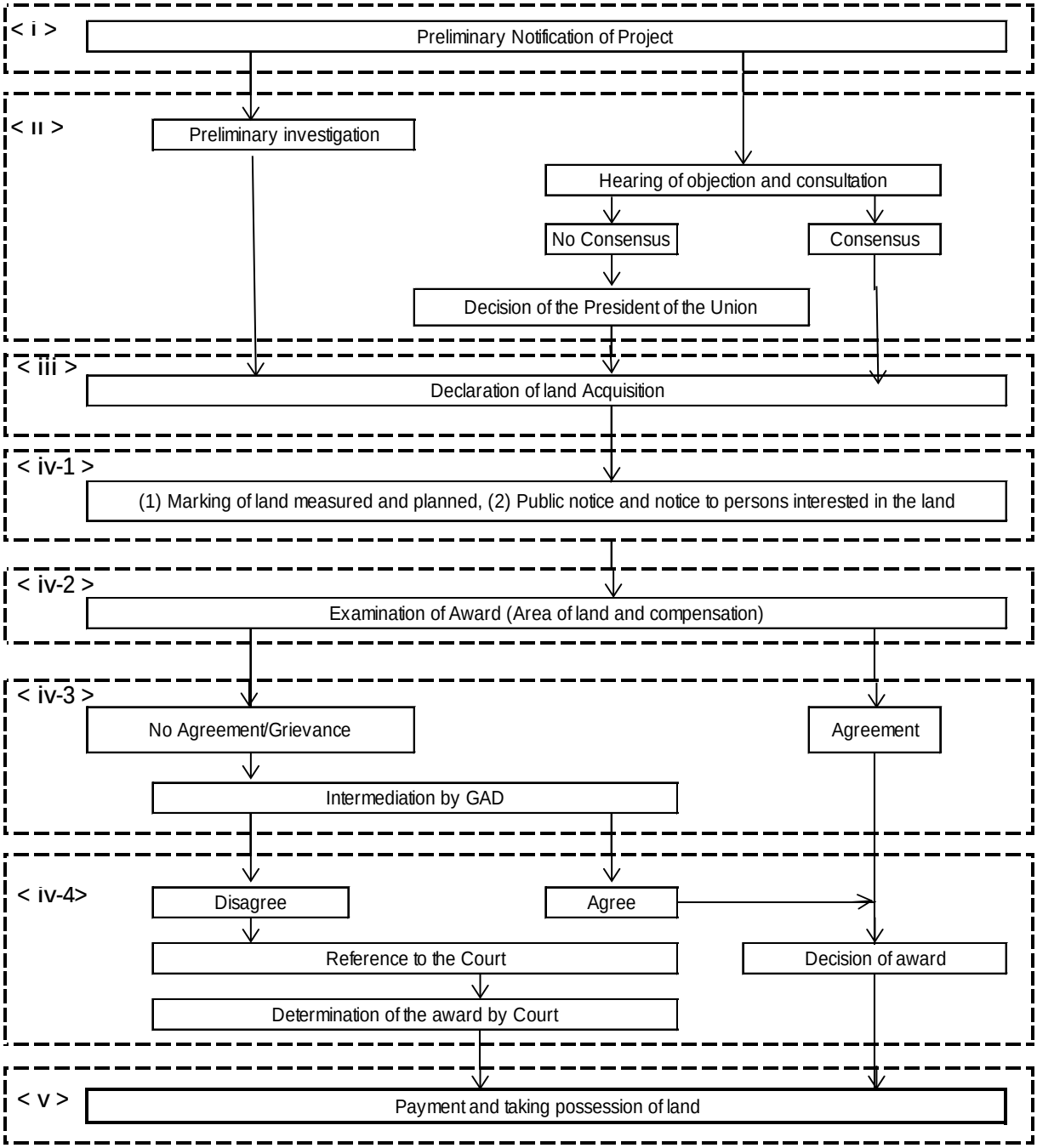
16.1.5 Laws, Rules and Regulations concerning Land Use, Ownership and Acquisition

There are many significant laws which govern land issues, land administration, and land ownership in Myanmar such as Land Nationalization Act (1953), Disposal of Tenancies Law (1963), Land Acquisition Act (1894), Forest Law (1992), Farm Land Law (2012), and so on.

Among them, the Land Acquisition Act (1894) is even now the core law of land acquisition.

The Land Acquisition Act 1894 promulgated in the British Colonial Era is even now the core law for land acquisition and resettlement in Myanmar. As there are problems such as consistency of the procedures by MONREC with the procedures by Ministry of Home Affairs or by local governments, and problem of abilities in MONREC to do institutional management of the system, etc., the new effectual system is also undecided at present.

Flow of Land Acquisition under Myanmar Legislation is shown in Fig. 16.1-9. The process is summarized to following 5 steps.



Source: JICA Survey Team based on information of Myanmar Legislation

Fig. 16.1-9 Flow of Land Acquisition under Myanmar Legislation

(1) Preliminary investigation

A notification is publicized in gazette and the substance of public notice is given at convenient places. Preliminary investigations are conducted, which include any surveys, digging/boring, delineation of the land boundaries.

(2) Hearing of objections

Objection to the land acquisition are collected in writing within 30 days. The Collector examines the objections and make consensus against the objections. If the Collector decides necessity, a report containing recommendations on the objections is submitted to the President of Union for the decision.

(3) Declaration of intended acquisition

The declaration of land acquisition is publicized in the Gazette, and stated at the district or other territorial division in which the land situates. The declaration includes the purposes, approximate area, location and plan.

(4) Enquiry into measurements, value and claims, and award by the collector

1) The Collector marks out and measures the land, and give the public notice at convenient places near the land. The notice is also provided to persons known or believed to be interested in the land.

2) Examination of Award (Area of Land and Compensation)

The Collector proceeds to inquire into objections to the measurement, the value of the land at the date of the publication of the notification, the respective eligibilities to claim the compensation and examines an award based on the area of the land, compensation including opinions of PAPs and the apportionment of compensation among PAPs.

The award is filed for conclusive evidence between the Collector and the persons interested in the land. The Collector immediately notices the awards to the persons who are not presented or their representatives when the award made.

The Collector makes any efforts to fix the enquiry.

3) Grievance

If deliberation reaches agreement, Award Committee issues the decision concerning type and amount of compensation. If not reach agreement, the deliberation is continued until reach agreement. If the affected people and Award Committee cannot conclude with the further deliberation meeting, GAD (General Administration Department) can intermediate between them.

4) Reference to Court

Any person interested in the land who do not accept the award can required that the matter be referred by the Collector for the determination of the Court with written application, whether the objection to the measurement of the land, the amount of the compensation, the person to whom it is payable, or the apportionment of the compensation among the persons interested.

If the persons agree the compensation, the particular are specified in the award for the conclusive evidence. If any disputes arise, the Collector may refer the disputes to the decisions of the Court.

5) Payment and Taking possession of land

The Collector pays compensation and takes possession of the land. The Collector gives the persons sufficient time to remove their property without inconvenience before taking possession.

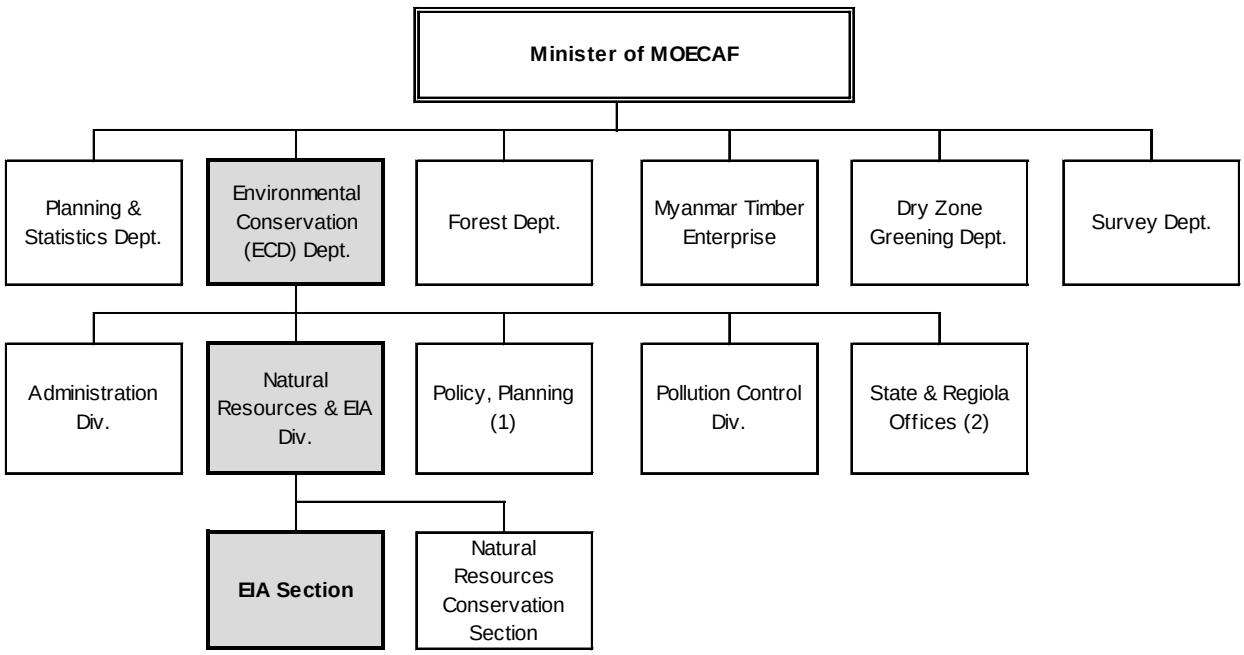
16.1.6 Institutional Framework

(1) Institutional Framework for Environmental Conservation

The Ministry of Forest was re-named as the MOECAF on September 6th 2011 in order to undertake both environmental and forest conservation and management more effectively. As described the above, recently name of MOECAF was changed to MONREC.

However, new organization chart is not yet established as of September 2016. Thus, function of environmental conservation and forestry is described based on that of former MOECAF at present.

MOECAF consists of six departments as shown in Fig. 16.1-10. In MOECAF ECD is responsible for environmental affairs including EIA. ECD has four divisions with state and regional offices.



Note: (1) Policy, Planning & International Relations, Research and Extension Division,
(2) State & Regional Offices (Yangon, Mandalay, Sagaing, Bago, Tanintharyi)

Source: JICA Survey Team

Fig. 16.1-10 Organization Chart of MOECAF

Among them EIA Section has following duties and responsibilities:

- To develop EIA procedure and regulations to avoid, minimize and/or mitigate adverse environmental impacts,
- monitor the implementation of environmental conservation,
- To review EIA reports for development projects.

(2) Institutional framework for Land acquisition and Resettlement

Agencies responsible for land acquisition differ from those of management of land acquisition as shown in Table 16.1-11.

Table 16.1-11 Responsible Agencies for Land Acquisition

Land		City Development Committee (CDC)	MOAI (Ministry of Agriculture and Irrigation)	MONREC (Forest Dept.)	GAD (Ministry of Home Affairs)
1	Yangon, Naypyidaw and Mandalay Cities	X			X
2	Farmland, vacant, fallow and virgin land		X		X
3	Forest lands			X	
4	Other town and village lands				X

Source: JICA Survey Team

16.2 Environmental Baseline Conditions of the Project Area-1 Baluchaung No.1 Hydropower Plant

16.2.1 Social Environment

(1) Administrative division

1) Kayah State

Situated in eastern Myanmar, it is bounded on the north by Shan State, on the east by Thailand's Mae Hong Son Province, and on the south and west by Kayin State. It lies approximately between 18° 30' and 19°55' north latitude and between 94°40' and 97°93' east longitude. The area is 11,670 km^2. Its capital is Loikaw with the estimated population of approximately 207,357, in 1998. It is inhabited primarily by the Karenni ethnic group, also known as Red Karen or Kayah, a Sino-Tibetan people.

As for Kayah State, formerly known as "Karenni State", The Constitution of the Union of Burma in 1947 proclaimed that the three Karenni States should be amalgamated into a single constituent state of the union, called Karenni State. It also provided for the possibility of secession from the Union after 10 years. In 1952, the former Shan state of Mong Pai was added, and the whole renamed Kayah State.

The ethnicity living in the State are, Kayah, Kayaw, Shan, Kayin, Kachin, Chin, Bamar, Rakhine, Gaykho, Gaybar, Kangan and Manaw, among which Kayan, Kayin and Shan are the main ethnicities. The religions are Buddhism, Christianity and Animist with 50%, 28% and 22, respectively. The terrain is generally mountainous and is traversed by the Thanlwin (Thanlwin) River. The State is fairly well provided with Kyun (Teak) and other hard woods, such as Pyin-ka-do (ironwood), Pa-dauk (gum-kino tree) and In-gyin (sal tree). Other forest products are orchid, bamboo shoot, resin, honey, etc. Tin is produced in the southern part of the State. Marble is also a product of Kayah State. Agriculture is one of the main livelihoods of the people and rice, wheat, maize, millet, groundnut and sesame are widely grown.

Kayah State is well-known in the country due to its Baluchaung No.2 HPP (Hydropower Plant). It was the country's first power station to become operational, completed in 1974. It has a capacity of 168 MW with six generators. Construction of Baluchaung No.1 HPP began in 1986 and was completed in 1992. It has an installed capacity of 28 MW. To date, these power stations stand as the country's largest and most important HPP, distributing power mainly to Yangon and Mandalay Regions. Since then the State has been famous as the main contributor of electric power to the country.

2) Loikaw Township

Loikaw Township is the capital of Kayah State and located in the southern rim of Eastern Highland. It is one of the four townships of Loikaw District in Kayah State. It lies between 19°14' and 20°59' north latitudes and also between 97°07' and 97°22' east longitudes. The Township has an area of 1548.97 km^2. Longest length is 132.14 km from east to west and 146.03 km from north to south. It is bounded on the east by Shartaw Township, on the west by Demoso Township, on the south by Bawlakhe Township and on the north and northwestern by Hsesaing and Phekon Townships (Fig. 16.2-1). There are 13 Wards and 13 village tracts including 133 villages in Loikaw Township. The eastern part of the boundary line is only 32.2 km away from Myanmar-Thailand international boundary. The northern part is more extensive than to southern part. The study area is elongated in shape (Fig. 16.2-2). The areas of each Ward and Village Tracts of the township was presented in Table 16.2-1. Fig. 16.2-3

shows the location of thirteen Wards, locally known as Myoma, in Loikaw Town. The Baluchaung River (Balu Stream) passing through the middle of the town, and historic lakes beauties the Loikaw Town a unique and picturesque spot.

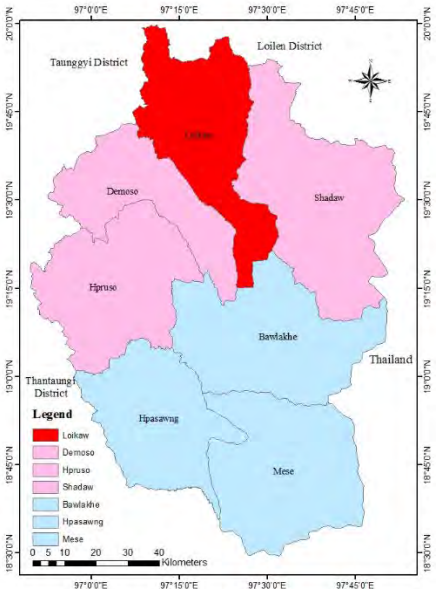


Fig. 16.2-1 Location of Loikaw Township in Kayah State

Source: Land Records Department, Loikaw Township (2000)

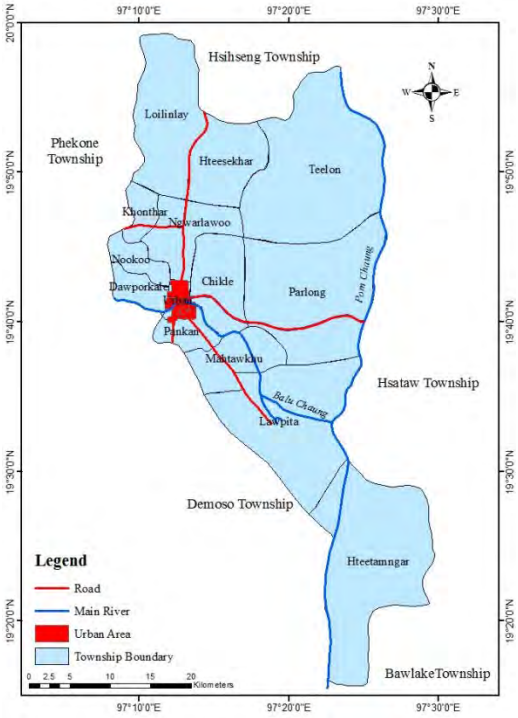


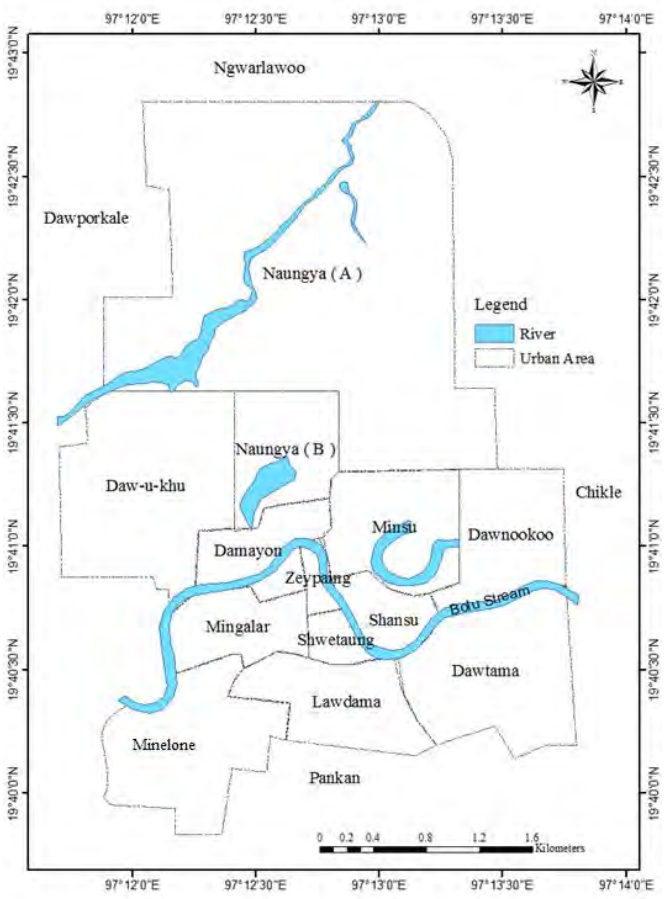
Fig. 16.2-2 Location of Village Tracts in Loikaw Township

Source: Land Records Department, Loikaw Township

Table 16.2-1 Areas of Wards and Village Tracts in Loikaw Township (2010)

No.	Wards/Village Tracts	Area (km^2)	No.	Wards/Village Tracts	Area (km^2)
1	Naungya (Ka)	7.56	14	Pankan	22.27
2	Naungya (Kha)	0.62	15	Hteesekhar	114.42
3	Dawukhu	3.52	16	Loilinlay	118.7
4	Minelone	2.38	17	Nookoo	30.22
5	Mingalar	0.59	18	Konethar	22.25
6	Damayon	0.13	19	Dawpawkale	25.79
7	Zeypaing	0.28	20	Ngwalawoo	57.03
8	Shwetaung	1.35	21	Chikle	89.09
9	Lawdama	4.3	22	Mahtawkhu	159.88
10	Dawtama	2.02	23	Parlong	246.8
11	Dawnookoo	0.75	24	Teelon	204.53
12	Shansu	0.21	25	Lawpita	212.22
13	Minsu	2.15	26	Hteetanhnya	219.81
Total		**1,548.97**			

Source: Township Peace and Development Council, 2010



Source: Land Records Department, Loikaw Township

Fig. 16.2-3 Location of Wards (Myoma) in Loikaw Town

1) Mobye Reservoir, Phekon Township

2) Dawtacha Weir blocking water flow of Baluchaung River

3) Waterway from Dawtacha Weir to the Pondage

4) Mite Kan Pondage

5) Penstock and Surge Tank

6) Baluchaung No.1 HPP

Source: JICA Survey Team

Photo 16.2-1 Baluchaung No.1 HPP Site and related Facilities

(2) Demographic conditions

1) Population

For the Demographic information in Loikaw Township, total population are 114,783 in 2015 as shown in Table 16.2-2. Among the national races, Kayah is the largest, which occupies 37.5%, followed by Bamar with 30.0% and Shan with 25.3%. The foreigners residing in this Township are 2,884 in total (2.6%).

2) Ethnicity condition

Ethnographers generally classify from seven to ten ethnic groups (not including ethnic sub-groups) as native to Kayah State. In addition, Shan, Intha, and Bamar live in the north and Pa-O in surrounding hills. Each group is also known by more than one name. Clearly, ethnicity in Kayah State is a complex issue.

According to the 1983 census conducted by United Nations and the Burmese government, the Kayah composed 56.1%, while Bamar (17.6%), Shan (16.7%), Karen (6.5%), mixed races (2.1%), and other groups formed minorities.

Table 16.2-2 Composition of National Races in Loikaw Township

No.	Race	Population (Persons)	Percent (%) of to the population
1	Kachin	137	0.12
2	Kayah	44,046	38.37
3	Kayin	4,065	3.54
4	Chin	369	0.32
5	Mon	298	0.26
6	Bamar	33,962	29.59
7	Rakhine	314	0.27
8	Shan	28,708	25.01
	Township total	111,899	97.49
	Foreigner (Chinese, Indian, Pakistani, Bangladeshi)	2,884	2.51
	Total	**114,783**	**100**

Source: General Administrative Department, Loikaw Township, 2015

Padaung, a tribe of Kayan ethnic group and known as women wearing brass neck and leg rings reside in a community located in Demoso Township in Loikaw District. Their livelihood

depends upon rain-fed rice production, maize and animal husbandry. In addition, their community is a spot of tourist attraction and they sell hand-woven traditional clothes as souvenir.

Household number and total population in Loikaw Township are 21,233 and 113,120, respectively. The urban and rural households are 44 % and 56%, respectively. (Table 16.2-3). Population under 18 years of age is 71,500 while above 18 years is 41,620, and male and female in this township are 49% and 51%.

Table 16.2-3 Household and Population in Loikaw Township

No	Particular	HH*	Quarter/ village Tract	Population under 18			Population above 18			Total population		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
1	Urban	9,261 (44%)	13	15,088	16,648	31,736	7,175	7,362	14,537	22,263	24,010	46,273
2	Rural	11,972 (56%)	Village tract:12; Village: 127	19,751	20,013	39,764	13,618	13,465	27,083	33,369	33,478	66,847
3	total	21,233		34,839	36,661	71,500	20,793	20,827	41,620	55,632 (49%)	57,488 (51%)	113,120

*HH : Household

Source: General Administrative Department, Loikaw Township, 2015

(3) Local Economy

With the improvement in transport and communication sectors in recent years, Loikaw Township has a direct air link with the major tourist areas, such as Yangon, Mandalay and Nyaung-u. Although the Kayah State has rugged terrains, the transportation network is being developed. Roads connecting Loikaw Township with Shan State, Kayin State and central and lower parts of Myanmar provide the easy access to Kayah State. With the development in trading, the economy of the Kayah State is visibly enhancing.

As for existing economic conditions in Loikaw Township, there are 173 commercial industries, such as rice mills, saw mills, bakery, water purification, furniture industries, and automobile repair with the total workers of about 1,000. The cottage industries like loom weaving, blacksmith, goldsmith, sewing etc. provide job opportunities to about 300 workers. In the rural area, farming is the major activity for income generation of all households. The major crops are rice, maize, pigeon peas, ground nut and sesame.

According to the data recorded by the GAD, Loikaw Township has the work force of total 71,500 people. Among them the highest number is 31,351 farmers (44.1%), followed by casual workers of 18,594 (26.0%). Government staff are recorded as 5,285 (7.4%). The data people working in small industry and fishery are not available (Table 16.2-4).

Table 16.2-4 Population by Livelihood in Loikaw Township

No.	Particular	Number	% of work force
1	Government staff	5,285	7.39
2	Services	305	0.42
3	Agriculture	31,531	44.1
4	Livestock	9,751	13.6
5	Trading	1,670	2.3
6	Small industry	-	
7	Fishery	-	
8	Casual labor	18,594	26.0
9	Others	4,364	6.1
10	Total	71,500	

Source: General Administrative Department, Loikaw Township, 2015

(4) Land Use

The type and major land use in Loikaw Township was shown in Table 16.2-5. The cultivated areas were recorded as 54,773 acres while the reserved and non-reserved forest areas were 72,873 acres in 2015. Farmers usually grow crops only in monsoon season. Summer rice is grown with irrigation near the area of Mobye Dam in Phekon Township in Shan State. In the township level, the largest areas were covered by monsoon rice and three types of rice ecosystems – (1) *Le* land (flooded rice), (2) *Ya* Land (rain-fed) and (3) *Taung-ya* Land (rain –fed land in hilly area, mostly with rotational cropping) were observed.

Out of the total land of 382,760 acres, the cultivated areas are 54,773 acres (14.3 %), while reserved and non-reserved forest are 72,873 acres (19.0 %). There are huge areas of upland, *Ya*, which occupies 66.0 %, the low land rice area is 33.3% in the total township's cultivated areas. The other land utilization in reserved and non-reserve forest, such as farming and mining industries, are observed with total area of 2,119.48 acres as also shown in Table 16.2-5.

Table 16.2-5 Major Land Use in Loikaw Township

Sr.	Particular*	Area (acre)	
1	Cultivated area	54,773	
	(a) Net sown area	54,773	(14.3%)
	Le Land	18,256	(33.3%)
	Ya Land	36,148	(66%)
	Kaing /Kyun (Alluvial soil)	0	
	Orchard	175	
	Taung-ya land	194	
	(b) Fallow Land	1379	
2	Virgin land/ *Taung- yaing*	498	
3	*Taw -yaing* (unclassified forest)	48,665	
4	Reserved and non-reserved forest	72,873	(19.0%)
5	*Urban, rural and others*	204,572	
	Total	**382,760**	

Note: *Definition - *Le* land (flooded rice), *Ya* Land (rain-fed) and *Taung-ya* Land (rain –fed land in hilly area, mostly with rotational cropping)

Source: Land Use Division, Department of Agriculture, Loikaw Township, 2016

Table 16.2-6 Land Utilization in Reserved and Non-Reserve Forest in Loikaw Township

No.	Name of reserved/ non-reserve forest	Area (acre)	Private forest (acre)		Other uses of forest area (acre)				% of other use
			Teak	Hard wood	Farming	Mine	Water logged	Total	
1	Mahtawkhu	1,214	100	40	200			200	16.47
2	Painchit	24,320			44.6	199.59		264.19	1.09
3	Nantparpone	46,080			52.5			52.50	0.11
4	Konethar (non)	13,53			543.05			543.05	40.11
	Total	**22,080**	**100**	**40**	**840.15**	**199.59**		**1,059.74**	**1.45**
								2,119.48	

Source: Department of Forest, Loikaw Township, 2014

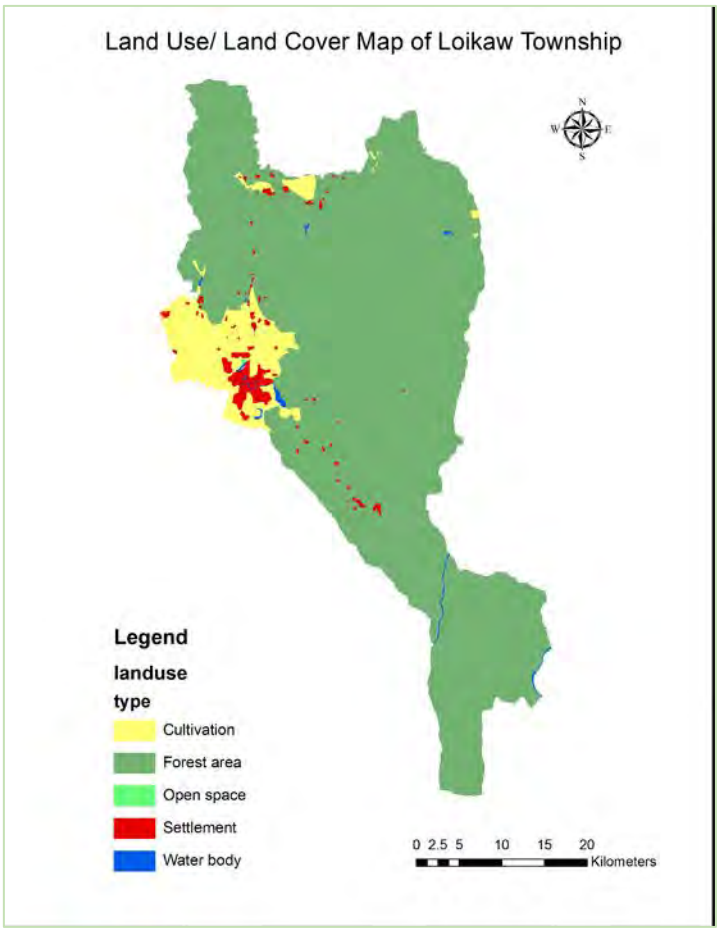
With good rainfalls and irrigation facilities, some villages have homestead gardens, growing vegetables and kitchen crops for extra income. The perennial trees are also found in several villages although forest areas do not generally exist in rural area. Because of the timber extraction, charcoal making and fuel wood for several decades, the lands were already deforested, encroached by agriculture lands.

According to the Loikaw Township Land Use / Cover Map ArcGIS 10.1 version, (Scale of 1/50,000), UTM (Universal Transverse Mercator) maps of 2003, 2006 and 2007, the areas of total township area, cultivation area and settlement area were calculated (Table 16.2-7, Fig.16.2-4).

Table 16.2-7 Land Use / Cover in Loikaw Township

Township Area:	1,535.3 km^2	(%)
Cultivation Area:	127.8 km^2	8.32
Forest Area:	1,374.2 km^2	89.51
Settlement Area:	26.6 km^2	1.73
Others	6.7 km^2	0.44

Source: JICA Survey Team



Source: Land Use Division, Department of Agriculture, Loikaw Township, 2016

Fig. 16.2-4 Land Use / Land Cover Map of Loikaw Township

1) Utilization of Local Resources

Most households have small scale livestock husbandry for home consumption, such as swine and chicken. Cattle raising is becoming uncommon with the scarcity of pasture and grazing lands and availability of small machines. However, many farmers use draft cattle for their farming activities. In 2015 -2016, the number of buffalo and cows were 6,912 and 16,689 numbers, respectively (Table 16.2-8). These days, many affordable farmers use power tillers for tillage and farm machinery for harvesting and threshing. Some villages have more commercial scale farmers while the subsistence farming is more common in some other villages.

It was recorded that firewood is the main source of energy for cooking for 69.2% of the households in Myanmar (Myanmar Census, 2014). Therefore, the major forest products the village community rely on for their daily life are fuel wood and charcoal. The forest products from Loikaw Township also include bark (for tanning), gums, medicinal plant, lac which are important items for household extra income. The quantity of the NTFPs (Non-Timber Forest Products) produced were listed in Table 16.2-9.

Table 16.2-8 Livestock Breeding in Loikaw Township

No.	Year	Buffalo	Cow	Pig	Goat/sheep	Chicken	Duck	Other poultry
1	2014-15	6,724	16,232	19,865	207	402,377	1,085	3,300
2	2015-16	6,912	16,689	20,994	225	432,017	1,200	3,334

Source: General Administrative Department, Loikaw Township, 2015

Table 16.2-9 Forest Products in Loikaw Township

No.	Particular	Unit	Quantity
1	Fuel wood	Cu ton*	770
2	Charcoal	Cu ton	2050
3	Bamboo	No. ($\times 10^3$)	160.2
4	Bark (for tanning)	Viss*	24,430
5	Gums	Viss	14,120
6	Thanatkhar	Viss	100
7	Thatch	No. (x 10^3)	342
8	Thit sae	Viss	530
9	Medicinal plant	Viss	3,600
10	Lac	Viss	6,200

Note: Cu ton = cubic ton, Viss (Myanmar weighing scale, 1 kg = 0.6 Viss)
Source: Department of Forest, Loikaw Township, 2014

(5) Social infrastructures

1) Electricity Supply

To date, around 70 % of Myanmar people still have little or no access to electricity. It was stated that 32.4% of households use electricity as their main source of energy for lighting, although disparities between urban and rural areas are striking (Myanmar Census, 2014). Even those who have access are suffering from frequent power outage due mainly to the deterioration of power generation facilities, shortage of fuel gas, and limited output of hydropower stations in the hot summer season. It is a common issue that the urban areas of

Myanmar, including Loikaw Town and rural villages, have limited electricity access or a poor electricity power situation.

With increasing population, the electricity demand has risen gradually; insufficient amount/voltage of electricity becomes a major issue. In the urban, the priority for 24-hr. electricity is provided to government offices, schools, hospitals and etc. The remaining residential areas are only accessible at night time, with a poor voltage. The requirement of power line extension and construction of lamp-posts are common complaints of many villages. There are a few households who use solar power for lighting while the majority use candle lights and battery lamps. The following Table 16.2-10 shows, as an example, the status of the electricity access of all villages under the Lawpita Village Tract, which is situated nearest to the Baluchaung HPPs (as of February, 2016).

Table 16.2-10 Status of Electricity Accessibility in Lawpita Village Tract, Loikaw Township

No.	Village	Status of Household Accessibility to Electricity (HH)		Requirement of Transformer	Other Requirement
		Total HH	Accessible HH* (%)		
1	Lay Ein	95	38 (40%)	Required	Extension of power line
2	Pa Ra Hi Ta	70	42 (60%)	-	Extension of power line
3	Law Pi Ta - Shan (new)	225	138 (61%)	required	Extension of power line
4	Law Ka Htu	145	56 (39%)	Required	
5	Law Ka Htu (new)	31	23 (74%)	Combine	
6	Se Mye	26	20 (77%)	-	
7	So La Se	132	65 (49%)	required	Extension of power line
8	Koe Mye	21	13 (62%)		
9	Mite Kan	168	121 (72%)	Required	
10	No-1 quarter	18	15 (83%)		
11	Kyauk Taung	120	93 (78%)	-	
12	Law Pi Ta	189	127 (67%)	required	Extension of power line
13	Law Da Lay	196	187 (95%)		
14	Damma Set Kyar	168	135 (80%)		
15	Kan Ni and Daw Se	82	0 (0%)		Lamp post
16	Pa Daung Kone	70	34 (49%)		
TOTAL		**1,756**	**1,118 (64%)**		

Source: General Administrative Department, Lawpita Village Tract, Loikaw Township, 2016

2) Water Supply

The Census Myanmar, 2014 states that 69.5% of all household's main source of drinking water is classified as an improved water source across the country.

In the Loikaw Town, sources for household water use and drinking water are one water pond and 23 tube wells. Moreover, deep tube wells and shallow tube wells are 23 and 4, respectively. There is 26 pipe water supply from springs. In the rural areas, many villages which are located to the water sources, they are accessible to Baluchaung River and along the waterway to Mite Kan pondage. The villages near the hilly areas, have water access from the spring sources. However, it is common that many villages suffer water shortage particularly in summer season.

Villagers have to fetch water from distance using a small cargo truck (*Traw-ler-gy* in Myanmar language) and motorbikes, bicycles, bullock carts, etc.

3) Water Sanitation

In Myanmar existing sewerage system covers only a small part of the big city such as Yangon and Mandalay City. People living Loikaw Township the sewerage service area employ on-site disposal systems such as septic tank and pit latrine.

(6) Social Services

Concerning with social services, Loikaw Township has three higher education (university /college level) facilities. The number of teachers and students in 2015 were listed in Table 16.2-11. For the basic education infrastructure, the primary, middle and high school status are described in Table 16.2-12. The total numbers of teachers are recorded as 1,265 and students as 35,486 in 2015 academic year. Moreover, there are five monastic schools with 553 students, where most orphanage children and the poor from rural areas are attending to the basic education level. Table 16.2-13 shows the basic education facilities of Lawpita Village Tract, which is located near the Baluchaung Hydropower Stations. There are one State High School, one Middle School, and three Affiliated Primary Schools in the project area.

Table 16.2-11 Universities and Colleges in Loikaw Township

No.	Name of university/college	Location	Area (acre)	No. of teacher	No. of students
1	University of Loikaw	Naung Yar (A)	158.63	275	2,861
2	Computer university	Chi Kal	76.09	104	77
3	Technical university	Pan Tan	87.46	108	575

Source: General Administrative Department, Loikaw Township, 2015

Table 16.2-12 Basic Education Level in Loikaw Township

No.	Particular	Quantity	Area (acre)	No. of teacher	No. of student
1	High schools	6	57.06	279	8195
2	Middle schools	17	130.31	369	11,302
3	Primary schools	98		540	14,509
4	Pre- school	32		57	927
5	Monastic school (primary)	5		20	553
Total				**1,265**	**35,486**

Source: General Administrative Department, Loikaw Township, 2015

Table 16.2-13 Education Facilities in Lawpita Village Tract in Loikaw Township

No.	Name of School	Location	Area (acre)	No of teacher	No of student
1	State High School Lawpita	Law Pi Ta	14.45	20	355
2	State Middle School (Law Da Lay)	Law Da Lay	5.7	15	316
3	State Middle School (Shan)	Shan Ywar	7.34	14	433
4	Affiliated Primary School	So La sel		2	33
5	Affiliated Primary School	Mite Kan		2	39
6	Affiliated Primary School	Dawtacha (Pa-O)		1	21
		Total		**54**	**1,197**

Source: General Administrative Department, Lawpita Village Tract, Loikaw Township, 2015

(7) Vulnerable Groups

Under the mismanagement for about half a century, Myanmar faces many environmental challenges. As a whole, environmental degradation has a disproportionate impact on poor and vulnerable people. Approximately 70% of the population is rural, relying directly on natural resources for their livelihoods and employment. Environmental degradation directly affects them from the following aspects.

- Decreasing agricultural productivity, food insecurity and loss of income;
- Water shortage leads to increased workloads to collect water, and decreased agricultural production;
- Climate change negatively impacts on agriculture, health and basic infrastructure; and
- Forest degradation leads to loss of fuel, food, medicinal sources and increased workloads.

The poor in urban areas are also affected by environmental degradation. Environmental degradation means they have less access to safe water, to waste disposal systems, to clean air, etc. As a result, their living standards and health are directly affected. In general, wealthier people live and work in areas that are affected less. The wealthier have a better investment, education, technologies and information, so that they can develop alternative livelihoods and survive under the stress periods. In conclusion, poverty undermines the efforts to protect natural environment, leading to the downward spiral of poverty and environmental degradation, particularly in rural areas of Myanmar.

Much of the displacement from Kayah State dates back to the 1990s, and the armed clashes before and after the failed 1995 ceasefire between the Tat-ma-daw (Government army) and the KNPP (Karenni National Progressive Party). Decades of conflict in Kayah State has left several thousand people internally displaced, while thousands more fled into neighboring Thailand. As of 2013, there are approximately 16,079 refugees from Kayah State. It was estimated in 2012 that about 34,600 people remained internally displaced (UNHCR; Office of the United Nations High Commissioner for Refugees, 2014). The relocation sites are also inadequate to sustain a healthy and economically viable livelihood. The majority sites do not have sanitation facilities, electricity or access to safe drinking water. The land surrounding the sites is often barren. As productive lands have usually been claimed by the original inhabitants or confiscated by the military, farming opportunities are limited and it creates very poor livelihood condition.

(8) Situation of Gender and Children

Although no specific studies are available for Myanmar, research from other countries show that environmental impacts such as forest loss, water degradation, and climate change have a negative impact on gender balance. In general, women are responsible for collecting forest products, for

basic agriculture and tending to livestock. Environmental degradation decreases their access to needed items and greatly increases their workload. Women are also responsible for caring for sick children and old people, and as environmental degradation leads to increased sickness, it again increases women's workloads.

Women are more vulnerable to reproductive health problems. In addition, in general, women and men experience the effects differently because of their different social role, discrimination and poverty. In poor and marginalized societies, women are less able to adapt to environmental shocks. They have less access to education, information, credit, and technologies– these factors give them less adaptive capacity. They have less of a voice, and so are less involved in planning and decision-making. These situations are more prevalent in rural than urban areas, in general.

Similarly, poor economy and under development during the last decades enhanced the child labor across Myanmar. In urban and rural alike, children are seen working laboriously in various work places, such as tea- shops, restaurants, ports, road construction, etc. The worse situation is military expansion with recruitment of children. Myanmar was very often internationally criticized for its child labor issues.

(9) Situation of Conflict or Split of the Communities relevant to the Project Area

In the study site, Lawpita Village Tract of Loikaw Township, although several ethnic people are living together in a village, no significant conflicts were not noted among the races, religions and community. Children are going to the same schools, the youths and elders are working together in social and religious activities, hand in hand for a long history.

However, a conflict on land issue between land owners and Baluchaung No.1 HPP has not been yet settled today. When the HPPs started, many lands were confiscated; some areas were designated for military compounds, some for power stations, and some for station staff quarters. When the Baluchaung No.1 HPP was completed and in operation phase, some staff quarters were removed since there were fewer staffs than the construction period. These lands (about 40 ac; next to the current Baluchaung No.1 HPP's staff compound in the western side) have been used for cultivation by the station staffs and workers. Thirteen land owners in Lawpita Village Tract are demanding to get back their lands and the issue is still in the court.

At the 1st stakeholder meeting held on July 2nd in Law Pi Ta Village Tract, above mentioned land issue was asked to solve in the comment of attendants, although the issue is out of scope of the Rehabilitation Project. In the consultation with village representative at the 2nd stake holder meeting on September 17th, the issue was not raised. According to the Law Pi Ta Village Tract Administrator, above said issue is in considerable progress to the solution.

(10) Activities of Community Based Organization and Non-government Organization

A number of LNGO (local NGOs: Non-government Organization) and INGO (international NGOs) have been established for a few decades in Myanmar. The civil society organizations exist at the village level, township and national levels. The majority have responsibilities related to poverty alleviation and livelihood improvement. In addition, there are several organizations with a specific focus on environment, and/or climate change and/or biodiversity conservation. At the community and village level, a large number of CBOs (Community Based Organizations) and semi-formal self-help groups are active throughout the country, often with the support of international partners such as UNDP (United Nations Development Programme). For example, these are active in developing credit systems, developing savings systems, providing social support, providing technical support mechanisms and etc.

Currently, about 40 numbers of LNGOs and INGOs exist in Loikaw Township, some are actively working and some are inactive, depending on their projects. The examples are World Vision, Care Myanmar, Mercy corps, ACF, UNDP, PSI, Mitta Foundation, UNHCR, Nyein Foundation, etc. Some local ethnic CBOs are Karenni Social Welfare Development Center, Karenni National Women Organization, Karrenni State Farmers Union are among others. These have mostly been working on humanitarian assistance and support to livelihood development, with the focus at the community and village level. Moreover, the eight Registered Civil Society, such as Association for Age-old Care, Youth Association, SRG Township Leading Group, etc., exist in Loikaw Township.

(11) Cultural, Historical Heritage and Religious Sites

Regarding with religious infrastructure, there are 93 pagodas in Loikaw Township. The most famous and much attractive to the tourists, local and abroad is the "Taung-kwe Sedi (Broken Hills)", which is located in the center of the town. Taung-thone-lone (Three mountain ranges), Shwe-let-war (Gold palm pagoda) and Mya-kalart pagodas are the most well-known pagodas located on the hill tops, with a scenic beauty of Loikaw. The Buddhist monastery are 96 in number while nun-monastery are three. The total number of monks, novices and nuns are 521, 1,373 and 202, respectively.

The Christ Church (Christ Central Roman Catholic Church) and Cathedrals are situated in Nyaung-khar quarter of Loikaw Township. It was the first Christian mission church in the Township built in 1989, stands as the largest one in Myanmar. The list of the infrastructure of other religions, besides Buddhism are noted in the following Table 16.2-14.

Table 16.2-14 List of Infrastructure of Various Religions in Loikaw Township

No.	Particular	Christianity	Islam	Hindu	Chinese temple
1	Urban	15	1	1	1
2	Rural	62	0	1	0
	Total	77	1	2	1

Source: General Administrative Department, Loikaw Township, 2015

Due to the natural geographic settings, the township has a variety of recreation attractions, like Hti-se-khar waterfall, Nyaung-khar Lake, Ngwe-daung spring, etc. The most popular cultural historic tourism spot is the "Gyat Cave" situated about 2 km away in the east of the town. It is believed to be a place where evil spirits live and a number of old coffins and bats dwelling inside it.

Source: JICA Survey Team

Photo 16.2-2 Famous Taung-kwe Sedi, Loikawa

After 2011, local and international tourism was introduced to Kayah State, which has rich natural resources ranging from scenic landforms of natural beauty to the traditional culture of indigenous people, such as "Kayan / Padaung". These days, with the improvement of transportation and communication after the restoration of peace and tranquility, the area development, as well as economy development, has been achieved in a momentum.

(12) Fishing Rights, Water Rights and Rights of Common

In Myanmar there are two types of fishing rights; one is "fishing grant", which is given with specified river area and another is "license", which is a permit of fishing. In the project area there is no commercial scale fishing resources, such as lakes and rivers and stream, no fishing grant is established.

(13) Public Health and Sanitation

Kayah State, like most areas in the country, has poor health care facilities due to the alleged mismanagement by the previous successive government. Although government tried health care services to be less cost, in reality patients have to pay high cost for medicine and treatment even in public clinics and hospitals. Public hospitals are lack many of the basic facilities and equipment. As Kayah State was one of the most isolated state in Myanmar, it had great difficulties in addressing health concerns in previous days. To date infrastructure for health services and health indicators recorded in 2015 are shown in the following Table 16.2-15.

Table 16.2-15 Health Facilities in Loikaw Township

No.	Particular	Quantity
1	General hospital	1
2	Station hospital	2
3	Rural health center	7
4	Sub center	28
5	Medical doctor	69
6	Nurse	293
7	Health assistance	4

Source: General Administrative Department, Loikaw Township, 2015

(14) Infectious Diseases

The most common disease recorded in Loikaw Township are malaria, diarrhea, tuberculosis, dysentery with the cases of 150, 1854, 473, and 761, respectively. Moreover, the HIV/AIDS (Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome) are found to be 160 cases in 2015. The health indicators are shown in the following Table 16.2-16.

Table 16.2-16 Most Common Diseases and Health Indicators in Loikaw Township

Most common diseases			Health indicators	
Particular	Cases		Particular	Cases
Malaria	150		No of delivery (mother)	2,419
Diarrhea	1,854		Birth rate-	18.55/1,000
Tuberculosis	473		Maternal Mortality rate	0.85/1,000
Dysentery	761		Infant mortality rate	6.82/1,000
HIV /AIDS	160		Abortion rate	2.59/1,000

Source: General Administrative Department, Loikaw Township, 2015

(15) Working Environment and Conditions

The Baluchaung No.1 HPP has operation and maintenance manuals. However, there is no regular safety training conducted and no health and safety audits have been conducted. Staff are not issued with PPE (Proper Protective Equipment). There is no first aid trained staff in the station itself. In addition, a Rural Health Center with limited facilities and staffed by a nurse is stationed at Mite Kan village, less than 2 km away from the Baluchaung No.1 HPP. The nearest hospital in Loikaw Town is 16 km away.

Water supply for the staff is provided through tube wells. As for sanitation, the site is not on mains sewerage system. All wastewater and sewerage is discharged to the ground. There is no plan for handling of solid waste, and no collection by the Municipal service occurs but much waste is either burnt or buried at the site.

For noise level, the previous data were recorded that they were lower than the standard threshold noise levels within the station and the compound. Thus, it is not significant disturbances both for staff at the Baluchaung No.1 HPP and surrounding communities.

Flooding of the site is not reported as an issue since it is situated at a higher ground level. Open drains carry away excess water to the surrounding fields in the rainy season. Discharges to the surroundings are not directed to and not a particular risk to fields with fresh edible crops.

No environmental monitoring process currently takes place. There is no equipment to measure noise or air pollution levels. There are no wells to measure possible groundwater pollution in or around the station.

Currently health and safety conditions at the station are unsatisfactory. No health and safety manuals exist. There is no regular safety training conducted and staff are not issued with the PPE. There is no first aid trained staff in the station itself. The lack of safety training and equipment for staff combined with only limited management plans creates a working environment that is in urgent need of improving.

(16) Hazards and risks

The armed conflicts between Myanmar army and insurgent (Karenni / Kayah) were taking place in these areas before HPP project began. The Myanmar authorities placed landmines around the base of the cable line- towers for the protection. They were fenced with timber and warnings were given to the villagers nearby. There were many cases of landmine incidence to human beings and cattle that stray to those areas. In those days, villagers from nearby villages were assigned to take duties to guard these towers at night. After the ceased fire agreement in 2010, these areas turned to be a stable condition. At the time of insurgency, many landmines were also planted in the forested areas; villagers were always anxious whenever they have to venture into the forest that they might step on such a landmine. There have been several cases of death and injury of human and cattle with mine accidents. There were about 3 - 4 persons in each village who lost their legs.

According UNHCR South-East Myanmar Information Management Unit, the status of the ceasefire agreements for most prominent Kayah State based Non-State Actors is shown in Table 16.2-17.

Table 16.2-17 Status of the Ceasefire Agreements

No.	Non-State Armed Group	Location/Conflict Zone	Ceasefire Agreements	Situation
1	Karennni National Progressive Party (KNPP)	Near Thai-Myanmar border in Kayah State	Signed a ceasefire agreement with the government on 21 March 1995. Broke down after 3 months. Singed ceasefire with the government on 8 March 2012. Follow-up negotiations on 9-10 June and 22-23 October 2013.	Seven-point agreement finalized on 22-23 October 2013, including points related to the nationwide ceasefire, pilot projects for IDPs, demining plans and expansion of electricity services throughout Kayah State.
2	Kayan National Guard (KNG)	Special Region 1, Kayah State	Signed a ceasefire agreement with the government on 27 February 1993.	Transformed into BGF in accordance with 2008 constitution.
3	Karenni Nationalities People's Liberation Support (KNPLF)	Special Region 2, Kayah State	Signed a ceasefire agreement with the government on 9 May 1994.	Transformed into BGF on November 8, 2009.
	Karenni New Land Party (KNLP)	Special Region 3, Kayah State	Signed a ceasefire agreement with the government on 26 July 1994.	-The SPDC granted the KNLP a small territory bordering Mong Pai Township of Shan State. -The KNLP has supported itself since 1994 through teak and gems trading.

Source: UNHCR South-East Myanmar Information Management Unit (2014.6) Kayah State Profile

At present, there is no information of conflict or split of the communities relevant to the project area.

Several villages received landmine risk education in school and community, even though the contaminated lands have been cleared these days. School children and village youth received the awareness training. Some LNGOs and INGOs are also working to alleviate the suffering of the affected community in high risk environments. The INGOs, for example "Save the children", held trainings on awareness raising for protection and safety from land mines in some study villages.

If we see back in the history, over 12,000 people were displaced by Mobye Dam and the power stations. Since 1961, for the security reason of the power stations, a number of Burma Army troops stationed near the HPP. It has increased in number gradually, and this increase has come with incidents of forced labor and porter, land confiscation, and sexual violence by the troops, etc. An estimated 18,000 land mines have been planted around the power stations. Water use for irrigating local farms has been restricted and fishing has been negatively impacted by the dam's reservoir, with grave consequences to livelihoods. The conflict between SPDC (State Peace and Development Council) and the KNPP persisted. Displacement was followed the stationing of IB72 (Army force) for the HPP security. Armed opposition group sporadically attacked the high voltage cable pylons and frequent skirmishes broke out between State Law and Order Restoration Council and KNPP forces around the HPPs. In 1990, the SPDC, evicted villages around the HPPs, labeled the area a restricted zone, and planted numerous landmines. Military expansion to fight against the Karenni resistance groups created forced labor and portering. The duty was also assigned to the villagers nearby to guard the periphery of the HPP. They had to monitor and protect the surrounding of the HPP. Many mines placed in the area. Many of villagers, livestock and even Burma army soldiers being injured and killed by landmines.

Power cable towers and lines, access roads and the power stations were all confiscated without payment from relevant owners. Thousands of acres of farmlands were demolished due to the construction of military bases, military plantations, railways and roads, and the demarcation of security areas. As a result of constant forced labor, no time to struggle for their livelihood, thereby no other options, but to abandon their villages and flee to refugee camps in Thailand.

Currently there are about 4,800 IDPs (Internally Displaced Persons) in relocation sites throughout Karenni State. These relocation sites are a result of the Burmese military regimes mass relocation program in Karenni State in 1996. Following the collapse of the ceasefire between State Law and Order Restoration Council and the KNPP, tens of thousands of people were forcibly evicted from their homes during this program. Most relocation sites are located close to military camps, army bases and along main roads. In addition, this increases the vulnerability of exploitation and abuse. The sites are inadequate to sustain a healthy and economically viable livelihood. They do not have sanitation facilities, electricity or access to safe drinking water. The opportunities to farm are limited. There are also very few employment opportunities in forced relocation sites.

To date, for security of premises and property, the security force are guarded at the entrance road (Loikaw – Lawpita Road). In addition, the staff are assigned rotationally day and night shifts for security of the station. They are responsible for inner circle security and have to check and inspect to every individual at the entrance gate.

(17) Accidents

Serious accidents were not recorded in the station as well as in the staff compounds. However, occupational health training needs to be conducted. The fire risk and precautions are taken in such ways that no smoking in vulnerable areas and warning signs boards are displayed in several areas inside the station.

Every staff member of the Power Station is always checked by their own identity cards before entering the station compound so that only authorized personnel can enter the Power Station.

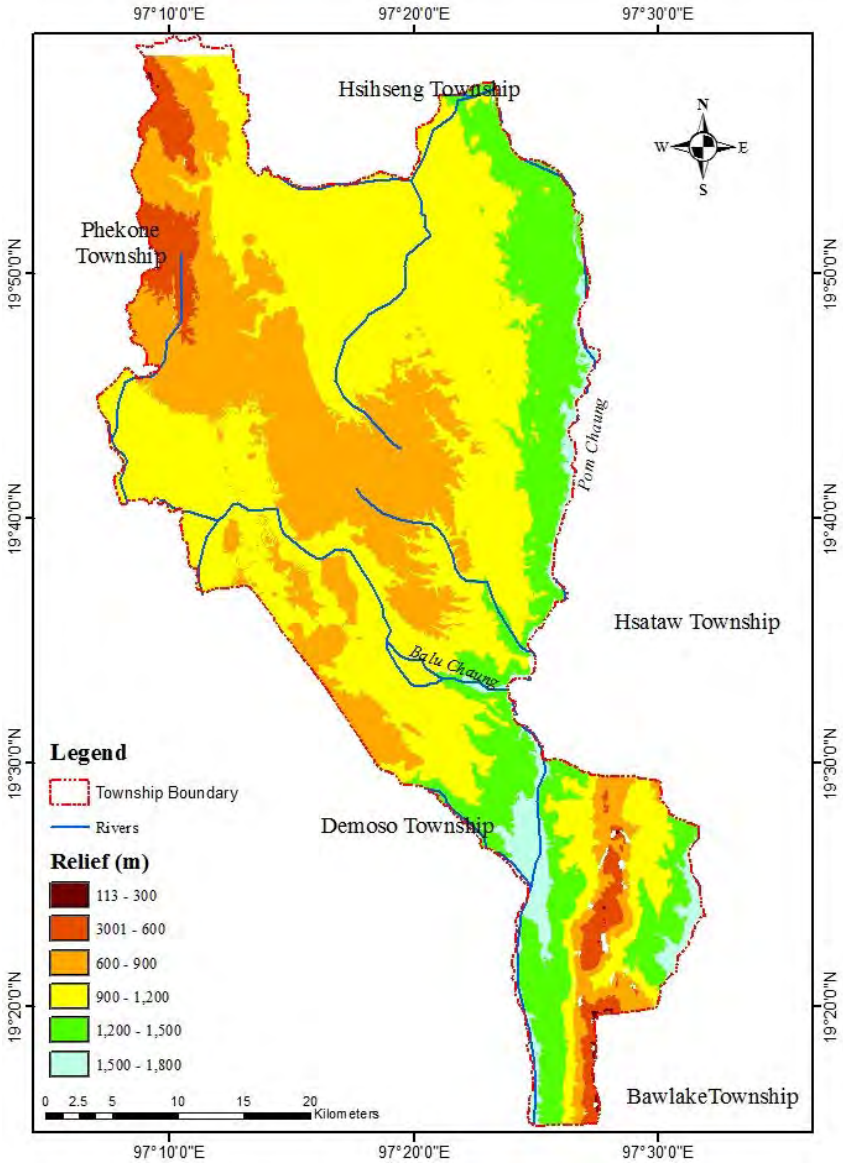
16.2.2 Natural Environment

(1) Topography, geology and soil condition

1) Topography and Drainage

Loikaw Township is located in Kayah State at 899 meters above sea level. Physically, Kayah State is a part of Shan Plateau, however when it stretches out southwards, it gradually loses its plateau character. In the whole township, a number of hills and mountain ranges are seen. The Kanti Mountain Range, with the highest peak about 1,565 meters lies on the east of Baluchaung River. Loikaw Township is famous for its beautiful waterfalls and lakes. The Baluchaung River passes through in the centre of Loikaw and then continues about 10 km southeast ward approaching Mahtawkhu Waterfall (76.2 m height) and then continues flowing southeast ward, in the Lawpita village where Lawpita waterfall appears with an altitude of the 442 m. These waterfalls are now used as the site of the Baluchaung No.1 and No.2 HPPs.

The small streams flowing into the Baluchaung River are Namphe, Namsamkha and Ngwegaung streams. Generally, water level of Baluchaung River ranges from 905 m to 875 m. The Ngwedaung Dam was constructed particularly for irrigation to agriculture fields. The water from Mobye Dam is mainly used for the hydro-electric power generation at Lawpita. The Dam also controls floods along Baluchaung River below Loikaw Township and it irrigates 4,856 ha of rice fields.



Source: SRTM
Source: Land Use Division, Department of Agriculture, Loikaw Township

Fig. 16.2-5 Topography of Loikaw Township

2) Soils

Relief, drainage, climate and natural vegetation are the principal soil forming factors. According to Land Use Division, the following soil types found in Loikaw Township can be classified as follows;

(a) Alluvial soils (*Fluvisol*): in the plains and valleys of the Baluchaung River.

(b) Meadow (*Le*) soils (*Fluvisol/ Gleysol*): along the narrow valleys or small streams as well as on geologically old plains and along the Baluchaung and in Nookoo and Teelon village tracts.

(c) Yellow Brown soils (*Cambisol / histic*): at an altitude between 152 m and 914 m above

the sea level and along the valley of Nampown Stream.

(d) Dark Brown Yellow Soils (*Ferrasol*): at an elevation between 609.6 m and 914.4 m.

(e) Lateritic Yellow Brown Soils (*Ferrasol*): in western parts of Teelon, Lawpita, and Chikle village tracts.

(f) Red Brown Forest Soils (*Acrisol*): on the rolling topography lying above 1,524 m and in Hteetanhnya village tract and other villages.

Red soils (*Acrosol P.B*) and mountainous red soils (*Cambisol*) develop on limestone within Kayah Highlands. Mountainous red soils and lateritic soils are found on the mountain ranges and rolling plain.

(2) Climate Condition

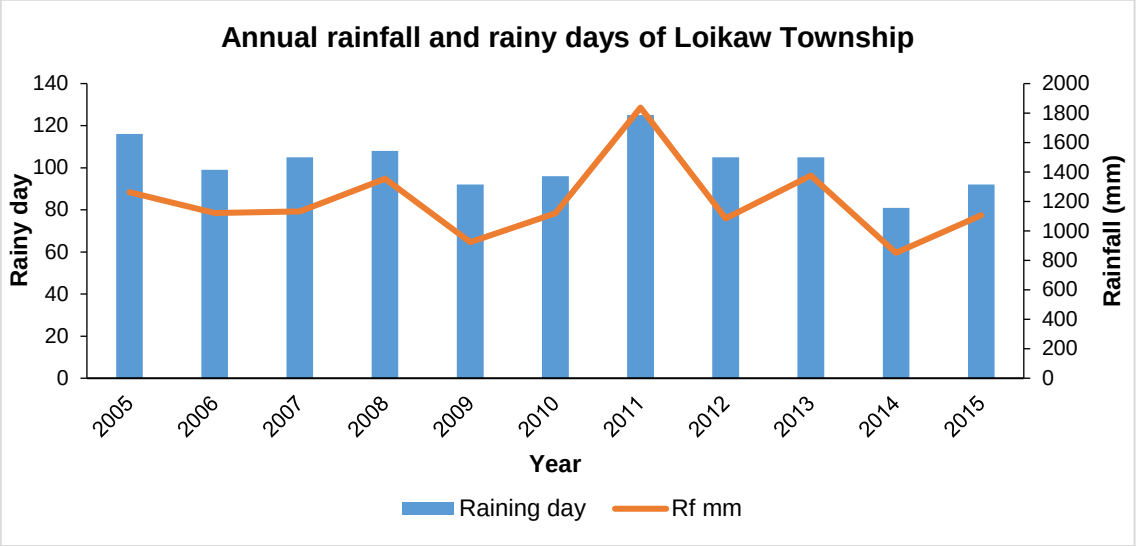
According to the latitudinal location of Loikaw Township, upland areas enjoy humid subtropical type of climate and the lower portion have tropical monsoon type of climate. From 2001 to 2010, the highest maximum temperature was 36.7°C (in April) and the minimum of 8.1°C (in January). The average maximum and minimum temperatures were 32.3°C and 13.8°C, respectively. The mean temperature was 23.11°C.

As Loikaw Township is situated on the mountain slope of the highland region, it receives moderate rainfall. During the ten year period (2005 – 2015), the highest annual rainfall of 1,837 mm with 125 rainy days was observed in 2011 while the lowest rainfall (925 mm) with 92 rainy days in 2009 (Table 16.2-18 and Fig. 16.2-6). The average monthly rainfall (mm) for 11-year average rainfall from 2005 to 2015 was presented in Table 16.2-18 and Fig. 16.2-7). It was observed that rainfall starts in April with 53 mm) and higher in May with 144 mm and 12.5 rainy days. The rainfall drops in June and July, and the highest rains come in August, September and October with 264 mm, 194 mm, and 155 mm, respectively. After that it decreased abruptly in November (38 mm). As the study area lies within Dry Zone of Central Myanmar, its average annual rainfall was found to be 994 mm during this period. The natural disaster such as flood and drought often damaged the crop production of the study area.

Table 16.2-18 Annual Rainfall (mm) and Rainy Day of Loikaw Township

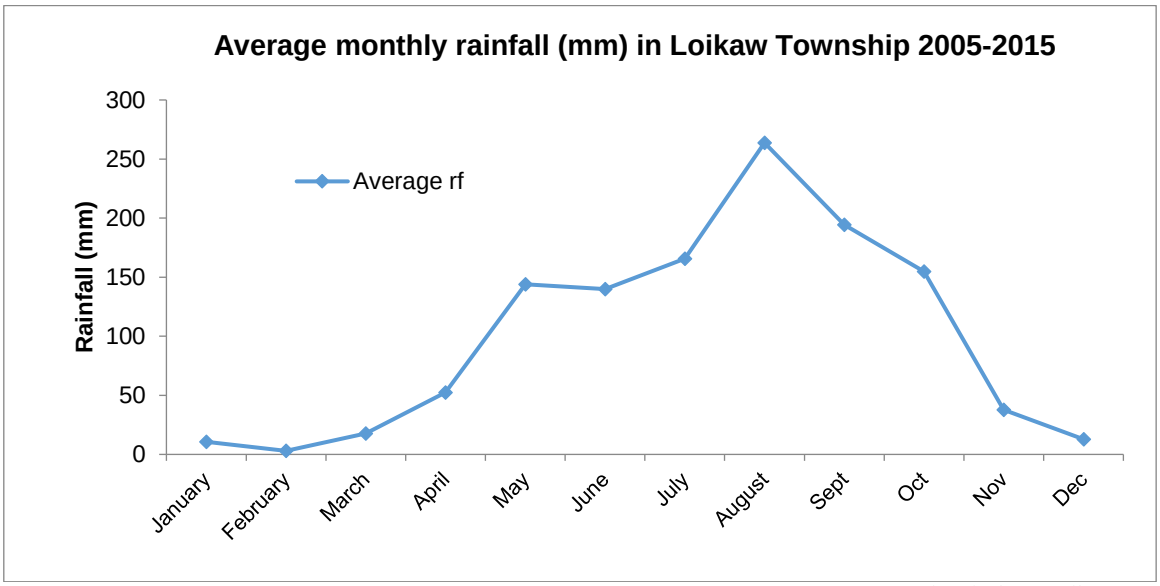
Year	Monthly Rainfall (mm)													Rainfall Day
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	Annual
2005	0	0	20	40	130	148	148	198	231	224	80	44	1262	116
2006	0	0	10	95	59	158	208	327	195	58	13	0	1122	99
2007	0	2	2	13	159	211	96	299	154	126	66	0	1132	105
2008	15	0	0	40	291	121	146	230	242	220	49	0	1355	108
2009	0	0	5	42	113	89	135	206	194	131	10	0	925	92
2010	7.1	0	0	3	82	109	209	359	153	168	22	6	1118	96
2011	18	1	77	130	370	246	150	405	197	200	31	11	1837	125
2012	11.2	0	3	51	164	79	172	235	185	135	20	29	1084	105
2013	13	0	13	62	70	124	149	264	366	226	52	38	1376	105
2014	0	0	0	15	69	10	210	191	82	84	39	0	851	81
2015	54.1	1	66	86	76	95	200	186	141	132	33	13	1106	92
Average	11	0.4	18	53	144	140	166	264	194	155	38	13	1197	102.2

Source: Department of Agriculture, Loikaw Township



Source: Department of Agriculture, Loikaw Township

Fig. 16.2-6 Annual Rainfall and Rainy Days in Loikaw Township during 2005 -2015



Source: Department of Agriculture, Loikaw Township

Fig. 16.2-7 Average Annual Rainfall in Loikaw Township during 2005 -2015

(3) Environmentally Sensitive Areas

1) Conservation of Ecosystems and Biodiversity

Myanmar has taken significant measures to conserve land and biodiversity by enacting an impressive array of laws and regulations. It has joined in international efforts, notably in combating the illegal trade of biodiversity, through Convention on International Trade in Endangered Species of wild flora and fauna and related agreements. Some of the notable measures include establishing an impressive network of protected areas and parks. By 2007, a total of 33 national parks and wildlife sanctuaries had been created. Six additional protected areas have been proposed since 1999. The protected area increased from around 1% of the

country in 2004 to over 5% by 2006.

NBSAP (National Biodiversity Strategy and Action Plan), Myanmar was published in 2011 by the MOECAF (At present MONREC)) and United Nations Environmental Programme with Global Environmental Fund. NBSAP needs to develop to integrate conservation and sustainable use of biodiversity. It includes the five strategic directions and related investment priorities as follows:

(a) Strengthen conservation of Priority Sites
(b) Mainstream biodiversity into other policy sectors
(c) Implement focused conservation actions for Priority Species
(d) Support LNGOs and academic institutions to engage in biodiversity conservation
(e) Create capacity to coordinate conservation investment in Myanmar

It should be noted that there are weaknesses associated with all measures being taken. Notably, they all require more national support and funding. In particular, prevailing weaknesses in governance makes it extremely challenging to achieve the natural resources goals. What Myanmar needs is the sufficient funding and commitment to implementing the NBSAP.

There are no rare or endangered species of plant or animal recorded from the site. The environmentally sensitive areas (Protected Areas) do not exist in and surrounding area of the HPP site.

There are several “Reserved Forest”, such as Ma Htaw Ku, Nat Pan Mon Reserved Forests in Loikaw Township. Forest Department has been striving for the establishment of Protected Public Forest from the unclassed forests, with the land use right of Taung-ya cultivation and fuel wood collection to the community. As a “Green Environment Campaign (Year 2016)” Kayah Regional Forest Department cultivated 2600 teak tress near the Loikaw airport at the entrance of the Loikaw Town. Forest Department also takes care of the tree plantation previously cultivated along the Loikaw - Pinlong highway for the reforestation of the surroundings areas.

Among the five villages of study sites, Mite Kan village established a “Community Forest” of 210 acres from their traditionally conserved forests in 2015. The objectives are conservation of forests and spring sources, sustainable use of forest products and to improve the socio-economy of the local community. Most tree species in the Community Forest are Inn, In-gyin, Thit-yar, Htauk-kyant trees (in Myanmar language).

2) Natural disasters and hazards

There are no natural disaster such as land slide, earthquake, etc. recorded near the HPP and in Loikaw Township. Foods and inundation sometimes happen in monsoon season, but the impact was not significant. The Station was situated at the higher ground level comparing with the surrounding.

For the rural farming in the Township, because of drought, crops were often damaged. In 2015, the arrival of monsoon was late and no sufficient rains caused the maize crops reduce production. In addition, the incidence of rats and other diseases in pigeon pea cultivation, which may be related with the climate change. The adaptation technologies, support and rehabilitation programs should be considered for these small holder farmers who are the most vulnerable to the natural disasters.

Concerning with situation of reservoir side, the watershed areas are degrading due to the extensive deforestation and mining for gold. It is of much concerns for siltation of the

reservoir with a higher rate than the normal condition.

(4) Landscape and visual amenity

The Karenni (Kayah) State is located in the eastern part of Myanmar. The relief of the State is mountainous with the Dawna Range and the Karen Hills also known as "Karenni-Karen" mountains separated by the Thanlwin River as it flows through Karenni (Kayah) State. Baluchaung River, called Nam Pilu in local language, flows from Inle Lake and converges with the Thanlwin in southern part of the State. Around the project site, the landscape of typical rural area and agricultural fields spreads over the project area with topographically flat and hilly conditions.

At present the natural vegetation is seen as replaced by agricultural lands around Loikaw Township. The main contributors for the depletion of natural forests are – extensive timber extraction, fuel wood collection and the encroachment of agriculture lands. The traditional '*Taung-ya*' shifting cultivation (rotational cropping system) is still ongoing by the ethnic minorities on the upland areas. Burning of land clearing for *taung-ya* and upland crop residues of maize and pigeon pea fields is commonly seen in the summer season. The valuable landscape manifests the economy and livelihoods of ethnic upland farmers in these areas.

1) Landscape in April, 2016 (Western side of Loikaw – Lawpita Road)

2) Mite Kan village with vast upland fields in April 2016 of land preparation time (Eastern side of Loikaw – Lawpita Road)

3) Landscape in Sept. 2016 in Loikaw Township. Corn plantation in commercial scale

4) Green Environment Campaign 2016 in Loikaw Township by Kayah Regional Forest Department

Source: JICA Survey Team

Photo 16.2-1 Typical Landscape of Farmland and Hilly Area in the Project Area

16.2.3 Environmental Pollution

(1) Air Pollution

Project site is located in rural area and there are hardly found residential houses, public facilities such as schools and religious facilities such as pagodas in the vicinity. In addition, no major air pollution sources are distributed. Soot and dust emission from open burning the dead grass in a field and exhaust emission from road traffic vehicles such as trucks and motorbikes are found in some areas with some occasions. However, they are in limited scale and temporary.

(2) Water Pollution

Level of pollution of turbid matter and organic matter is very low in these water bodies.

(3) Noise and Vibration

Project site is located in rural area and there are hardly found residential houses, public facilities such as schools and religious facilities such as pagodas in the vicinity. In addition, no major noise and vibration generation sources are distributed except hydropower station. However, impacts due to generation of noise and vibration is limited within existing site. Noise from road traffic vehicles such as trucks and motorbikes are found in some areas with some occasions. However, they are in limited scale and temporary.

(4) Soil Contamination

There is no data about soil contamination and toxic materials in soil.

(5) Solid Wastes Problem

Waste management in Myanmar falls under responsibility of the CDCs (City Development Committees) in Yangon, Mandalay, Naypyidaw and the Township Development Committees in the townships under the Department of General Affairs. Solid waste collection in Myanmar is labor intensive and relies on manual collection with non-specialized vehicles, ranging from pushcarts to garbage trucks. In Loikaw Township similar situation is found in Loikaw Township.

There are sectoral laws and regulations related to management of toxic chemicals and legislation such as the Factories Act (1951) and Public Health Law (1972) which are related to management of hazardous waste. However, as for hazardous wastes national legislation on the management of hazardous wastes - including other categories of hazardous wastes, such as pesticides, certain industrial wastes, etc., is not clearly developed. There is no specific government institution assigned with the task of overall management of toxic chemicals and hazardous wastes.

(6) Subsidence

There is no data about subsidence due to a large scale pumping up of groundwater, situation of foundation and pumping up of groundwater.

16.3 Existing Environmental Conditions of Project Area - 2 Sedawgyi Hydropower Plant

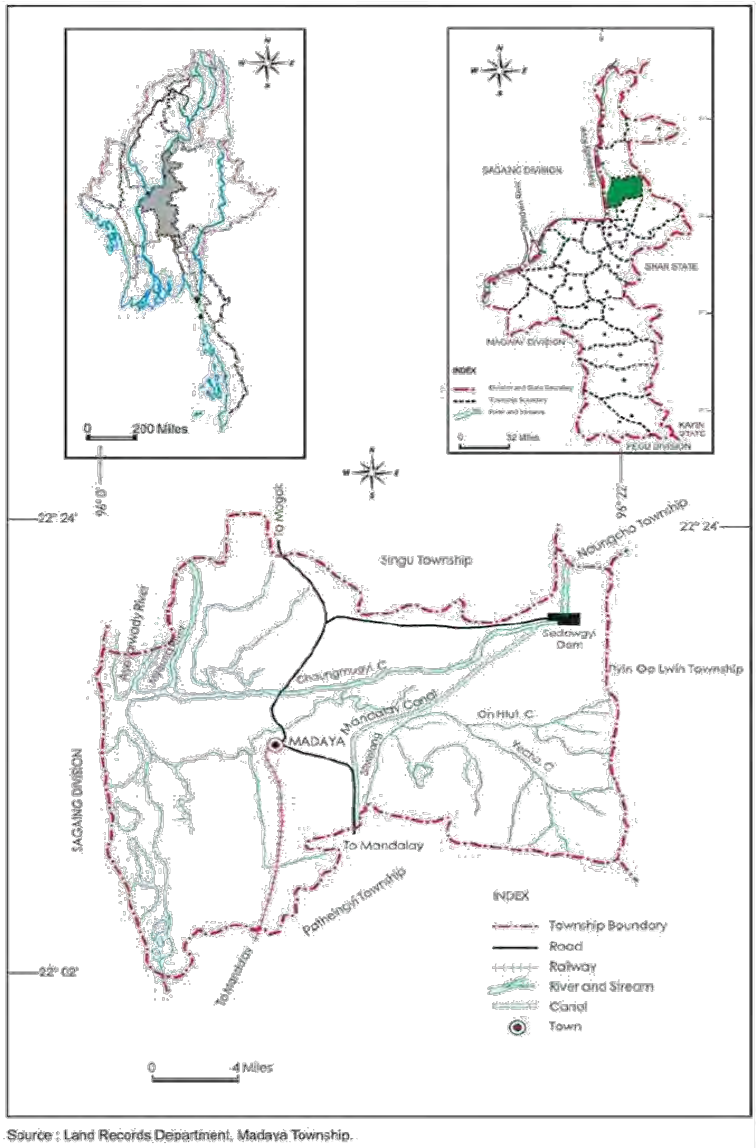
16.3.1 Social Environment

(1) Administrative division

Sedawgyi HPP is located in Madaya Township, which is one of the 31 townships of Mandalay Region. It is located between 20°2' N and 20° 24' N latitudes and 96° 0' E and 96°22' E longitudes. It covers an area of 454.97 square miles (291,187 acres). Madaya Township lies in Sedawgyi Area, which is locally known as the areas irrigated by Sedawgyi Dam. The irrigated areas are located at the northern part of Mandalay Region, comprising four Townships, namely Madaya, Mandalay, Patheingyi, and Amarapura. Although Sedawgyi area is located in dry zone in Myanmar, it is an agriculturally well-developed area due to the irrigational development, plain topography, more fertile soils. The plain lies between the Shan Highland in the east and the Ayeyarwady River in the west with an altitude of about 76.2 meters above sea level.

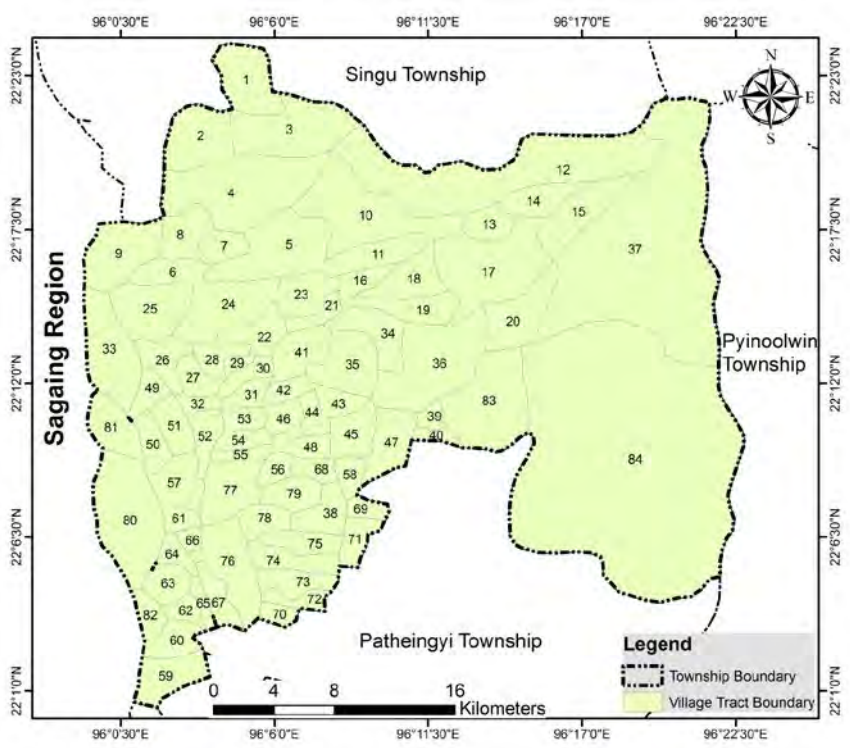
The shape of the township is like a rectangle. The study area is bounded on the north by Singu Township, on the east by Pyin Oo Lwin Township, on the northeast by Naungcho Township, on the south by Patheingyi Township which serve as administrative land boundaries and on the west by Ayeyarwady River which serves as a natural water boundary between Mandalay and Sagaing Region. The total length of land boundary is about 66 miles and water boundary is about 18 miles (Fig.16.3-1).

Fig. 16.3-1 shows the location of Madaya Township and its Village Tracts. Name of those Village Tracts and their location numbers were described in Table 16.3-1.



Source: Land Record Department, Madaya Township

Fig. 16.3-1 Location Map of Madaya Township



Source: MIMU, 2016: Village Tracts and location

Fig. 16.3-2 Location of Madaya Township and its village tracts

Table 16.3-1 Name of the Village Tracts

No.	Village Tract Name	No.	Village Tract Name	No.	Village Tract Name	No.	Village Tract Name
1	Pin Lel Inn	22	Pan Ya	43	Tha Min Twin	64	Kone Tan
2	Kauk Yoe Pon	23	Kyauk Sa Yit Kone (South)	44	War Yin Doke	65	Chaung Pauk
3	Nyaung Oke	24	Wun Su	45	Si Taing Kan	66	Kywe Chan Kone
4	Mway Pon Kan	25	U Dein	46	Kan Ta Bet	67	Su Kar
5	Kyauk Sa Yit Kan (North)	26	Po Wa	47	Wa Thon Da Ra	68	Kan Peit
6	Mway Hin Thar	27	Taw Pu	48	Wet Khe	69	Lin Mway Chaung
7	Sa Kyin	28	Thu Ye Zet	49	Shin Hla	70	Ka Paing
8	Mway Shwe Khe	29	Ha Lin	50	Shwe Boe Gyi	71	Htee Taw Moe
9	Myay Sun	30	Tha Yet Taw	51	Hin Thar Kone	72	Tha Yet Kan (South)
10	Yae Nant Thar	31	Thea Kaw	52	Auk Taung Kaing	73	Tha Yet Kan (North)
11	Tha Pyay Thar	32	Wai Hin Ga Ma	53	Shan Taw	74	Taung Pyone
12	Sa Lay	33	Thea Kyun	54	Set Hteik	75	Tha Lun Hpyu
13	Myit Kan	34	Yway Su	55	Myit Kauk	76	Nyaung Kone
14	Gway Pin	35	Let Kaung Gyi	56	Te Kone	77	Shwe Chaung
15	Sa Kar Pin	36	La Maing	57	Nge Toe	78	Lun Taung
16	Zee Hpyu Kone	37	Kyar Pin	58	Ya Ta Nar Bon Mi	79	Kyone
17	Ah Htet Taung Kaing	38	Thein Kone	59	Pauk Wea	80	Aint Daing
18	Kyaung Kone	39	Kyar	60	Nan Taw Kyun	81	Pyin Kar
19	Seik Thar	40	Htan Pin Kone	61	Shwe Baung	82	Sin Kyun
20	Tha Hpan Kaing	41	Urban	62	Hlaing Kyun	83	Taung Kan
21	Kwayt Taw	42	Bay Meit	63	Thone Se Pay	84	Yae Kyi

Source: General Administrative Department, Madaya Township 2015

(2) Demographic Conditions

There are five quarters (urban) and 83 Village Tracts and 285 villages in Madaya Township. Through household level survey and secondary data collected, the existing social conditions, such as population, number of households, ethnicity were recorded. The population of Madaya Township is not evenly distributed. The "Eastern Hilly" region of Madaya Township has a rugged terrain and the result is sparse population. In the central area, where the land is flat and agriculture is very productive, there is dense population. In the western lowland area, there is a moderately dense settlement. The western edge of the Township is always flooded annually, and at the flooded tine many people move to other areas.

The demographic situations of population by races in Madaya Township in 2015 were shown in Table 16.3-2. Township total population is 234,529, of which majority of residing people are Bamar with 99.9%. The foreigners are 253 and Shan are recorded as 53 persons. The total household numbers living in urban and rural are shown in Table 16.3-3. The total household is 51,015 of which most people are living in rural area with 91.1% while only 8.9% are in Madaya Town. The male and female population are not much different with (47.8%) and (52.2%), respectively.

Population by religion was observed that the Buddhist are the highest number followed by some Christians and Muslims (Table 16.3-4).

Table 16.3-2 Composition of National Races in Madaya Township

No.	Race	Population	Township total population	Percent of township total
1	Kachin	5	234,782	0.0021
2	Kayah	1		0.0004
3	Kayin	17		0.0072
4	Chin	13		0.005
5	Mon	-		
6	Bamar	234,305		99.882
7	Rakhine	2		0.0008
8	Shan	53		0.022
9	Pao			
10	Danu			
11	Others	386		0.1644
	Township total	234,529		
	Foreigner (Chinese, Indian, Pakistani, Bangladesh)	253		0.11

Source: General Administrative Department, Madaya Township 2015

Table 16.3-3 Household and Population in Madaya Township

Sr	Particular	House-hold	Quarter/ V- Tract	Population under 18			Population above 18			Total population		
				Male	Female	Total	Male	Female	Total	Male	Female	Total
1	Urban	4,541 (8.9%)	5	7,461	8,845	16,306	2,582	2,530	5,112	10,043	11,375	21,418
2	Rural	46,484 (91.1%)	Vt- 83 Vl-285	65,065	73,212	138,277	37,164	37,923	75,087	102,229	111,135	213,346
3	Total	51,015		72,526	82,057	154,538	39,746	40,435	80,199	112,272 (47.8%)	122,510 (52.2%)	234,782

Source: General Administrative Department, Madaya Township 2015

Table 16.3-4 Population by Religion

Total population	Buddhist	Christian	Hindu	Islam	Others
238,118	234,312	143	19	308	-

Source: General Administrative Department, Madaya Township 2015

(3) Local Economy

Since Madaya Town is 32 km away from Mandalay city, the urbanization has already developed. Regarding with rural livelihoods, several business and cottage industries exist in Madaya Town, as well as in large villages, like Yae Nant Thar village. The rural people are also working as government staff in Madaya or Mandalay. (Table 16.3-5). Several villages lie beside the Mandalay – Mogoke highway and easy access of transportation. Being with the large crop production, and its nearness to Mandalay, the second largest city of the country, and good market access, the socio-economy is well improved.

Total number of working people in various kinds of works are recorded as 196,611 persons. Among them 57.4% are working in agriculture, followed by casual labors of 16.3%. People working in services are 9%, and livestock breeding people are 7% of the total work force.

Table 16.3-5 Population by Livelihood in Madaya Township

No.	Particular	Number	% of the total work force
1	Government staff	2,672	1.4
2	Services	18,090	9.2
3	Agriculture	112,874	57.4
4	Livestock	13,820	7
5	Trading	6,950	3.5
6	Small industry	5,680	2.9
7	Fishery	1,002	0.5
8	Casual labor	31,989	16.3
9	Others	3,462	1.8
10	Total	196,539	

Source: General Administrative Department, Madaya Township 2015

(4) Land Use

Table 16.3-6 shows the type of land utilization in Madaya Township. Among the total land area of 291,187, the cultivable lands were 134,823 acre (46.3%) and reserved and non-reserved forest are 38,812 acre (13.3%). Under the cultivate areas, *Le* (flooded rice system, mainly for rice), and *Ya* (mainly rain-fed and for upland crops) were 53,421 acre and 32,916 acre, respectively. Alluvial soils are formed the bank of Ayeyarwady and Chaungmagyi River, totaling 45,283 ac. Reserved/Non-Reserved land are recorded as 38,812 acre out of the total land area of Madaya Township (291,187 acre).

Of the cultivable lands *Le* lands areas are the largest number with 39.6%, followed by alluvial lands with 33.6%. Alluvial soil types are suitable for rice, pulses and oil seed crops. The *Le* lands are designated for paddy cultivation, possible for double cropping of paddy with canal irrigation. Because of the large areas of these productive lands, Madaya Township is famous for its large

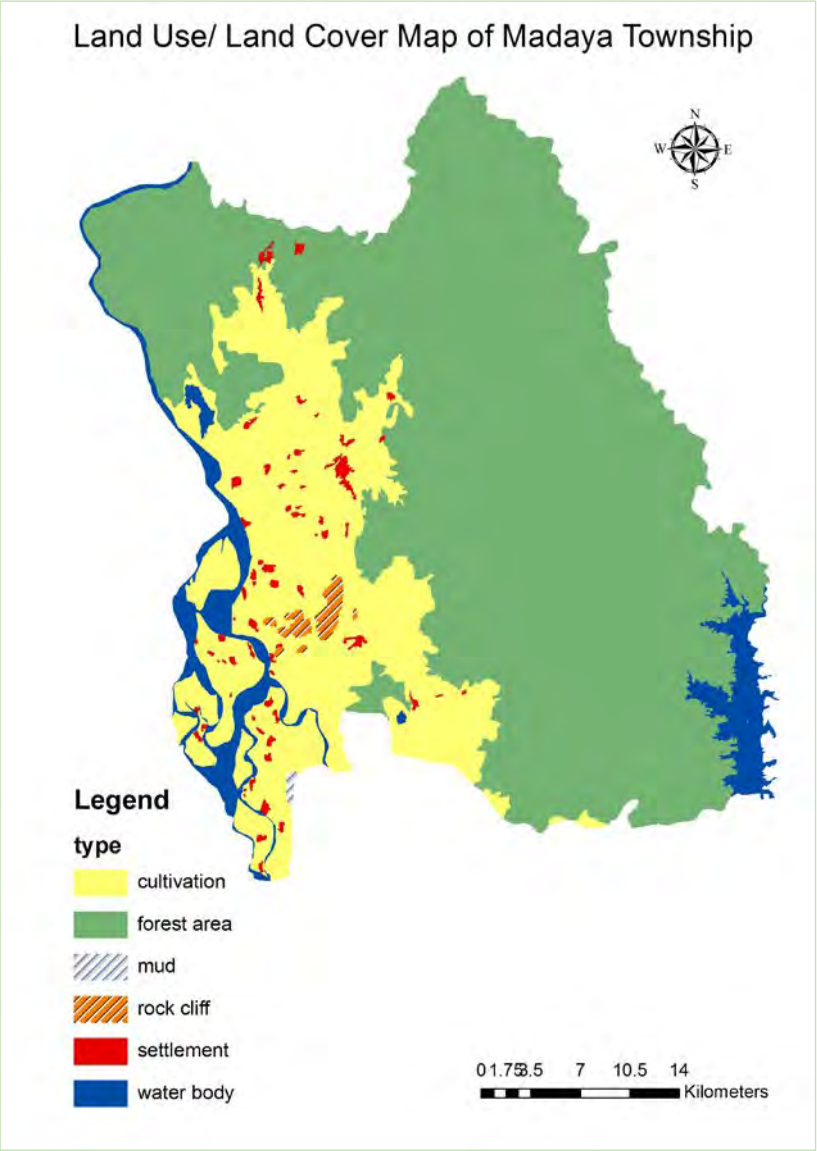
production of various crops. After paddy, various pulses are widely grown and among them black gram, green gram and pigeon pea are the huge products of Madaya Township. Oil seeds crops of sesame, peanut and sunflower are also grown as double crop after rice or single crop in *Ya* land in post- monsoon season. Where the irrigation access is favorable, many farmers are practicing triple cropping system: Monsoon Rice – pulses – Summer Rice.

Land use / land cover map was shown in Fig. 16.3-3. According to the Sedawgyi Township Land Use Map ArcGIS 10.1 version, (1: 50,000), UTM maps of 2003, 2006 and 2007, the areas of total township area, cultivation area and settlement area were calculated as shown in Table 16.3-7.

Table 16.3-6 Land Use in Madaya Township

Sr.	Particular	Area (acre)	
1	Cultivated land	134,823	46.3%
	Le	53,421	(39.6%)
	Ya	32916	(24.4%)
	Alluvial	45,283	(33.6%)
	Orchard	3,203	(2.4%)
2	Uncultivable Land	102,519	35.2%
3	Fallow Land	12	0.004%
4	Virgin Land	15,021	5.2%
5	Reserved/Non-Reserved land	38,812	13.3%
	Total		**291,187**

Note: *Le* (flooded rice system, mainly for rice), and *Ya* (rain-fed and for upland crops)
Source: General Administrative Department, Madaya Township 2015



Source: Department of Agriculture, Madaya Township

Fig. 16.3-3 Land Use / Land Cover Map of Madaya Township

Table 16.3-7 Land Use/ Cover in Madaya Township

Land Cover Area	Area (km^2)	(%)
Township Area:	1530	100
Cultivation Area:	377.4	24.7
Forest Area:	1032.4	67.5
Settlement Area:	14.8	0.97
Others	105.4	6.9

Source: JICA Survey Team

(5) Utilization of Local Resources

Some villages are interested in growing trees and forest conservation. For example, Gwe Pin village has their own conserved forest of about 200 acre. Most villagers are actively participated in the village -tree growing programs supported by the forest Department.

In several villages, most houses have Tha-na-kha trees (Chinese box trees: *Limonia acidssima;* Family: Rutaceae) as a fencing or in their homestead. They can be sold with a good price and many villages keep the tradition of growing these plants for extra income

In the township wise, for the timber production, teak, hardwoods and other woods are produced annually. The timber extraction in 2015 by the private companies were recorded.

The most NTFPs are fuel wood, bamboos, bat guano, and barks. The main product needed for the rural livelihoods is fuel woods. The electricity access does not cover considerably even in Madaya Town, not only in the rural villages. The household cooking is entirely by fuelwoods and charcoal for the well - off families.

The NTFPs production from Madaya Township in 2015-2016 were recorded in Table 16.3-8. Bat guano are widely used as natural fertilizers for agriculture. The number of cattle, cow and goats are also listed in Table 16.3-9. Rural households are familiar with breeding cattle or small livestock. For extra earning, most household are rearing livestock in a small scale level.

Table 16.3-8 Timber Production Status in 2015

No.	Particular	Production (ton)	
		Government	Private
1	Teak	-	13.898
2	Teak plank	-	0.098
3	Hard wood	-	5.888
4	Hard wood plank	-	2.539
5	Other	-	20.495
6	Other plank	-	7.353
	Total		50.272

Source: Department of Forest, Madaya Township, 2015

Table 16.3-9 NTFPs of Madaya Township in 2015-2016

Sr	Particular	Unit	Production
1	Fuel wood	Cubic Feet	1,700.4
2	Charcoal	Cubic Feet	6.72
3	Bamboo	Number	1,155
4	Barks	Viss*	1,450
5	Thatch/ Roofing materials	Number	50
6	Bat Guano	Viss	29,000

Note: *Viss -Myanmar weighing scale. 1kg = 0.6 Viss.

Source: Department of Forest, Madaya Township, 2015

Table 16.3-10 Number of Livestock in Madaya Township in 2015

No.	Year	Buffalo	Cow	Pig	Goat	Chicken	Duck	Other poultry
1	2012-13	2,070	71,800	11,006	2,660	552,060	33,725	-
2	2013-14	2,182	77,612	28,812	2,888	435,295	49,502	-
3	2014-15	1,230	63,318	10,170	3,747	530,676	6,414	37,000

Source: Department of Agriculture, Madaya Township, 2015

The status of fish breeding was recorded in Table 16.3-11. There are two types; fish breeding with the ponds and fish catching from the natural ponds. The pond numbers were 2,640 in the Township, and the license business were 51.

Table 16.3-11 Fish Breeding Status in Madaya Township in 2015

No.	Year	Fish breeding			Fish catching from natural ponds		
		No. of pond	Area (acre)	Production Viss (,000)	No. of license	No. of business)	Production Viss (,000)
1	2013-14	2604	4,678.5	14,483	51	51	9,246.8
2	2014-15	2640	4,838.7	14,483	51	51	9,246.8

Source: Department of Agriculture, Madaya Township, 2015

(6) Social infrastructures

1) Electricity Supply

No transformer was installed for the village electricity. Electricity is available from private engine at night for 3-4 hours. The community cannot afford a transformer, but they will do so in near future. In case that the village is a bit far from the power house/ grid line, the price of the cables is not affordable at this moment

2) Water Use

The villages in Madaya Township generally have good access of irrigation water. The majority of rice fields are irrigated. Some areas can grow summer rice where the irrigation is possible. Due to the location and higher ground level of their lands, some farmers have difficulties for irrigation. The irrigation sources are Yaenantthar main canal and its distributaries.

The majority of households use canal water for drinking. Many villages have easy access of underground water extraction with shallow tube wells. However, villagers prefer the canal water for drinking water to the groundwater. Tube well water is for household use. They said the quality of canal water is more tasty and purer for drinking.

3) Water Sanitation

In Myanmar existing sewerage system covers only a small part of the big city such as Yangon and Mandalay City. People living Madaya Township the sewerage service area employ on-site disposal systems such as septic tank and pit latrine.

(7) Social services

The social services such as educational, health, public facilities and religious facilities were recorded in Table 16.3-12 and Table 16.3-13.

Table 16.3-12 Education Infrastructure

No.	Particular	Quantity	Area (acre)	No. of teacher	No. of student
1	High schools	6	60.79	259	7,524
2	Middle schools	11	47.8	277	7,687
3	Primary schools	173		1,052	25,576
4	Pre school	11		11	170
5	Monastic school (primary)	11		47	1,441

Source: General Administrative Department, Madaya Township 2015

Table 16.3-13 Health Facilities

Sr	Particular	Quantity	Remarks
1	Leprosy Hospital	1	200 bed
2	Township General hospital	1	25 bed
3	Station hospital	3	16 bed each
4	Rural health center	6	-
5	Sub center	41	-
6	Medical doctor	4 + 14	-
7	Nurse	7	-
8	Health assistance	7	-

Source: General Administrative Department, Madaya Township 2015

(8) Vulnerable Groups -the poor, refugees, indigenous of ethnic people etc.

The vulnerable group such as refugee, indigenous and ethnic people were not observed in this Township. In remote villages more or less poor people are residing. Some households are so poor that they cannot afford to get the power distributed by diesel engine power, or a solar lamp. These people are mostly with few acreage of crop lands. Many are relocated from the dam site, or from the old village damaged by river bank erosion.

(9) Situation of Gender and Children

There is no significant abuse of gender and children issues in these areas. There is a general issue in rural areas – several drunkard men in the late afternoon. A few complaints by housewives, that their spouses often bully them when they are drunk. Fighting in the family sometimes occur.

In some villages cases new activities to improve gender situation were observed. In Gwe Pin village, a traditional loom weaving industry started 3-5 years ago by a young woman. She learned the skills from the other village and introduced the business to her own village; these days about 20 young women are earning a good income, and their gender roles are improved. At present 40 households are doing weaving business as a good income source.

(10) Situation of Conflict or Split of the Communities relevant to the Project Area

At present, there is no information of conflict or split of the communities relevant to the project area.

(11) Activities of CBO and NGOs

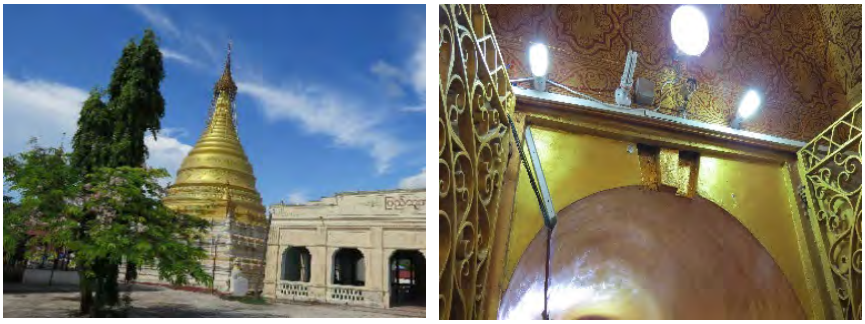
Significant activities of CBO and NGOs have not been recorded in recent years. There are no LNGOs, INGOs and CBOs stationed at Madaya Township.

(12) Cultural, Historical Heritage and Religious Sites

In Madaya Township, most residents are Buddhists, and thus a large number of pagodas and monasteries exist (Table 16.3-14). In Madaya Township, the total monks are recorded as 1,528 while the numbers of novice and nun are 766 and 118, respectively. One church and one mosque also exist in the town.

Besides the pagodas and monasteries, there are two significant cultural, historical and religious sites in the Township. One of the famous pagodas is Yet-kan-sin-taung Pagoda situated in Pat Le Inn village in Madaya Township. The next famous pagoda is Ku-tho-daw Pagoda located in Taung Byone village, built by King Anawrehta (11th century) as shown in Photo 16.3-1. Every year in August in vivid 7-day festival is held to celebrate and worship spirits. The festival is called "Taungbyone Pwe"and it is famous nationwide.

Ku-tho-daw Pagoda, inside which two bricks missing in the ceiling while construction



Source: JICA Survey Team

Photo 16.3-1 Ku-tho-daw Pagoda

Table 16.3-14 Features of Religious Facilities

No.	Particular	Number
1	Pagoda	1,570
2	Monastery	412
3	Dha-ma-yone (Religious meeting hall/ building)	140
4	Nun monastery	11
5	Church	1
6	Mosque	1

Source: General Administrative Department, Madaya Township 2015

(13) Fishing Rights, Water Rights and Rights of Common

In Myanmar there are two types of fishing rights; one is "fishing grant", which is given with specified river area and another is "license", which is a permit of fishing. In the project area there is no commercial scale fishing resources, such as lakes and rivers and stream, no fishing grant is established.

The fishing activities, aquatic ecology and some fish species observed in a small scale and mostly applying traditional fishing methods in the ponds and rivers.

(14) Public health and Sanitation

The existing legislation does not adequately address issues of health care management and sanitation. Also, coordination and supervision of medical wastes at all levels in the country is not clearly developed and needs further strengthening while a National Action Plan should be implemented to manage practices at all levels in an integrated health care system.

(15) Infectious diseases such as HIV/AIDS

The common diseases recorded in Madaya Township were shown in Table 16.3-15. Diarrhea is the highest cases followed by Malaria cases. Seventeen cases of HIV/ AIDS cases were recorded.

Table 16.3-15 Common Diseases in Madaya Township

No.	Disease	Cases
1	Malaria	336
2	Diarrhea	891
3	Tuberculosis	32
4	Dysentery	25
5	HIV/AIDS	17

Source: General Administrative Department, Madaya Township 2015

(16) Working environment/conditions, the welfare of worker's safety and health, relevant legislation

Low level of awareness of and poor compliance with code of conduct, universal precaution and technical guidelines for safety measures; insufficient resources for training of health care personnel and education and public awareness in link to healthcare.

(17) Hazard/risk - unstable security condition, existence of land-mine etc.

There is no information of hazard/risk, unstable security condition, existence of land-mine etc. in Madaya Township.

(18) Accidents

No serious accidents were informed in the HPP and its environs.

16.3.2 Natural Environment

(1) Topography

Madaya Township is marked by the mountains and hill ranges, river valley and plain. It is about 76.2 m above sea level most area lies within the flood plain of the Ayeyarwady River and Chaungmagyi River. The Ayeyarwady River flows as a western boundary. Chaungmagyi River passes through the Township, flowing from northeast to west, and then entering into the Ayeyarwady River. The River that originates from the Eastern Highlands passes through the Sedawgyi area. It enters the region at its northeast corner and flows southward and forms as the boundary between the irrigated area and the Shan Highland. It is a perennial stream and

navigable by boats in rainy season.

In 1875, King Mindon built Shwetachaung and Shwelaung canals. Then a weir was built across the Chaungmagyi River with stones with a catchment area of about 3,424.9 km^2. In 1902, for backing of a storage reservoir, to adequately supply in Mandalay canal system, a stone dam was built at the former weir's site. The Sedawgyi Dam was constructed in 1976 and completed in 1987, across the Chaungmagyi River for multi-purposes, irrigation and hydropower. It stands as one of the vital water resources for crop cultivation in Mandalay Region. The Yaenantthar Irrigation Canal with 21 km length was constructed on the right bank of the Chaungmagyi River. During 1985-86 the total irrigated area of the region was 268,471 acres and it was increased to 278,087 acres in 1999-2000.

Generally, the study area is an alluvial plain which is deposited by Ayeyarwady River and Chaungmagyi River. Topographically, it can be divided into the "Western Plain" and the "Eastern Highland". The "Western Plain" has an area of 945 km^2 and occupies 80 % of the total area of the Township. This plain is sub-divided into three parts, namely "Recent Alluvial Plain", "Old Alluvial Plain" and "Foothill Alluvial Plain". The "Eastern Highland" is the western continuation of Shan Plateau and it covers about 233 km^2 between the contour line of 150 m and 600 m. It rises gradually eastward and composed of limestone, forming the watershed for Chaungmagyi and Shwelaung River *(Chaung)*.

Ayeyarwady River flows from north to south about 26 km as the western water boundary of the township. The river forms rich alluvial deposits every year on the eastern bank, and Ayeyarwady alluvial plain is the most important for *'kaing'* cultivation. However, it is not useful for irrigation in the study area. Chaungmagyi River, about 37 km, takes its source from the Shan plateau. The Sedawgyi Dam was built at upper Chaungmagyi near Se Daw Gyi village, which is an important source for the irrigation networks of Madaya Township.

(2) Geology and Soil Condition

Two groups of rock units are found – sedimentary rock units and metamorphic rock units. Alluvium deposits are widely distributed at the western part of the study area and it also covers the areas near Chaungmagyi River and its tributaries.

The main soil types of Madaya Township can be grouped into the followings:

(a) Alluvial Soils
(b) Meadow and Meadow Alluvial Soils
(c) Dark Compact Savanna Soils and Dark Compact Irrigated Savanna Soils
(d) Yellow Brown Savanna Soils
(e) Mountainous Red Brown Forest Soils

Dark Compact Savanna Soils and Dark Compact Irrigated Savanna Soils occupy about 50 % of total township area, mainly in the central part of the township. Due to their high clay content, they have high plasticity and are very sticky and heavy for cultivation whereas they are very hard when dry and are very difficult for cultivation. They are the major soils for paddy, gram, and various kinds of pulses, chili, cotton and sesame. Yellow Brown Savanna Soils occupy the eastern part of Mandalay Canal and the foothill areas of eastern highland area. They cover about 10 % of the total area. These soils are loamy soils which are formed as a result of deposition of sediments of water erosion. Mountainous red brown forest soils are found under the forest areas in the north-eastern most part of the township. They occupy about 25 % of the total area. They are suitable for *"Ya"* crops and garden crops.

(3) Climate Condition

Being located in the Dry Zone of Central Myanmar, Madaya Township receives a hot, dry climate. It was recorded that during the period in 1983-2006, the mean annual temperature of Madaya Township is about 28°C with maximum mean temperature (34°C) and minimum mean temperature (22°C), respectively.

As Myanmar embraces monsoon season, rainy months are from June to October generally. The rainfall is an important factor for the inflow supplied and distributed water from the Sedawgyi dam. Generally, January, February and December are months with fewer rain or sometimes no rains. Since Sedawgyi Dam site is located in Madaya Township and it is very close to the "Eastern Highland", it receives more rains than the other parts of Madaya Township.

The 11-year average rainfall (2005 – 2015) was described in Table 16.3-16 and Source: Department of Agriculture, Madaya Township

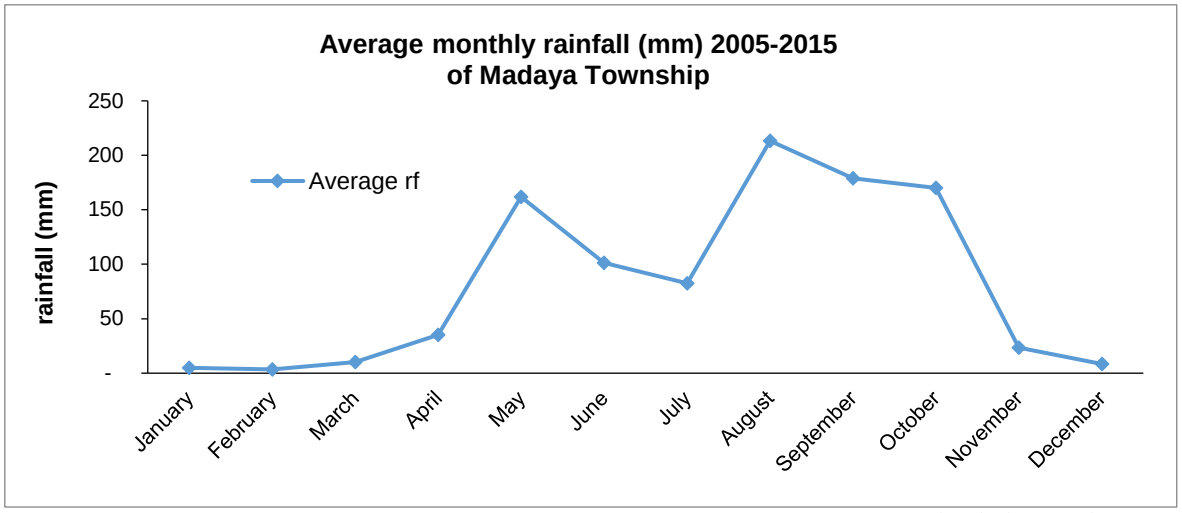
Fig. 16.3-4. It was observed that rainfall starts in April (35 mm) and higher in May (162 mm) which is sufficient for crop cultivation. The rainfall drops in July (83 mm), known as July drought in dry zone in Myanmar and the highest rains come in August, September and October with 213 mm, 179 mm, and 170 mm, respectively. After that it decreased abruptly in November (23 mm). As the study area lies within Dry Zone of Central Myanmar, its average annual rainfall was found to be 994 mm during this period. A comparative study of annual rainfall in Madaya Township from 2005 to 2015 was shown in Table 16.3-16 and Source: Department of Agriculture, Madaya Township

Fig. ***16.3-5***. The highest annual rainfall of 1,690 mm was observed in 2006 while the lowest data of 602 mm in 2012. Concerning with rainy days, the lowest of 39 days and the highest value of 71 days were recorded in 2005 and 2011, respectively.

Table 16.3-16 Annual Rainfall (mm) and Rainy Day in Successive Eleven Years (2005 – 2015) of Madaya Township

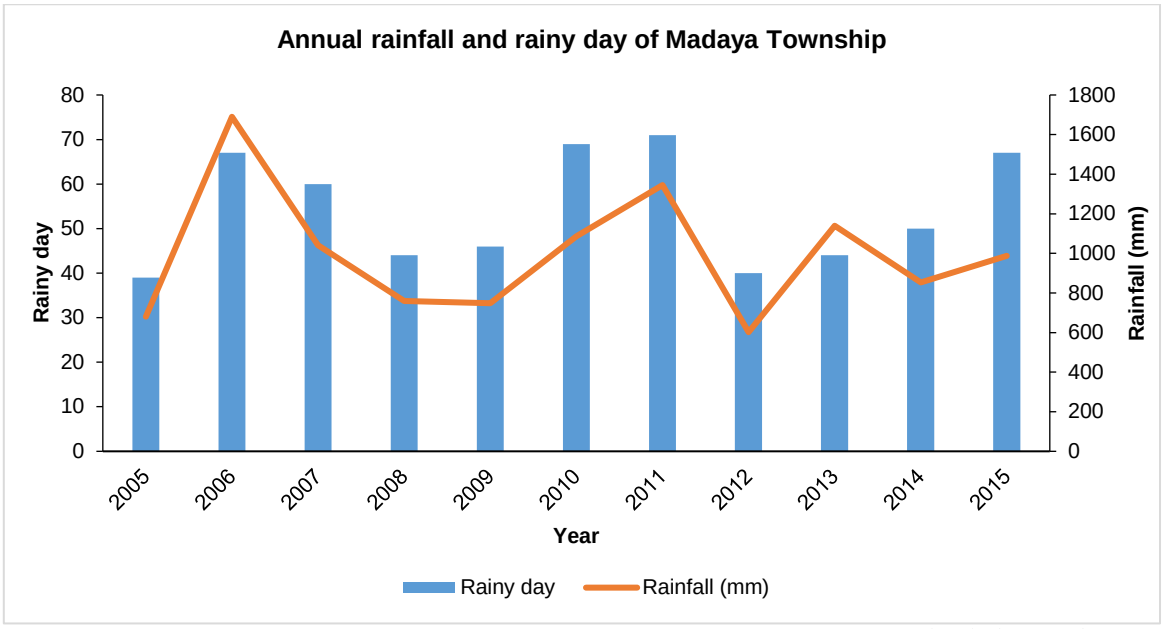
Year	Monthly (mm)												Annual (mm)	Rainy Day/Year
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec		
2005	-	-	22	47	47	16	41	69	271	103	48	29	680	39
2006	-	-	-	117	273	246	144	445	310	98	58	-	1690	67
2007	-	24	-	19	224	197	113	135	95	215	18	-	1040	60
2008	31	-	4	31	102	28	30	95	139	284	15	-	758	44
2009	-	-	-	28	165	113	32	186	159	64	3	-	748	46
2010	-	-	5	7	101	170	102	186	140	334	-	42	1087	69
2011	3	-	60	78	285	33	142	408	82	267	8	15	1345	71
2012	-	-	3	23	70	91	49	86	181	51	49	-	602	40
2013	-	-	-	3	174	166	27	301	194	275	-	-	1140	44
2014	-	14	-	31	121	44	34	220	284	75	31	-	853	50
2015	21	-	18	18	253	11	196	214	117	106	28	6	988	67
Average	5	3	10	35	162	101	83	213	179	170	23	8	994	54.3

Source: Department of Agriculture, Madaya Township



Source: Department of Agriculture, Madaya Township

Fig. 16.3-4 Average Rainfall (Rainfall Pattern) in Eleven Years (2005 - 2015) in Madaya Township



Source: Department of Agriculture, Madaya Township

Fig. 16.3-5 Annual Rainfall and Rainy Days of Eleven Years (2005 -2015) of Madaya Township

(4) Hydrological Situation

The Sedawgyi Dam is located at the Chaungmagyi River in Madaya Township and it stands as the main supply for the irrigation network in the Sedawgyi Region. Its main objective is to supply enough water to boost the agricultural production. The secondary benefits are for the hydropower generation at the dam site and for the increase of water supply to Mandalay. The water resource consists of Sedawgyi Lake and local annual rains which are adding to it. The water is used for irrigation and household use by the people in Sedawgyi Area. The primary irrigation canals are diversion canals taking water from the Chaungmagyi River at the Sedaw weir. Secondary canals are the distributaries connecting the irrigation areas to the MCC (Mandalay Main Canal). MCC is

formed in the north by the Sedaw weir where the Chaungmagyi River is separated into three sections – Chaungmagyi River, Yenatha Canal and MCC. Finally, the Chaungmagyi River flows further west into the Ayeyarwaddy River. The Yenatha Canal, a man-made canal, flows into the northern irrigation network distributaries, ranging from distributaries 1 to distributaries 9. The third is the MCC, which flows southward to Mandalay. MMC is also a man-made canal with a constant cross-section over the whole length. Along the MMC there are many distributaries or secondary canals. The irrigation network is shown in Fig.16.3-6.

Most of the water supply in Mandalay Region is controlled by the Sedawgyi Dam. The dam can regulate the discharges from the Chaungmagyi River as required. Depending on the requirement for irrigation, the amount to water flow for irrigation can be controlled. However, in practical, it is not such an easy work. During the summer time, water needs to accumulate in the dam for hydropower generation, resulting in less water for irrigation. On the other hand, during the rainy season the water level is too high in the lake area, so that the spill gates are opened to release water. This leads to a large flow going downstream of the dam into the irrigation network. Farmers do not require the extra water but they have to drain out of their fields in order to avoid flood.

The annual and daily water balance is regulated by the collaboration of Sedawgi HPP and the Irrigation Department. The inflows of the water balance are inflow by Chaungmagyi River and rainfall at the lake. Regarding with the water inflows, no serious concerns occurs about the water volume of the lake.

Source: Irrigation Department, Kayah State

Fig. 16.3-6 Maps of Sedawgyi Irrigated Areas

(5) Environmentally sensitive areas (Protected Areas, IBAs, valuable habitat, forest reserves etc.)

There is no designated IBAs (Important Bird and Biodiversity Areas) or valuable habitat, other than the reserved and non-reserved forests.

Regarding with terrestrial flora, the dominant plant species in the lowland area are cacti, Da-Hat (*Tectoma hamiltoniana*), toddy palm (*Palmyra*), neem tree (*Azadrirachta indica*), rain tree, acacia, plum, tamarind, Than (*Terminalia oliveria brandis*), Subok (*Acacia pennata*), Zaung-gyan (*Osyis oarborea*), Kin-pun (*Acacia corcina*), Let-pan (*Samalia malaberica*) and thorny shrubs. In the eastern high land area the following plants were common – teak (*Tectona gradle*), Inn (*Dipterocarpus tuberculatus*), In-gyin (*Pentacme oblenngifolia*), Thiya (*Shovea oblengifolia*), Pyin-ka-do (*Xylia dolabrifornus*), *mango* and bamboo species such as Myin-wa (*Dendrocalanus Strictus*) and Tin-wa.

According to 1985-86 and 1999-2000 statistics, forest covers about 17,380 acres (6.47%) and 16,146 acres (5.81%) respectively of the region's total area. Since the Sedawgyi Region is located in the Dry Zone where the rainfall is very less, most trees are very short and thorny and bush type. It is observed that the forest distribution is not even and mostly covered in eastern part of MCC and northern part of Madaya Township. In 1999-2000, the percentage of land under forest is recorded as 9.5% in Madaya Township. Although it lies in the Dry zone and receives low rainfall, the rainfall intensity sometimes is very high. Having less vegetative cover and undulating topography, this region is also facing severe erosion problem. There are three Reserved Forests in Madaya Township, namely, Chaung- tha -baut (7,434 ac.), Chaung -tha -baut (extension) (1,801 ac.) and Taung -khaung (27,499 ac.) forests. Pan –tha- lae and Boe- daw Non-Reserved Forests are designated with 909 ac. and 1,063 acre.

(6) Natural Disaster and Hazard

There has been no serious natural disaster of landslides and earthquake. However, flood problems have risen that there is too much spillage of water during the rainy season, while during the dry season there is a water shortage. The current situation in the Sedawgyi basin is the low efficiency of the water usage in the water resources system. During the rainy season lots of water need to release to avoid spillage. Agricultural areas cannot use these water, thus the water flows towards Mandalay and it causes serious floods. On the other hand, during the drought periods there is not enough water for all the demand. Another issue is the flood risk caused by the Shan Hills to the east of Mandalay. Precipitation in the catchment area flows towards Mandalay city and causes floods eastern parts of Mandalay.

(7) Landscape and Visual Amenity

The landscape in the project area is mainly agriculture fields and there is no other significant valuable landscape.

16.3.3 Environmental Pollution

(1) Air quality

Project site is located in rural area and there are hardly found residential houses, public facilities such as schools and religious facilities such as pagodas in the vicinity. In addition, no major air pollution sources are distributed. Soot and dust emission from open burning the dead grass in a field and exhaust emission from road traffic vehicles such as trucks and motorbikes are found in some areas with some occasions. However, they are in limited scale and temporary.

(2) Water Pollution

The Sedawgyi Multipurpose Dam and Irrigation was considered important and beneficial to the economic and social development of the irrigated Project area, including Madaya Township. Moreover, it contributes to the urgent needs of the country's power system for development.

The key environmental aspects concerned by the community are sedimentation due to land erosion. The encroachment on watershed forests were uncontrollable with the extensive extraction of timber as well gold mines. The water quality has not been tested, even the villagers around the Sedawgyi areas are consuming it. In the uplands areas of the dam, the streams are severely polluted with sediments due to the acute soil erosion. There is no complaints from the community about the quality of drinking water directly from the canals. Some prefer the canal water to the tube well water. They complain that tube well water has a bit saline, their children who take the water have significant yellow color of teeth.

The second concern is their fields' salinization problem, which may become more serious in the long term irrigation system for monsoon and summer double rice program. Water logging is evident due to lack of proper drainage system

(3) Noise and Vibration

Project site is located in rural area and there are hardly found residential houses, public facilities such as schools and religious facilities such as pagodas in the vicinity. In addition, no major noise and vibration generation sources are distributed except hydropower station. However, impacts due to generation of noise and vibration is limited within existing site. Noise from road traffic vehicles such as trucks and motorbikes are found in some areas with some occasions. However, they are in limited scale and temporary.

(4) Soil Contamination

There is no data about soil contamination.

(5) Solid wastes Problem

Waste management in Myanmar falls under responsibility of the CDCs in Yangon, Mandalay, Naypyidaw and the Township Development Committees in the townships under the Department of General Affairs. Solid waste collection in Myanmar is labour intensive and relies on manual collection with non-specialized vehicles, ranging from pushcarts to garbage trucks. Similar situation is found in Madaya Township.

There are sectoral laws and regulations related to management of toxic chemicals and legislation such as the Factories Act (1951) and Public Health Law (1972) which are related to management of hazardous waste. However, as for hazardous wastes national legislation on the management of hazardous wastes - including other categories of hazardous wastes, such as pesticides, certain industrial wastes, etc., is not clearly developed. There is no specific government institution assigned with the task of overall management of toxic chemicals and hazardous wastes.

(6) Subsidence

There is no report for the cases occurring of subsidence due to activities such as a large scale pumping up of groundwater.

16.4 Project Alternatives and Outline of the Project

16.4.1 Alternative Comparison

The analysis of alternatives for priority projects is generally divided into the "Without Project (No action case)"and "With project" cases including other alternatives.

(1) Without project

It was reported that the run-of-river type HPPs especially which started commercial operation from 1970s to 1990s such as Baluchaung No.1 and Sedawgyi HPP are aging and dilapidated without appropriate rehabilitation. Due to deterioration of facilities and failures of equipment, etc. as compared to rated power output of all existing HPPs actual power output decreased by approximately 30% in the wet season and furthermore in the dry season actual one decreased by approximately 50% due to decrease of river flow.

Without project rehabilitation of these HPPs deterioration of facilities and failures of equipment, etc. will proceed rapidly resulting in worsening electric power supply condition. Consequently, economic and social development of Myanmar will be considerably delayed or disrupted

(2) Comparison of Alternatives

1) Alternative Power Supply Schemes

Required conditions of alternative power supply schemes are generation capacity with same amount, compatibility with emergent power supply to ensure continuous power supply, stable power supply, prevention of environmental pollution and global warming, etc. Considering above conditions following alternative power generation schemes are selected as alternatives.

a) Improvement generation performance by rehabilitation of existing HPP (neither expansion nor increase in capacity)
b) Construction or expansion of HPP (Run-of-river type)
c) Construction or expansion of HPP (Impoundment type)
d) Construction or expansion of TPP (thermal power plant)
e) Renewable energy plant (solar power and wind power)
f) Power supply through power network system form other generation sources 、
g) Diesel generator
h) Kerosene lamp for lighting

2) Methodology of Comparison – Evaluation Items

Alternative comparison was carried out by applying following evaluation items including environmental and social aspects.

a) Power generation capacity
b) Emergent power supply
c) Stable power supply
d) Technical feasibility
e) Time for construction
f) Investment cost (construction)
g) Occurrence of land acquisition/resettlement
h) Environmental pollution and nature conservation
i) Global warming

3) Methodology of Comparison –Evaluation Criteria

Power supply scheme was prioritized qualitatively by using following three classes of evaluation criteria.

a) (+++) Higher compatibility - very favorable,
b) (++) Some compatibility - a little favorable,
c) (+) Little compatibility -unfavorable or not compatible.

4) Results of Comparative Evaluation

Results of alternative comparison is shown in Table 16.4-1.

Table 16.4-1 Alternative Comparison of Power Generation Schemes

Power generation scheme	a) Power Generation Capacity	b) Emergent Power Supply	c) Stable Power Supply	d) Technical feasibility	e) Time for construction	f) Investment cost (construction)	g) Land acquisition/ resettlement	h) Environmental pollution and nature conservation	i) Global warming
1) Rehabilitation of existing HPPs	++	+++	+++	+++	++	+++	+++	+++	+++
2) Construction of run-of-river (diversion) HPP	+++	++	++	+++	+	+++	+++	+++	+++
3) Construction of impoundment (dam) HPP	+++	+	+++	+++	+	+	+++	+	++
4) Construction of TPP	+++	++	+++	+++	+	+	+	+	+
5) Renewable energy (Solar power and/or wind power)	+	++	+++	+++	+	++	+++	+++	+++
6) Interchange through power network system	++	++	++	+	+	+++	+++	+++	+++
7) Diesel engine generator	+	+++	+	+++	++	+	+	++	+
8) Kerosene lamp	+	+	+	+++	+++	+++	++	+++	++

Note: Requirement by power supply. (+++) Higher compatibility, (++) Some compatibility, (+) Little compatibility
Source: JICA Survey Team

Among alternative power supply schemes, construction or expansion of HPP (2, 3) and TPP (4) are favorable in terms of generation capacity and stable power supply. However, development of thermal power and HPPs in Myanmar cannot be attained without careful considerations to environmental and social aspects including obtaining the consensus with local people. In addition, it will take a long time from feasibility study to operation.

In addition, a large-scale power supply by gas fired TPP for domestic use is hardly anticipated before new development of natural gas field. There are no other options than to buy back natural gas for export or to import fossil fuel such as diesel oil and LNG, which have higher cost.

Thus, comparing with power supply by rehabilitation of existing plant, the above options are unfavorable in view of compatibility with emergent supply and environmental and social considerations.

Power supply by renewable energy such as solar power and wind power (5) is favorable in terms of prevention of global warming and environmental pollution. However, they are

unfavorable in terms of stable electric power supply, lead time of construction and compatibility to a large-scale demand

Power interchange through network system from other generation sources (6) is often utilized in other countries. However, there is no available capacity in other power generation sources in Myanmar and neighboring countries.

Diesel engine power (7) is effective to in emergent and a small-scale power supply, and kerosene lamp (8) is suitable to lighting for house use in night time. However, they are also unfavorable in terms of stable electric power supply and compatibility to a large-scale demand.

(3) With project

In the speech by the former President U Thein Sein in August 2013 power sector is considered to be the top priority of economic and social development. In the scheme of the National Electricity Master Plan it is suggested that rehabilitation of these HPPs is recommended from a standpoint of preventive measures against failures because deterioration of major equipment and parts of Sedawgyi HPP, Baluchaung No.1 HPP, etc. are progressing, also rehabilitation of existing HPPs is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel and so on.

As shown in Table 16.4-1 rehabilitation of existing HPPs which, can provide stable electric power supply by impoundment will be carried out by only replacement and repair of dilapidated facilities, equipment and devices without civil engineering work such as earthmoving, excavation, cutting and filling. In addition, no land acquisition/resettlement is anticipated in surrounding areas. Therefore, possible negative impacts are temporary and mostly site secific.

Rehabilitation of both HPPs will prevent deterioration and failiures facilities, equipment, and attain functional recovery and stable and efficient power supply, resulting in ensuring rapid growing economic develoment and upgrading living conditions of Myanmar

- Therefore, “With project” case is recommendable from environmental and social consideration viewpoints.

16.4.2 Outline of the Project Plan

(1) Objectives and Scope of the Project

1) Objectives

In the scheme of the National Electricity Master Plan it is suggested that rehabilitation of HPPs is recommended from a standpoint of preventive measures against failures because deterioration of major equipment and parts of existing Baluchaung No.1 and Sedawgyi HPPs are progressing. Rehabilitation of existing HPPs is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel and so on.

As improvement of existing electric power supply conditions is expected in terms of such as increase of power generation efficiency and reduction of blackout occurrence by rehabilitation of both HPPs

2) Scope of the Project Activities

Scope of the Rehabilitation Project is as follows (See Table 16.4-2):

a) Rehabilitation of Baluchaung No.1 HPP

Rehabilitation of existing Baluchaung No.1 HPP through replacement, repair or addition of facilities / equipment / devices without expansion of site / facilities and increase in power generation capacity

b) Rehabilitation of Sedawgyi HPP

Rehabilitation of existing Sedawgyi HPP through replacement, repair or addition of facilities/equipment/devices without expansion of site / facilities and increase in power generation capacity

Table 16.4-2 Necessity of Rehabilitation (Replacement, Repair or Addition) with Major Facilities/Equipment of Existing HPP

Necessity of Rehabilitation with Major Facilities/ Equipment of Existing HPP		Baluchaung No.1 HPP	Sedawgyi HPP
1) Change in Existing Land Use	Rehabilitation work and subsequent operation of the HPP will be done within the existing site. Thus, there will be no changes in the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities such as farming and livestock, and living conditions of residents in surrounding area are required.	**No**	**No**
2) Change in External of Existing Facilities or Civil Structures	No changes in space, capacity and dimension from the existing HPP are not expected for following facilities and structures: (1) No raising / expansion of existing body of dam, (2) No changes in amount of length, and dimension and route of flow channel due to sluicing intake water, (3) No change in dimension of civil facilities such as powerhouse.	**No**	**No**
3) Change in Internal of Existing Facilities, Equipment or Devices	The preliminary inspection and records of the failure of existing Baluchaung No.1 and Sedawgyi HPPs found considerable deterioration of major parts and systems relevant to turbine and auxiliary equipment, generator and auxiliary equipment, control and protection system, substation and transmission facilities, gates and penstock, as well as civil facilities. Therefore, rehabilitation through replacement and/or repair are expected to improve such equipment.	**Yes**	**Yes**
4) Operation of Hydropower Generation	There will be no change in conditions of operation for electric power generation such as power generation capacity, pattern and schedule of operation.	**No**	**No**

Source: JICA Survey Team

3) Period of Rehabilitation Work

About 2 years

4) Expected number of workers engaged to the rehabilitation work

About 50 workers who are mostly employees of EPGE (Electric Power Generation Enterprise) for each site

5) Estimated Project Cost

Estimation of the project cost is not yet completed.

6) The Project Proponent

EPGE, MOEE (Ministry of Electricity and Energy)

7) Location of HPPs

a) Baluchaung No.1 HPP

Baluchaung No.1 HPP is located in the Baluchaung River which is a tributary of the Nam Pawn River of the Thanlwin River system and was commenced in operation in August 1992 by Japan's ODA (Official Development Assistance) as one of cascade-type power generation scheme utilizing precipitous geography. In the same river system Baluchaung No.2 HPP (MOEP, 1960) and Baluchaung No.3 HPP (Future Energy, 2014) are operating, which are important HPP group for Myanmar and which can supply stable power all through the year by regulating river flow by the Mobye Reservoir in the upstream. Features of Baluchaung No.1 HPP are shown in Fig. 16.4-1, Photo 16.4-1 and Table 16.4-3.

The electric power generated by Baluchaung No.1 HPP is transmitted to the substation located in Baluchaung No.2 HPP by 132 kV T/L (transmission line) and to Taungoo S/S (substation) by 230 kV T/L as shown in Fig. 16.4-1. The HPP is located about 20 km far from Loikaw City the capital of Kayah State and it takes about 30 minutes.

Source: JICA Survey Team

Fig. 16.4-1 Location Map of Baluchaung HPPs along Baluchaung River

Source: JICA Survey Team

Photo 16.4-1 Existing Baluchaung No.1 HPP

Table 16.4-3 Major Parameters of Baluchaung No.1 HPP

Item	Baluchaung No.1 HPP
Max. power	28.0MW
Annual generated energy	200GWh (nominal) / 186GWh (2013 actual)
Annual operation hour	8,104 hour (2012 actual)
Commencement of operation	Aug-92
Power generation type	Run-of-river
Region/state	Kayah state
River	Thanlwin River system, Baluchaung River
Catchment area	7,960km^2
Max. power discharge	47.6m^3/s
Dam/weir	Concrete weir 11.0m
Effective head	69.6m
Turbine type	Francis turbine (Hitachi-Mitsubishi), 14.0MW × 2 units

Source: JICA Survey Team

b) Sedawgyi HPP

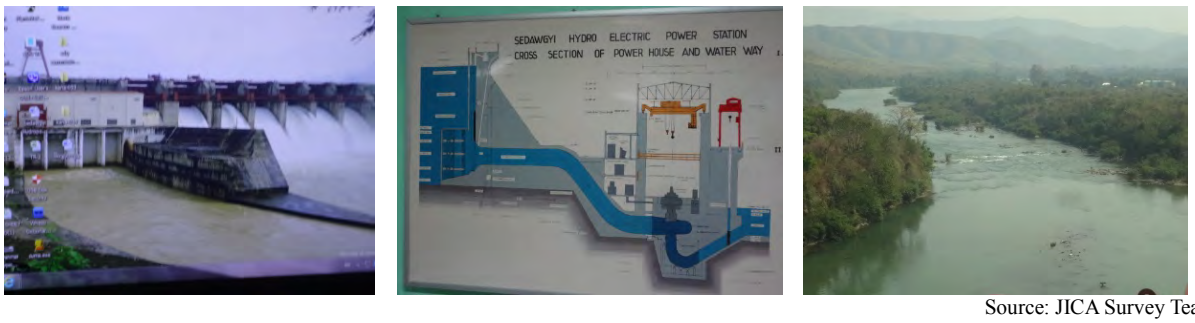
Sedawgyi HPP is located in the Chaunmagyi River of the Ayeyarwady River system, which is a HPP equipped with multi-purpose dam for irrigation and power was constructed by ADB's (Asian Development Bank) finance.

Upper Sedawgyi site in the upstream is selected as candidate development project, but it is under study stage and specific progress is not yet confirmed. MOAI (Ministry of Agriculture and Irrigation) has jurisdiction over the dam body and controls water utilization. MOAI operates the reservoir setting priority to irrigation usage. Features of Sedawgyi HPP are shown in Fig. 16.4-2, Photo 16.4-2 and Table 16.4-4.

The electric power generated by Sedawgyi HPP is transmitted to Belin substation by 132 kV transmission line, which is connected to 230 kV bulk system. The HPP is located about 60 km far from Mandalay. But it takes about three and half hours by car in the rainy season because condition of access road pavement from main road to the HPP is bad at present. This access road is owned and managed by MOAI.

Source: JICA Survey Team

Fig. 16.4-2 Location Map of Sedawgyi HPP along Sedawgyi River



Source: JICA Survey Team

Photo 16.4-2 Existing Sedawgyi HPP

Table 16.4-4 Major Parameters of Sedawgyi HPP

Item	Sedawgyi HPP
Max. power	25.0MW
Annual generated energy	134GWh (nominal) / 99.9GWh (2013 actual)
Annual operation hour	6,919 hour (2012 actual)
Commencement of operation	May-89
Power generation type	Multi-purpose (irrigation)
Region/state	Mandalay region
River	Ayeyarwady River system, Sedawgyi river
Catchment area	3,384km^2
Max. power discharge	51.7m3/s ´
Dam/weir	Rock-fill dam 40.6m high
Effective head	28.2m
Turbine type	Kaplan turbine (Toshiba), 12.5MW ´ 2 units

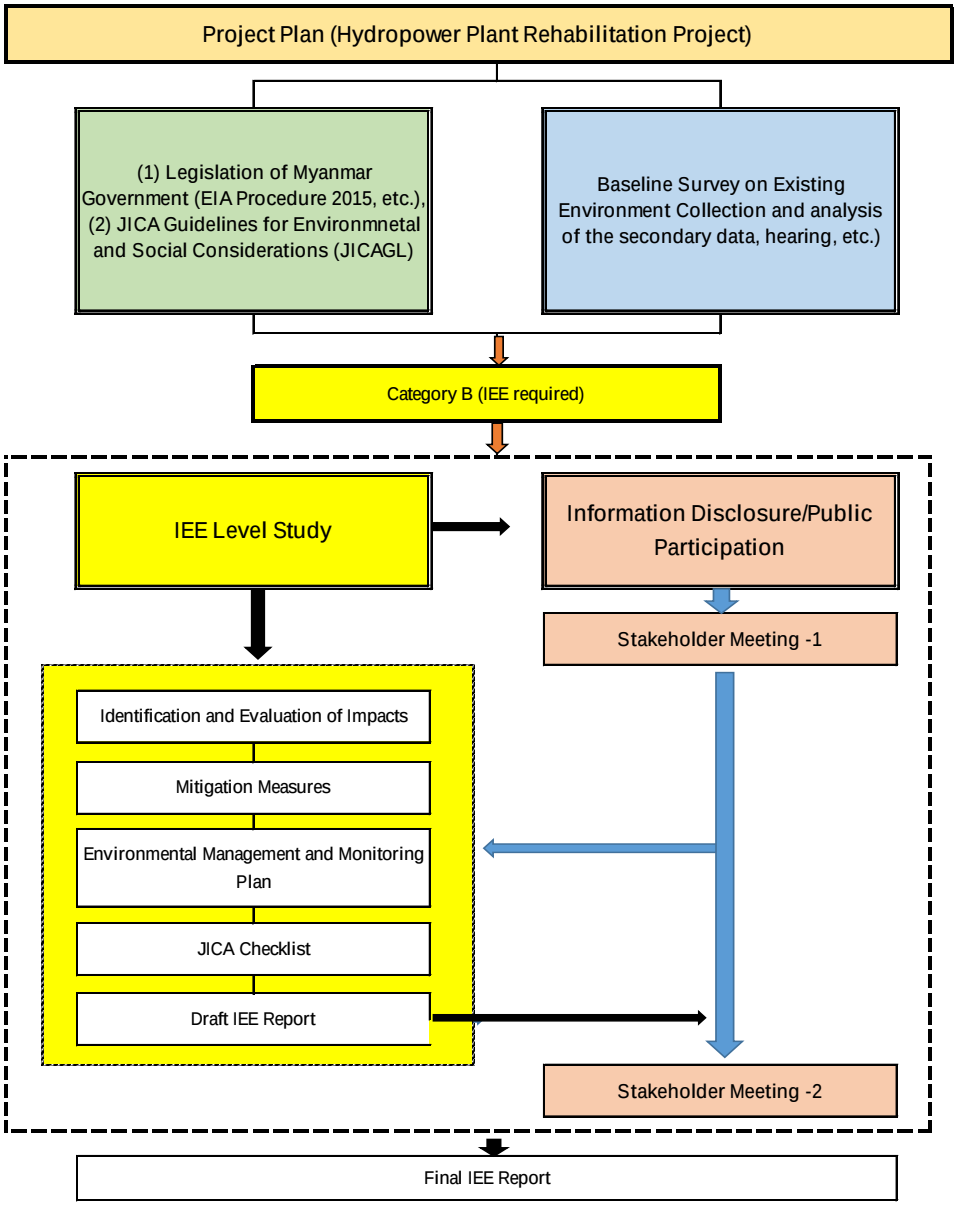
Source: JICA Survey Team

16.4.3 Scope and Procedures of IEE

According to the JICA (Japan International Cooperation Agency) Guidelines for Environmental and Social Considerations (2010.4), the project is classified as "Category B", which means that an IEE level study (not full EIA) is required.

In addition, as shown in Table 16.4-2, construction work for rehabilitation and subsequent operation of the HPP will be done within the existing plant site. Thus, there will be no changes in the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities such as farming and livestock, and living conditions of residents in surrounding area are required. Thus, preparation of resettlement action plan is excluded.

Fig. 16.4-3 shows the procedures of IEE in this Study.



Source: JICA Survey Team

Fig. 16.4-3 Schematic Flow of IEE Level Study in the Preparatory Survey

16.4.4 Results of Preliminary Scoping

(1) Project Activities

Anticipated activities due to the proposed project plan for both HPPs are shown in Table 16.4-5.

Table 16.4-5 Anticipated Activities due to the Rehabilitation of Existing HPPs

Stage	Anticipated Activities	Baluchaung No.1 HPP	Sedawgyi HPP
I Planning Stage (Pre-construction Stage)	Securing land/space for HPP and related facilities	No	No
	Securing construction yard including storage of construction materials	No	No
	Change in land use and utilization of local resources	No	No
II Construction Stage (Rehabilitation Work)	Procurement of construction materials and securing power supply	No	No
	Earth moving work such as excavation, cutting and mounting	No	No
	Work for exchange/renewal of dilapidated facilities /equipment and/or parts/devices to new ones	Yes	Yes
	Collection, transportation and storage of generated waste including hazardous materials such as toxic metals and asbestos through exchange of older transformers and others to new ones	Yes	Yes
	Carrying out dilapidated facilities /equipment and/or parts/devices and carrying in new ones by manually and/or using machines and vehicles	Yes	Yes
	Workers, their working activities and worker's camp	Yes	Yes
III Operation Stage	Operation of HPP and related facilities/equipment	Yes	Yes
	Spatial occupancy of HPP and related facilities	Yes	Yes

Source: JICA Survey Team

(2) Setting of Environmental Components and Items for IEE

To grasp whole features of possible environmental impacts caused by the project, it is necessary to identify and evaluate environmental component and item, which compose of environmental and social considerations, one by one and to integrate the impacts.

According to the JICA Guidelines for Environmental and Social Considerations (JICA Guidelines), possible impacts to be assessed include those on human health and safety, as well as on the natural environment, which are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights,

cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.

In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational to do so.

In the IEE by taking into consideration the JICA Guidelines, and relevant laws and regulations of Myanmar, together with environmental condition of the project area, three environmental components and 38 items (Social Environment 17, Natural environment 10, and Environmental pollution 11) were selected as indicators expressing environmental and social conditions (See Table 16.4-6 below).

(3) Rating of Possible Impacts

Possible impacts were identified and the extent of the impacts are also evaluated one by one for each implementation stage by applying rating against the above mentioned 38 environmental items.

In the evaluation following rating criteria were adopted to examine extent of the possible impacts:

- In general, both positive impact (+) and negative impact (-) are expected due to the anticipated project activities.

- Ratings are as follows:
  (a) A (+/-) - Significant positive/negative impact is expected,
  (b) B (+/-) - Not significant but some positive/ negative impact is expected
  (c) C (+/-) - Extent of impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses.
  (d) D - Negligible or No impact is expected.

- Implementation stage: I - Planning Stage, II - Construction Stage, III - Operation Stage. T-Whole stages with worst rating among I, II, and III.

(4) Results of Preliminary Scoping

Results of preliminary environmental scoping are shown in Table 16.4-6. After data collection and field survey, the results were re-examined and finalized.

Table 16.4-6 Preliminary Environmental Scoping of HPPs Rehabilitation Project (Common to Baluchaung No.1 and Sedawgyi HPPs)

Environmental Items		Rating by Stage				Reasons
		T	I	II	III	
(1) Social Environment						
1	Involuntary Resettlement (land acquisition/ resettlement etc.), migration of population etc.	C	C	D	D	(I) All the activities for rehabilitation will be carried out within existing HPP site. Thus, neither land acquisition nor resettlement is expected.
2	Local economy such as employment and livelihood etc.	C	C	B+	A+	(II) Temporary employment of local people by rehabilitation work is somewhat anticipated. (III) Through rehabilitation improvement of power supply condition will be attained in efficiency and reliability. However, it is unknown whether the surrounding communities are able to enjoy the benefit equally or not at present.
3	Land use and utilization of local resources	D	D	D	D	(T) All the activities for rehabilitation will be carried out within existing HPP site. Thus, neither change of land use nor utilization of local resources is not anticipated.
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	C	C	(T) Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly informed to relevant community peoples and CBOs.
5	Existing social infrastructures and services	C	C	C	A+	(T) All the activities for rehabilitation will be carried out within existing HPP site. Thus, no negative impact is anticipated. (III) Through rehabilitation improvement of electric supply condition will be attained. However, it is unknown whether the surrounding communities are able to enjoy the benefit equally or not at present.
6	The poor, refugees, indigenous of ethnic minority people	C	C	C	C	(T) At present, situation of the poor and vulnerable peoples such as ethnic minorities, refugees, elderly and disabled in the communities is unknown.
7	Gender	C	C	C	C	(T) At present, situation of women regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities is unknown.
8	Children's Right	C	C	C	C	(T) At present, situation of situation of children regarding (1) provision of adequate standard of living, education etc., (2) protection from abuse, neglect, discrimination, (3) participation in the communities is unknown.
9	Misdistribution of benefit and damage	C	C	C	C	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
10	Local conflict of interests	C	C	C	C	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
11	Cultural property and heritage	C	D	C	C	(T) All the activities for rehabilitation will be carried out within existing HPP site. In addition, there are found no cultural, religious and historical heritage sites in and nearby. Thus, negative impact is not anticipated.
12	Fishing Rights, Water Rights and Rights of Common	C	C	C	C	Rehabilitation work will be limited within existing HPP site. Thus, negative impact is not anticipated.
13	Public health and Sanitation	C	C	C	C	There is a possibility of air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for rehabilitation work. In addition, generation of solid waste including hazardous material such as PCBs and asbestos through exchange of dilapidated equipment and/or devices with new ones. However, extent of impact on human health is unknown at present

Environmental Items		Rating by Stage				Reasons
		T	I	II	III	
14	Infectious diseases such as HIV/AIDS	C	C	C	C	(II) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of migrating workers with affected peoples at their camp in construction work. However, employment of migrating workers is unknown at present.
15	Working condition	C	C	C	C	(II, III) Adverse impacts on working condition including occupational safety are expected somewhat due to insufficient management of workers at rehabilitation work, and at operation of HPP. However, extent of impact is unknown at present.
16	Hazard/risk (disaster, security)	C	C	B-	C	(T) In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of spilling over of PCBs included waste transformers through exchange of dilapidated equipment and/or devices with new ones. However, feature of impact is unknown at present.
17	Accidents	C	C	B-	C	(T) Occurrence of accidents is somewhat anticipated, if inappropriate handling and management of rehabilitation work and operation of HPP are carried out.
(2) Natural Environment						
18	Topography and Geology	C	D	D	D	Rehabilitation work will be limited to exchange of dilapidated equipment and/or devices within existing HPP site. In addition, there is no specific/valuable feature of topography and geology in and surrounding area of the plant site.
19	Soil erosion/sand movement	C	D	C	C	(T) All the activities for rehabilitation will be carried out within existing HPP site, which has flat and good soil condition.
20	Movement of water/ Hydrological situation	C	D	C	C	No change in quantity of water intake and sluice from dam by hydropower generation is anticipated during rehabilitation and operation stage. However, feature of impact on hydrological condition of river downstream is unknown at present.
21	Groundwater condition	C	D	C	C	(T) All the activities for rehabilitation will be carried out within existing HPP site. In addition, no large scale pumping of groundwater will be planned. Water use for rehabilitation work will be done by supplying surface water of dam and river. Thus, impact on groundwater is not anticipated.
22	Environmentally sensitive areas (Protected Areas, IBAs etc.)	C	D	C	C	(T) All the activities for rehabilitation will be carried out within existing HPP site. However, information about designated environmentally sensitive areas such as National Parks, Nature Reserves, Bird Sanctuaries etc. in and surrounding area of the plant site is unknown at present.
23	Flora, Fauna, Ecosystem and Biodiversity (Terrestrial)	C	D	C	C	(T) All the activities for rehabilitation will be carried out within existing HPP site. However, information about terrestrial valuable ecosystem and biodiversity in and surrounding area of the plant site is unknown at present.
24	Flora, Fauna, Ecosystem and Biodiversity (Aquatic)	C	D	C	D	(T) All the activities for rehabilitation will be carried out within existing HPP site. However, information about aquatic valuable ecosystem and biodiversity in and surrounding area of the plant site is unknown at present.
25	Landscape and visual amenity	C	D	C	C	Rehabilitation work will be limited to exchange of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing HPP site. Thus, negative impact on landscape is not anticipated.
26	Micro-climate	C	D	C	C	Rehabilitation work will be limited to exchange of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing HPP site. Thus, negative impact on micro-climate is not anticipated.
27	Global Warming/Climate Change	C	D	B-	C	Through rehabilitation work GHG (greenhouse gas) emissions from vehicles and construction machines are somewhat anticipated. However, extent of impact is unknown at present.
(3) Environmental pollution						
28	Air pollution	C	D	B-	C	(II) Air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for rehabilitation work. However, extent of impact is unknown at present.
29	Water Pollution	C	D	B-	C	(II) Discharge of water pollutants to waterbodies is anticipated by operation of construction machines and vehicles for rehabilitation work. However, extent of impact is unknown at present.

Environmental Items		Rating by Stage				Reasons
		T	I	II	III	
30	Soil contamination	C	D	B-	C	(II) There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for rehabilitation work. In addition, there is also a possibility of spill-over of PCBs included waste transformers through exchange of dilapidated equipment and/or devices with new ones. However, feature of impact is unknown at present.
31	Bottom sediment contamination	C	D	B-	C	(II) There is a possibility of bottom sediment contamination of water bodies. However, extent of impact is unknown at present.
32	Solid waste	B-	D	B-	B-	(II) It is anticipated that generation of solid waste including hazardous material such as PCBs and asbestos through exchange of dilapidated equipment and/or devices with new ones.
33	Noise and Vibration	B-	D	B-	C	(II) Generation of noise and vibration is somewhat anticipated by operation of construction machines and vehicles for rehabilitation work. However, extent of impact is unknown at present.
34	Ground Subsidence	D	D	D	D	(II) Rehabilitation work will be limited within existing HPP site. In addition, foundation is stable and no large scale extraction of groundwater is included in the project plan. Thus, anticipated impact is negligible.
35	Offensive odor	C	D	C	C	(T) There is a possibility of offensive odor generation due to rehabilitation work. However, the work will be limited within existing HPP site. Thus, anticipated impact is negligible, if any.
36	Sunshine inhibition	D	D	D	D	(T) Rehabilitation work will be limited within existing HPP site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, impact on sunshine inhibition is not anticipated.
37	Electromagnetic interference	C	D	C	C	Rehabilitation work will be limited within existing HPP site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, interference with receiving radio wave is not anticipated.
38	Safety from Electromagnetic Field	C	D	C	C	Rehabilitation work will be limited within existing HPP site. In addition, there is neither houses nor public facilities in neighborhood. Thus, potential health effect of electromagnetic field is hardly anticipated.

Source: JICA Survey Team

16.5 Identification and Evaluation of Possible Impacts

16.5.1 Results of Identification and Evaluation of Possible Impacts

Based on results of the Preliminary Scoping, necessary survey was carried out to fill up lack of information by collection of relevant data and by hearing and consultation with related central and local governments and organizations as well as village and communities in the project area of both Baluchaung No.1 and Sedawgyi HPPs.

After the survey, by applying revised and upgraded information, possible impacts were also identified and the extent of the impacts were evaluated one by one with rating against 38 environmental items for rehabilitation of both Baluchaung No.1 and Sedawgyi HPPs.

Results are shown together with the results of the Scoping in Table 16.5-1. In Table 16.5-1 rating scores are same as shown in Section 16.4.3 (3) of the Scoping. Actually, results of identification and evaluation of possible impacts are mostly found the same. Thus, they are expressed commonly in the table.

Table 16.5-1 Identification and Evaluation of Possible Impacts due to HPPs Rehabilitation Project

Environmental Items		Scoping		After		Reasons
		I/II	III	I/II	III	
(1) Social Environment						
1	Involuntary Resettlement (land acquisition/ resettlement etc.), migration of population etc.	D	D	D	D	(I) All the activities for rehabilitation will be carried out within existing HPP site. Thus, neither land acquisition nor resettlement is expected for surrounding areas.
2	Local economy such as employment and livelihood etc.	B+	A+	B+	D	(II) Temporary employment of local people by construction work is somewhat anticipated.
3	Land use and utilization of local resources	D	D	D	D	(T) All the activities for rehabilitation will be carried out within existing HPP site. Thus, neither change of land use nor utilization of local resources is not anticipated in the surrounding areas.
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	B-	B-	(T) Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly informed to relevant community peoples and CBOs.
5	Existing social infrastructures and services (Traffic condition)	C	A+	B-	D	(II) It is anticipated to cause inconvenience to local traffic due to passing through vehicles for construction work and tracks loading heavy equipment and device access road to HPP.
6	The poor, refugees, indigenous of ethnic minority people	C	C	B-	B-	(T) Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, there is found no situation for necessary considerations with the poor and vulnerable peoples such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and related Township area. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
7	Gender	C	C	B-	B-	(T) At present, there is found no situation for necessary considerations with gender regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities and related Township area. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
8	Children's Right	C	C	B-	B-	(T) At present, there is found no situation for necessary considerations with children regarding (1) provision of adequate standard of living, education etc., (2) protection from abuse, neglect, discrimination, (3) participation in the community and related Township area. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.

Environmental Items		Scoping		After		Reasons
		1/II	III	I/II	III	
9	Misdistribution of benefit and damage	C	C	B-	B-	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
10	Local conflict of interests	C	C	B-	B-	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
11	Cultural property and heritage	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing HPP site. In addition, there are found no cultural, religious and historical heritage sites in and nearby. Thus, negative impact is not anticipated.
12	Fishing Rights, Water Rights and Rights of Common	C	C	D	D	(1) In Myanmar there are two types of fishing rights; one is "fishing grant", which is given with specified river area and another is "license", which is a permit of fishing. (2) Construction work will be limited within existing HPP site. Thus, negative impact is not anticipated.
13	Public health and Sanitation	C	C	B-	D	(II) (1) There is a possibility of air pollutants emissions such as NOx and PM by operation of construction machines and vehicles for rehabilitation work may cause some adverse effect of respiratory organ. (2) In addition, solid waste containing hazardous material such as toxic metals (Hg, Pb) and asbestos generated even in very small amount through replacing dilapidated equipment and/or devices with new ones, may cause some adverse effect on human health in case of direct dermal contact or inhalation.
14	Infectious diseases such as HIV/AIDS	C	C	D	D	(II) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of migrating workers with affected peoples at their camp in construction work. However, according to the rehabilitation plan workers engaged in the work will be basically EPGE employees having skill and experience working in HPP. Thus, infectious diseases such as HIV/AIDS is not anticipated.
15	Working condition	C	C	B-	D	(II) Adverse impacts on working condition including occupational safety are expected somewhat due to inadequate management of workers at construction work.
16	Hazard/risk (disaster, security)	B-	C	B-	D	(II) In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of leakage of hazardous materials, even a small amount, through replacement of dilapidated equipment and/or devices with new ones. (III) It is hardly anticipated any additional risk by the plant operation.
17	Accidents	B-	C	B-	D	(II) Occurrence of accidents is somewhat anticipated, if inappropriate handling and management of construction work. (III) Through rehabilitation upgrading in efficiency and reliability of operation will be attained resulting in reduction of accidental power failure.
(2) Natural Environment						
18	Topography and Geology	D	D	D	D	(II) Construction work will be limited to exchange of dilapidated equipment and/or devices within existing HPP site. In addition, there is no specific/valuable feature of topography and geology in and surrounding areas of the plant site.
19	Soil erosion/sand movement	C	C	D	D	(II) All the activities for rehabilitation will be carried out within existing HPP site, which has flat and good soil condition.
20	Movement of water/Hydrological situation	C	C	D	D	(II, III) No change from existing condition in quantity and quality of water intake and sluice from dam by hydropower generation is anticipated during construction and operation stage.
21	Groundwater condition	C	C	D	D	(II) All the activities for rehabilitation will be carried out within existing HPP site. In addition, no large scale pumping of groundwater will be planned. Water use for construction work will be done by supplying surface water of dam and river. Thus, negative impact on groundwater is not anticipated.
22	Environmentally sensitive areas (Protected Areas, IBAs etc.)	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing HPP site, where no Environmentally sensitive areas are found. Thus, no negative impact is anticipated due to the project.
23	Flora, Fauna, Ecosystem and Biodiversity (Terrestrial)	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing HPP site, where no endangered terrestrial species as well as valuable habitat is found. Thus, no negative impact is anticipated due to the project.

Environmental Items		Scoping		After		Reasons
		I/II	III	I/II	III	
24	Flora, Fauna, Ecosystem and Biodiversity (Aquatic)	C	D	D	D	(T) All the activities for rehabilitation will be carried out within existing HPP site, where no endangered aquatic species as well as valuable habitat is found. Thus, no negative impact is anticipated due to the project.
25	Landscape and visual amenity	C	C	D	D	(T) Construction work will be limited to exchange of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing HPP site. Thus, negative impact on landscape is not anticipated.
26	Micro-climate	C	C	D	D	(II) Construction work will be limited to replacement and/or repair of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing HPP site. Thus, negative impact on micro-climate is not anticipated.
27	Global Warming/Climate Change	B-	C	B-	B+	(II) Through the construction work generation of GHG emissions from vehicles and construction machines is anticipated even in a small scale. (III) Reduction of GHG emissions is a little anticipated by improving the efficiency of HPP operation.
(3) Environmental pollution						
28	Air pollution	B-	C	B-	D	(II, III) (1) In Myanmar at present air quality standards are not established. (2) Air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for rehabilitation work even in a little amount. (3) Emission of air pollutants such as PM and NOx is not anticipated from HPP operation.
29	Water Pollution	B-	C	B-	D	(II, III) (1) In Myanmar at present water quality standards are not established. (2) Discharge of wastewater by construction work is anticipated by operation of construction machines and vehicles for construction work even in a little amount. (3) Discharge of water pollutants is not anticipated from HPP operation.
30	Soil contamination	B-	C	B-	D	(II) There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for construction work. In addition, there is also a possibility of leakage of hazardous materials such as toxic metals (Hg and Pb) and asbestos even in very small amount through replacement of dilapidated equipment and/or devices with new ones.
31	Bottom sediment contamination	B-	C	D	D	(II) All the activities for rehabilitation will be carried out within existing HPP site, where there is no water body. Thus, bottom sediment contamination is not anticipated.
32	Solid waste	B-	B-	B-	D	(II) (1) In Myanmar regulation of solid waste management is not established. (2) Through construction work non-hazardous wastes such as construction waste and general waste will be generated. (3) In addition, it is anticipated that generation of solid waste containing hazardous material such as toxic metals (Hg, Pb) and asbestos even in very small amount, through replacement of dilapidated equipment and/or devices with new ones.
33	Noise and Vibration	B-	C	B-	B+	(II) Although construction work will be carried out within the plant site, generation of noise and vibration is somewhat anticipated by operation of construction machines and vehicles for rehabilitation work. (III) Through rehabilitation upgrading in efficiency and reliability of operation will be attained resulting in some reduction of noise and vibration.
34	Ground Subsidence	D	D	D	D	(II) Rehabilitation work will be limited within existing HPP site. In addition, foundation is stable and no large scale extraction of groundwater is included in the project plan. Thus, anticipated impact is negligible.
35	Offensive odor	C	C	D	D	(T) There is a possibility of offensive odor generation due to construction work. However, the work will be limited within existing HPP site. Thus, anticipated impact is negligible, if any.
36	Sunshine inhibition	D	D	D	D	(II) Construction work will be limited within existing HPP site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, impact on sunshine inhibition is not anticipated.
37	Electromagnetic interference	C	C	D	D	(II) Construction work will be limited within existing HPP site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, interference with receiving radio wave is not anticipated.
38	Safety from Electromagnetic Field	C	C	D	D	(II, III) Rehabilitation work will be limited within existing HPP site. In addition, there is neither houses nor public facilities in neighborhood. Thus, potential health effect of electromagnetic field is hardly anticipated.

Source: JICA Survey Team

16.5.2 Re-categorization of the Project

According to the JICA Guidelines any project is classified into four categories, i.e., Category A, B and C by the extent of environmental and social impacts, taking into account of an outline of the project, scale, site condition etc. At initial stage of work for environmental and social considerations proposed project was classified into "Category B".

The proposed project was re-classified into Category B due to following reasons:

(i) The project does not belong to (a) sensitive sectors such as large scale development of roads and bridges, (b) sensitive characteristics such as large-scale involuntary resettlement of more than 200 PAPs and (c) sensitive areas such as nationally-designated protected areas, primeval forests areas or areas with unique archaeological, historical, or cultural value as listed in Appendix 3 of the JICA Guidelines.

(ii) Results of identification and evaluation of expected environmental and social impacts indicate that (a) there is no affected item with rating of (A-), which means significant negative (adverse) impact and (b) other affected items are classified into rating (B-), which means not significant but some negative impact, or rating (D), which means no or negligible negative impact as shown in Table 16.5-1.

Thus, the proposed project was classified into "Category B" same as the result of identification and evaluation.

16.6 Mitigation Measures, Environmental Management and Monitoring Plan

16.6.1 Major Negative Impacts and Mitigation Measures

As shown in Table 16.5-1, major items identified and evaluated as negative impacts with rating of (B-) which means "not significant but some negative impact" are described with necessary mitigation measures as follows*:

*Item having negative impacts is described with serial number of the item {x}

(1) Planning Stage

No item.

For example, {1} Involuntary Resettlement (land acquisition/resettlement etc., migration of population etc. - All the activities for rehabilitation will be carried out within existing HPP site. Thus, neither land acquisition nor resettlement is expected for surrounding areas.

(2) Construction Stage (Rehabilitation work)

1) Social Environment

(i) {5} Existing social infrastructures and services (Traffic condition)

a) Possible negative impacts - It is anticipated to cause inconvenience to local traffic due to passing through vehicles for construction work and tracks loading heavy equipment and device access road to HPP.

b) Mitigation measures - (1) Prior to construction work, inform contents of the construction work and schedule. (2) Time shift of construction work. (3) Education of traffic safety and manner to construction workers and drivers. (4) Raise the traffic signal and arrange watchmen on approach road. (5) Equip sheet cover to prevent scattering dust from the bed of truck. (6) Setting staff in charge of complaints.

(ii) {13} Public health and Sanitation

a) Possible negative impacts - There is a possibility of air pollutants emissions such as NOx and PM by operation of construction machines and vehicles for rehabilitation work may cause some adverse effect of respiratory organ. (2) In addition, solid waste containing hazardous material such as toxic metals (Hg, Pb) and asbestos generated even in very small amount through replacing dilapidated equipment and/or devices with new ones, may cause some adverse effect on human health in case of direct dermal contact or inhalation.

b) Mitigation measures - (1) Preventive measures to control air pollutants emission in construction work. (2) Monitor public health condition by medical examination.

(iii) {15} Working condition

a) Possible negative impacts - Adverse impacts on working condition including occupational safety are expected somewhat due to inadequate management of workers at construction work

b) Mitigation measures - (1) In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). (2) Preparation of safety management plan and enlighten occupational safety to construction workers.

(3) Tangible safety considerations should be prepared for individuals involved in the project. (i) The installation of safety equipment and management of hazardous materials. (ii) Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction works. (4) Monitoring health condition and occupational safety of workers.

(iv) {16} Hazards/risk

a) Possible negative impacts - In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of leakage of hazardous materials, even a small amount, through replacement of dilapidated equipment and/or devices with new ones.

b) Mitigation measures - (1) Inspection daily behavior of construction workers and instruction them to acquire good manners. (2) Prepare emergency action plan for hazard and public security risks.

(v) {17} Accidents

a) Possible negative impacts - Occurrence of accidents is somewhat anticipated, if inappropriate handling and management are done in the construction work.

b) Mitigation measures - (1) Suitable planning and management over construction work to prevent and minimize the number and consequences of accidents. (2) To collect and analyze cases and causes of accidents. (3) Enlighten workers and local residents to prevent accidents by training and adequate notice. (4) Prepare emergency action plan for accidents.

2) Natural Environment

(i) {27} Global warming

a) Possible negative impacts - Through the construction work, GHG (greenhouse gases) emissions from vehicles and construction machines is anticipated even in a small scale.

b) Mitigation measures - (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) To inspect condition of good maintenance for construction machines and vehicles. (3) Physical observation of exhaust emissions and collect complaints, if any.

3) Environmental Pollution

(i) {28} Air pollution

a) Possible negative impacts – In general, air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for construction work within plant site and along access roads. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling, structure construction are not expected. In addition, traffic volume of access roads by trucks delivering replaced facilities, equipment and devices are in a small number. Further, surrounding areas farmland and a lone straggling village. Therefore, possible impacts will be in a small scale and temporary.

b) Mitigation measures - (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (3) Possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(ii) {29} Water pollution

a) Possible negative impacts – In general, discharge of wastewater is anticipated. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling ground and soil as well as road construction are not expected. Thus, wastewater is in a small amount and water pollutants such as soil and oil are seldom contained. Thus, possible impacts will be in a small scale and temporary.

b) Mitigation measures - (1) Preventive measures to control water pollutants discharge in construction work. (2) Major pollutants such as suspended solid and oily components will be discharged to existing drainage after simple treatment by filter. As mentioned the above, possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(iii) {30} Soil contamination

a) Possible negative impacts – There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for construction work. In addition, there is also a possibility of leakage of hazardous materials such as toxic metals (Hg and Pb) and asbestos even in very small amount through replacement of dilapidated equipment and/or devices with new ones.

b) Mitigation measures - (1) To prevent leakage and contamination of soil, the concrete and gravels heavily contaminated with hazardous materials will be removed and renewed. Then, they will be sealed in drums, and stored in the strict management area for hazardous wastes. (2) As mentioned the above, soil contamination may occur little. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(iv) {32} Solid waste

a) Possible negative impacts - (i) Through construction work,

b) generation of solid wastes such as general waste, industrial waste and hazardous waste is anticipated by replacement and repair of facilities, equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities as shown in Table 16.6-1.

Table 16.6-1 Solid Wastes Generation through Construction Work

Solid Waste	Generation Source	Baluchaung No.1 HPP*	Sedawgyi HPP*	Features (Materials)
1) General waste	Construction work	X	X	Garbage
2) Industrial waste	(1) Replaced facilities, equipment and devices (whole body or parts/ debris)**	XX	XX	Steel, Concrete, Wood, Plastics, etc. (Parts and debris)
	(2) Construction work for warehouses and other facilities, if it is necessary to be constructed.	X	X	Concrete, wood, plastics
3) Wasted oil	Replaced transformers	-	XX	Dilapidated insulation oil
	Replaced or repaired equipment	X	X	Dilapidated oil/grease
4) Hazardous waste	PCB	-	-	Not contained
	Toxic metals (Hg, Pb)	X	X	Measuring equipment, etc.***
	Asbestos	X	X	Generator rotor, etc.***

Note 1: * (XX) - a larger amount of generation, (X) - Some amount of generation, (-) - No generation
Note 2: ** Major items generating industrial waste are shown in Table 16.6-2.
Note 3: *** Refer to Table 16.6-3.

Source: JICA Survey Team

Characteristics of the solid wastes are as follows:

- General waste
  General waste generated is mostly garbage from offices of HPP station and worker's house. It can be treated and disposed similar to other general waste in HPP.
- Industrial Waste
  Most of solid wastes will be industrial wastes generated by replacement and repair of facilities, equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities are also shown in Table 16.6-2 and 16.6-3. Materials that make up the wastes are metals (mainly steel), rubbers, woods, plastics, ceramics, etc. In addition, it is anticipated generation of wasted oil including dilapidated insulator oil (about 2.5 m^3) by the replacement of transformers in Sedawgyi HPP.

Table 16.6-2 Major Anticipated Industrial Wates generated by Replacement and Repairing of Existing Facilities, Equipment, Devices, etc. (Baluchaung No.1 HPP)

Facility, equipment, device and parts, etc.		Materials
(1) Turbine	Turbine Runner	Metal (mainly steel)
	Guide Vane	Metal (mainly steel)
	Guide Vane Bearing and Stem Bush	Metal (mainly steel)
	Shear Pin	Metal (mainly steel)
	Gate Servomotor	Metal (mainly steel)
	Guide Bearing	Metal (mainly steel)
	Shaft Sleeve	Metal (mainly steel)
	Head Cover	Metal (mainly steel)
	Stay Ring	Metal (mainly steel)
	Inlet Valve	Metal (mainly steel)
	Inlet Valve Servomotor	Metal (mainly steel)
	Cooling Water Supply System	Metal (mainly steel)
	Water Drainage System	Metal (mainly steel)
	Pressure Oil Supply System	Metal (mainly steel)
(2) Generator	Stator winding	Metal (mainly steel)
	Rotor winding	Metal (mainly steel)
	Guide bearing	Metal (mainly steel)
	Thrust bearing	Metal (mainly steel)
	Oil cooler	Metal (mainly steel)
	Air cooler	Metal (mainly steel)
	Excitation system	Metal (mainly steel)
(3) Control and Protection System	Operation Board	Metal (mainly steel)
	Speed Governor System	Metal (mainly steel)
	Automatic Voltage Regulator	Metal (mainly steel)
	Protection Relay (Analog Type)	Metal (mainly steel)
	SSG Speed Monitor	Metal (mainly steel)
	Control Cable	Rubber and copper
	Fire Alarm System (Pumps, valves, parts, etc.)	Metal (mainly steel)
(4) Substation and Transmission Line Facilities	132kV Circuit Breaker	Metal (mainly steel)
	11 kV Main and Local Cubicle	Metal (mainly steel)
	LV Switchgear	Metal (mainly steel)
	DC battery	Metal (mainly steel)
	DC Battery Charger	Metal (mainly steel)
	Emergency Diesel Generator Set	Metal (mainly steel)
	Transmission Line Protection Panel	Metal (mainly steel)

Source: JICA Survey Team

Table 16.6-3 Major Anticipated Industrial Wates generated by Replacement and Repairing of Existing Facilities, Equipment, Devices, etc. (Sedawgyi HPP)

Facility, equipment, device and parts, etc.		Materials
(1) Turbine	Turbine Runner Vane	Metal (mainly steel)
	Turbine Runner Hub	Metal (mainly steel)
	Guide Vane	Metal (mainly steel)
	Guide Vanes Stem Bush	Metal (mainly steel)
	Inner Head Cover	Metal (mainly steel)
	Turbine Guide Bearing	Metal (mainly steel)
	Shaft Sleeve	Metal (mainly steel)
	Shaft Sealing Box	Metal (mainly steel)
	Runner Vane Return Mechanism	Metal (mainly steel)
	Pressure Oil Supply Pipe for Runner Vane Servomotor	Metal (mainly steel)
	Cooling Water Supply System (Pumps, valves, parts, etc.)	Metal (mainly steel)
	Water Drainage System (Pumps, valves, parts, etc.)	Metal (mainly steel)
	Pressure Oil Supply System	Metal (mainly steel)
(2) Generator	Stator winding	Metal (mainly steel)
	Rotor winding	Metal (mainly steel)
	Guide bearing	Metal (mainly steel)
	Thrust bearing	Metal (mainly steel)
	Air cooler	Metal (mainly steel)
	Brake system	Metal (mainly steel)
	Lubrication oil cooling system	Metal (mainly steel)
	Neutral grounding device	Metal (mainly steel)
	Generation meter	Metal (mainly steel)
(3) Control and Protection System	Control and Protection panel	Metal (mainly steel)
	Automatic Voltage Regulator	Metal (mainly steel)
	Generator Vibration Monitor	Metal (mainly steel)
	Control Cable	Rubber and Copper
	Ventilation System	Metal (mainly steel)
	Governor Control Equipment	Metal (mainly steel)
	Air Conditioning System	Metal (mainly steel)
(4) Substation and Transmission Line Facilities	Generator Transformer	Metal (mainly steel), dilapidated insulator oil (about 2.5 m^3)
	Switch Equipment (All)	Metal (mainly steel)
	132/11 kV Powerhouse Service Trans	Metal (mainly steel)
	11 kV Vacuum Circuit Breaker	Metal (mainly steel)
	11 kV Phase Shift Transformer	Metal (mainly steel)
	Powerhouse Service Transformer	Metal (mainly steel)
	Emergency Diesel Generator Set	Metal (mainly steel)
	Plant DC Battery Bank	Metal (mainly steel)
	DC Battery Charger	Metal (mainly steel)
	400 V House Service Equipment	Metal (mainly steel)

Source: JICA Survey Team

- Hazardous waste
  Possible hazardous wastes are toxic metals such as Mercury (Hg) and Pb (Lead), and asbestos as shown in Table 16.6-4 and 16.6-5.

Table 16.6-4 List of Possible Hazardous Materials Contained in Wasted Equipment and Devices (Baluchaung No.1 HPP)

Hazardous Materials	Equipment and Devices	
PCB	Not contained	
Asbestos	Generator Rotor	Phase to phase insulator
	Excitation system	Field circuit switch
		Field discharging resistor
		Initial flushing resistor
	Piping system	Packings
Hg	Measuring equipment	Pressured switch
Pb	Electric components	Soldering component

Source: JICA Survey Team

Table 16.6-5 List of Hazardous Wastes generated from Rehabilitation Work (Sedawgyi HPP)

Hazardous Material	Equipment/Device	
PCB	Not contained	
Asbestos	Generator Stator	Insulator
	Generator brake	Brakepad
	Pipes	Packings
Hg	Measuring equipment	Dial-type thermometer
Pb	Electric components	Soldering component

Source: JICA Survey Team

Among them, both mercury and lead are highly toxic to the developing brain and nervous system. Asbestos is fibrous material composed of silicate minerals. Due to outstanding properties of fiber strength and heat resistant, it has been used in a wide range of manufacturing processes as building materials (roofing shingles, ceiling and floor tiles), friction products (brake and transmission parts), heat-resistant fabrics, packaging, and coatings. However, it may cause serious and fatal illnesses including lung cancer, *mesothelioma*, and asbestosis (a type of *pneumoconiosis*) through prolonged inhalation, in case that debris of asbestos scatters or disperses in the air as a result of asbestos containing materials are broken or destructed

As for PCB waste, in case of rehabilitation of Baluchaung No.2 HPP, it was identified in several electrical transformers, electric capacitors, etc., because the installed transformers and other equipment were manufactured before 1978, when PCB was utilized as insulator oil due to its effectiveness and persistence. However, installed related equipment in both Baluchaung No.1 and Sedawgyi HPP were manufactured after 1978 and imported to install. Therefore, PCB waste was not identified in both HPPs.

c) Mitigation measures - (1) Preventive measures for reduction, proper treatment and disposal of solid waste during construction stage and operation stage in the plan. (2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. As for industrial waste, some parts of replaced facilities and equipment made of steel, ceramics, woods, etc. should be reused and recycled as materials of other house and facilities.

(3) Enlighten awareness of waste management to workers and employees. (4) Solid waste contaminated with hazardous materials should be segregated, transferred and stored with the name plate in sealed containers or leak-proof plastic bags, which are installed in the special warehouse with roof and wall within the HPP site. (5) At present there is no regulation of solid waste management in Myanmar. Thus, proper waste management including treatment and disposal should be carried out after consultation with relevant governmental organizations such as ECD and local government.

(v) {33} Noise and vibration

a) Possible negative impacts - In general, generation of noise and vibration is anticipated by operation of construction machines and vehicles for construction work within plant site and along access roads. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling, structure construction are not expected. In addition, traffic volume of access roads by trucks delivering replaced facilities, equipment and devices are in a small number. Further, surrounding areas farmland and a lone straggling village. Therefore, possible impacts due to noise and vibration will be in a small scale and temporary.

b) Mitigation measures - (1) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (2) Use equipment with low-noise and vibration. (3) Installation of soundproof walls/acoustic enclosures and provision of buffer zones. (4) As mentioned the above, possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(3) Operation Stage

It is anticipated that there is no change of scheme, conditions and schedule of operation from those of existing operation after rehabilitation. Thus, no additional negative impacts are expected.

(4) Whole Stages

1) Social Environment

(i) {3} Land use and utilization of local resources

a) Possible negative impacts – As for Baluchaung No.1 HPP, although it is out of scope of the proposed Project, former farmland of about 40 acres within the HPP site in Loikaw Township was enforced to use for station staff houses (called as "Japan Compound") during construction of the HPP by the Government and has not been restituted yet. Thus, even now it is a matter of suit between farmers and local government. At the 1st stakeholder meeting the above issue was asked to local government and HPP manager by village people.

b) Mitigation measures – Before the 2nd stakeholder meeting it was confirmed by hearing to corresponding Village Tract Chief that the sue issue was considerably progressed and present situation is as follows:

- The lands under dispute were planned to allocate by the Township-level Land Management Committee. The committee includes Township GA officer as the

chairman, and the members are Township-level officials.

- To come out to conclusion of providing alternative land based on the re-distribution plan was already designated as follows:
  - In front / Eastern side of the Japan Compound; land of 15 acres is allocated for station staff
  - Western side of the Compound: land of 8.2 acres will be re-distributed to 6 owners of HPGE (Hydropower Generation Enterprise) staffs who bought from the farmer years ago
  - In the western side of the Compound, immediate west side of a small road to Sole Sel village: land of 21.39 acres will be given back to the farmers.

Thus, at the 2nd stake holder meeting on September 17th, the issue was not raised. However, it should be followed up to closing the case.

(ii) {4} Social institutions such as social infrastructure and local decision-making institutions, a split of communities

a) Possible negative impacts - Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts, such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly informed to relevant community peoples and community based organizations.

b) Mitigation measures - (1) Information disclosure and public participation should be fully considered for all the stakeholders including local residents and road users from planning stage to operation stage for obtaining thorough understanding and consensus of the people and communities. (2) EPGE should set up a section in charge of public communication and complaints from peoples.

(iii) {6} The poor, refugees, indigenous of ethnic minority people

a) Possible negative impacts - Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, it was observed that there is no situation for necessary considerations with the poor and vulnerable peoples, such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and related Township area. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - (1) No serious situation was observed for vulnerable such as the poor, refugees, IDPs, indigenous of ethnic minority, disabled at present. However, in order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. For example, to give them priority of employment over simple construction work

(iv) {7} Gender

a) Possible negative impacts - At present, no situation has been found for necessary considerations with gender regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities and related

Township area. However, if proper care and management by local government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - No serious situation was observed for gender issues in related Township and surrounding area of the plant site at present However, in order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. One of necessary measures is to give women priority of employment in construction work.
In this IEE level study women were selected as the master of ceremony as well as the participation to Q&A section.

(v) {8} Children's Right

a) Possible negative impacts - At present, no situation has been found for necessary considerations with children regarding (1) provision of adequate standard of living, education etc., (2) protection from abuse, neglect, discrimination, (3) participation in the communities and in related Township. However, if proper care and management by local government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - No serious situation was observed for children's right in related Township and surrounding area of the plant site at present. However, in order to take care of them continuously EPGE and local government will watch the situation such as abuse and health condition, carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.

(vi) {9} Misdistribution of benefit and damage

a) Possible negative impacts - Through rehabilitation, improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.

b) Mitigation measures - Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to share equally benefits and damage. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.

(vii) {10} Local conflict of interests

a) Possible negative impacts - Through rehabilitation, improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted ~~to~~ by the relevant stakeholders including communities through proper information disclosure and public participation.

b) Mitigation measures - (1) Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to avoid local conflict

of interests. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from people.

16.6.2 Preparation of Environmental Management Plan

For each negative impact mitigation measures were examined for respective items in planning, construction and operation stage as well as whole stages in order that the plan can achieve intended objectives with avoiding, minimizing or reducing accompanied environmental impacts at implementation. The mitigation measures are examined for both Baluchaung No.1 and Sedawgyi HPPs and shown together with implementing organizations and responsible organizations as EMP in Table 16.6-6.

Table 16.6-6 Possible Major Negative Impacts and Mitigation Measures and EMP

Environmental Items		Mitigation Measures	Implementation organization*	Responsible and/or supervising organization**
(I / II) Planning Stage/ Construction Stage				
(1) Social Environment				
	Social Infrastructure and Services (Traffic condition)	(1) Prior to construction work, inform contents of the construction work and schedule. (2) Time shift of construction work. (3) Education of traffic safety and manner to construction workers and drivers. (4) Raise the traffic signal and arrange watchmen on approach road. (5) Equip sheet cover to prevent scattering dust from the bed of truck. (6) Setting staff in charge of complaints.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
13	Public health and Sanitation	(1) Preventive measures to control air pollutants emission in construction work. (2) Monitor public health condition by medical examination.		
15	Working condition	(1) In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). (2) Preparation of safety management plan and enlighten occupational safety to construction workers. (3) Tangible safety considerations should be prepared for individuals involved in the project. (i) The installation of safety equipment and management of hazardous materials. (ii) Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction works. (4) Monitoring health condition and occupational safety of workers.		
16	Hazard/risk (disaster, security)	(1) Inspection daily behavior of construction workers and instruction them to acquire good manners. (2) Prepare emergency action plan for hazard and public security risks.		
17	Accidents	(1) Suitable planning and management over construction work to prevent and minimize the number and consequences of accidents. (2) To collect and analyze cases and causes of accidents. (3) Enlighten workers and local residents to prevent accidents by training and adequate notice. (4) Prepare emergency action plan for accidents.		
(2) Natural Environment				
27	Global Warming/ Climate Change	(1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) To inspect condition of good maintenance for construction machines and vehicles. (3) Physical observation of exhaust emissions and collect complaints, if any.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
(3) Environmental pollution				
28	Air pollution	(1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (3) Possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE

Environmental Items		Mitigation Measures	Implementation organization*	Responsible and/or supervising organization**
29	Water Pollution	(1) Preventive measures to control water pollutants discharge in construction work. (2) Major pollutants such as suspended solid and oily components will be discharged to existing drainage after simple treatment by filter etc.. As mentioned the above, possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
30	Soil contamination	(1) To prevent leakage and contamination of soil, the concrete and gravels heavily contaminated with hazardous materials will be removed and renewed. Then, they will be sealed in drums, and stored in the strict management area for hazardous wastes. (2) As mentioned the above, soil contamination may occur little. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
32	Solid waste	(1)Preventive measures for reduction, proper treatment and disposal of solid waste during construction stage and operation stage in the plan. (2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. As for industrial waste, some parts of replaced facilities and equipment made of steel, ceramics, woods etc. will be reused and recycled as construction materials for other houses and facilities. (3) Enlighten awareness of waste management to workers and employees. (4) Solid waste contaminated with hazardous materials should be segregated, transferred and stored with the name plate in sealed containers or leak-proof plastic bags, which are installed in the special warehouse with roof and wall within the Plant site. (5) At present there is no regulation of solid waste management in Myanmar. Thus, proper waste management including treatment and disposal will be carried out after consultation with relevant governmental organizations such as ECD and local government.		
33	Noise and Vibration	(1) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (2) Use equipment with low-noise and vibration. (3) Installation of soundproof walls/acoustic enclosures and provision of buffer zones. (4) As mentioned the above, possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
(III) Operation Stage				
No item				
(T) Whole stages				
3	Land use and utilization of local resources	As for Baluchaung No.1 HPP, farmland of about 40 acres near the plant site in Loikaw Township used for station staff house site will be re-distributed to former users (farmers) by consultation with Township-level Land Management Committee. The lands under dispute were planned to allocate by the Township-level Land Management Committee. The committee includes Township GA officer as the chairman, and the members are Township-level officials. To come out to conclusion of providing alternative land based on the re-distribution plan was already designated. Thus, at the 2nd stakeholder meeting on September 17th, the issue was not raised. However, it should be followed up to closing the case.		
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	(1) Information disclosure and public participation should be fully considered for all the stakeholders including local residents and road users from planning stage to operation stage for obtaining thorough understanding and consensus of the people and communities. (2) EPGE should set up a section in charge of public communication and complaints from peoples.		
6	The poor, refugees, indigenous of ethnic minority people	(1)No serious situation was observed for vulnerable such as the poor, refugees, IDPs, indigenous of ethnic minority, disabled at present. However, in order to take care of them continuously EPGE and local		

Environmental Items		Mitigation Measures	Implementation organization*	Responsible and/or supervising organization**
		government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. For example, to give them priority of employment over simple construction work		
7	Gender	No serious situation was observed for gender issues in Township and surrounding area of the plant site at present However, in order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. One of necessary measures is to give women priority of employment in construction work. In this IEE level study women were selected as the master of ceremony as well as the participation to Q & A section.		
8	Children's Right	No serious situation was observed for children's right in Township and surrounding area of the plant site at present. However, in order to take care of them continuously EPGE and local government should watch the situation such as abuse and health condition, carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.		
9	Misdistribution of benefit and damage	Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to share equally benefits and damage. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.		
10	Local conflict of interests	(1) Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to avoid local conflict of interests. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.		

Note 1: *Implementing Organizations : EPGE (Head Quarter and/or Manager of HPP), CT - Contractor, Local

Note 2: **Responsible and/or supervising organization - Local Government (Township, District and/or State Government), ECD (MONREC), MOEE

Source: JICA Survey Team

16.6.3 Environmental Monitoring Plan

Considering mitigation measures against negative impacts in the EMP, EMoP (Environmental Monitoring Plan) which may support the measures, was prepared for both Baluchaung No.1 and Sedawgyi HPPs and shown together in Table 16.6-7.

Table 16.6-7 Environmental Monitoring Plan (JICA Format)

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Results of Monitoring during Report Period
(I) Planning Stage (Pre-Rehabilitation Stage)				
ECC and approval/ permission for the project implementation	(1) To get ECC from MONREC (2) Other permit/ approval, if necessary	MONREC	Before commence-ment of construction (rehabilitation)work	
(II) Construction Stage (Rehabilitation Stage)				
(1) Social Environment				
Traffic condition	Cases and causes of complaints to traffic condition	Visual observation and hearing with residents and road users	Daily	
Public health and Sanitation	Monitoring health condition of workers and local residents by medical examination.	(1) HPP site, (2) Access road for rehabilitation work	Monthly	
Working condition	Monitoring health condition and occupational safety of workers.	(1) HPP site, (2) Access road for rehabilitation work	Daily	
Hazard/risk (disaster, security)	(1) Inspection daily behavior of construction workers and instruction them to acquire good manners. 2) Prepare emergency action plan for hazard and public security risks.	(1) HPP site, (2) Access road for rehabilitation work	Daily	
Accidents	Records of accidents in the project area	(1) HPP site, (2) Access road for rehabilitation work	Daily	
(2) Natural Environment				
Global Warming/ Climate Change	Monitoring maintenance condition and exhaust emissions of construction vehicles and machine	(1) HPP site, (2) Access road for rehabilitation work	Daily	
(3) Environmental Pollution				
Air pollution	(1) Visual observation, 2) Complaints from residents 2) Monitor air pollutants emission and ambient air quality.	(1) HPP site, (2) Access road for rehabilitation work	Daily	
Water Pollution	(1) Visual observation, 2) Complaints from residents. 2) Monitor water pollutants discharge and environmental water quality.	(1) HPP site, (2) Access road for rehabilitation work	Daily	
Soil contamination	(1) In Myanmar measurement of PCB and mercury content in soil is not yet established. Thus, visual observation leakage of hazardous materials. (2) Inspection proper handling and storage situation of solid waste contaminated with hazardous materials in storage containers and facilities.	(1) HPP site, (2) Solid waste storage area	Every time with exchanging dilapidated equipment and devices Rehabilitation work	
Solid waste	(1) Record of collection, transportation and disposal of generated solid waste. (2) Visual observation leakage of hazardous materials from dilapidated equipment and devices such as transformers by rehabilitation work. (3) Inspection proper handling and storage situation of solid waste contaminated with hazardous materials in storage containers and facilities.	(1) HPP site, (2) Solid waste storage area	Daily	
Noise and Vibration	(1) Physical observation. (2) Noise measurement by sound level meter, as necessary. (3) Collection of complaints.	(1) HPP site, (2) Access road for rehabilitation work	Daily	
(III) Operation Stage				
No item				

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Results of Monitoring during Report Period
(T) Whole Stages				
1) Social Environment				
Land use issue around Baluchaung No.1 HPP site	Record of consultation with Township level Land Management Committee and follow closing of the case at the Township-level Land Management Committee.	Farmland with 40 acre near Baluchaung No.1 HPP site	By the end of solution	
Social institutions such as social infrastructure and local decision-making institutions, a split of communities	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the HPP	(1) One time per year, (2) As required	
The poor, refugees, indigenous of ethnic minority people	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations.	Surrounding villages and communities of the HPP	(1) One time per year, (2) As required	
Gender	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations. (3) Number of women workers in construction work.	Surrounding villages and communities of the HPP	(1) One time per year, (2) As required	
Children's Right	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the HPP	(1) One time per year, (2) As required	
Misdistribution of benefit and damage	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the HPP	(1) One time per year, (2) As required	
Local conflict of interests	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the HPP	(1) One time per year, (2) As required	

Note 1: *Implementing Organization: EPGE (Head Quarter and/or Manager of HPP, CT - Contractor,
Note 2: **Responsible and/or supervising organization - Local Government (Township, District and/or State Government), ECD (MONREC), MOEE

Source: JICA Survey Team

16.7 Results of Stakeholder Meetings

Stakeholder meetings were held two times for each HPP site.

16.7.1 Baluchaung No.1 Hydropower Plant

First stakeholder meeting was held on July 2nd Saturday 2016 to disseminate outline the rehabilitation project plan and second stake holder meeting was held on September 17th Saturday 2016 to inform the results of the IEE.

(1) First Stakeholder Meeting

1) Outline of the Meeting

a) Date and Time– July 2nd, Saturday 2016 (From 9AM to 11AM)

b) Venue –So Le Sel village, Loikaw Township, Loikaw District, Kayah State

c) Participants –66 persons (Including village chiefs and peoples, Local Government Officers, HPP employees).

d) Meeting Agenda:

- Opening Speech by Loikaw Township Officer of GAD
- Brief Explanation of the Rehabilitation the Project and Work for Environmental and Social Considerations by JICA Survey Team leader and a member in charge of Environmental and Social Considerations
- Existing Situation of Baluchaung No.1 HPP and Need of Rehabilitation by Baluchaung No.1 Hydropower Station Manager
- Necessity of Environmental and Social Considerations for the Project in Terms of Legislations of Myanmar and the JICA Guide lines the by Local Consultant
- Q & A Section
- Closing speech by the Township Officer of GAD

2) Opening Speech by Loikaw Township Officer of GAD

U Aung Ko Latt, the GAD Officer, gave the opening speech about of the project and work for environmental and social considerations including IEE and emphasized the importance of the participation with peoples of local communities and officers of related departments.

3) Brief Explanation of the Rehabilitation Project and Work for Environmental and Social Considerations by JICA Survey Team

Mr. Sano, team leader of JICA Survey Team briefly explained the purpose and scope of the JICA project, "Preparatory Survey for the Project of Hydropower Plant Rehabilitation in the Myanmar". In addition, *Mr. Okuzawa, a team member* also mentioned the importance of information disclosure and public participation in the work for environmental and social aspects of the project.

4) A brief explanation on "Existing Situation of HPP and Need of Rehabilitation" by Baluchaung No.1 Hydropower Station Manager

Mr. Than Win, Baluchaung No.1 Hydropower Station Manager of EPGE explained the history since 1992 and features of the Baluchaung No.1 HPP. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power generation capacity due to dilapidation by continuous operation for more than 25 years.

5) Importance of Environmental and Social Aspect for the Project to comply with both Myanmar legislations and the JICA Guidelines

Dr. Khin Lay Swe, Local consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and Myanmar legislations. Then, Dr. explained an IEE level study was required and now the study is in progress according to the JICA Guidelines. At the same time, Dr. also explained that any project is required to obtain prior permission, i.e. ECC from MONREC prior to implementation according to recently enacted EIA Procedure 2015. In addition, Dr. insisted roles of community participation and information disclosure in the project by using power point and hand out paper.

6) Q&A section

- *U Hpo Khin*, the village chief of So Le Sal village, mentioned that people of villages near the Hydropower Station have been served sufficient electric power supply until now. According to the National Vision 2020, all the peoples in the country have the right to benefit from sufficient power supply. In this regard, he requested EPGE and local government to install more distribution network for easy access to electric power supply by the communities

- *U Than Win*, *the Station Manager* answered that there are many governmental organizations relevant to electric power supply under the MOEE. The EPGE, which he belongs to is in charge of power generation. Regarding power distribution duty is in charge of another organization and he cannot make the decision for distribution of electric power. However, he recognized community's need, took note to inform EPGE and suggested that the community should request to local government and MOEE.

- *U Kyaw Myint*, villager of Law Ka Htoo, said location of existing Baluchaung No.1 HPP is very close to his village. However, his village and neighboring other villages have been not provided sufficient electric power supply since operation of the HPP. He also requested EPGE and local government to make effort providing sufficient electric power supply.

- *U Par Ral*, a villager from the village of Kan Ni, expressed a welcome to the rehabilitation project. At the same time, he also requested EPGE and local government to provide electric power supply to local communities, which are.in insufficient supply condition.

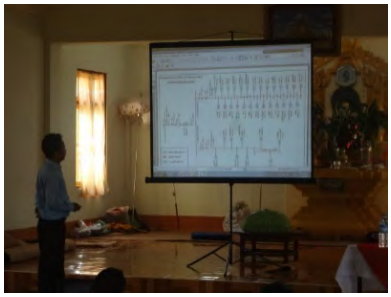
1) Venue – Monastery of So Le Sel Village

2) Most of Village Peoples came by motorbikes

3) Opening speech by GAD officer

4) Introduction of JICA Survey Team

5) Presentation by Hydropower Station Manager



6) Presentation by Hydropower Station Officer

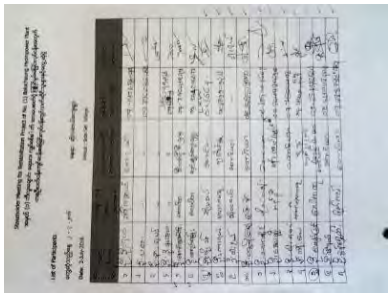
7) Presentation by Local Consultant

8) Participants at the meeting

9) Question and Comment by Participant - 1

10) Question and Comment by Participant - 2

11) Question and Comment by Participant - 3



12) Participants List

Source: JICA Survey Team

Photo 16.7-1 1st Stakeholder Meeting for Rehabilitation Project of Baluchaung No.1 HPP

(2) Second Stakeholder Meeting

1) Outline of the Meeting

a) Date and Time– September 17th, Saturday 2016 (From 9 AM to 11 AM)

b) Venue – So Le Sel village, Loikaw Township, Loikaw District, Kayah State

c) Participants –65 persons (Including village chiefs and peoples, Local Government Officers, HPP employees).

d) Meeting Agenda:

- Opening Speech by Loikaw Township Officer of GAD
- A Brief Explanation on the "Rehabilitation the Project and Work for Environmental and Social Considerations" by JICA Survey Team leader and a member in charge of Environmental and Social Considerations
- A Brief Explanation on "Existing Situation of Baluchaung No.1 HPP and Need of Rehabilitation" by Baluchaung No.1 Hydropower Station Manager
- A Brief Explanation on "Necessity of Environmental and Social Considerations for the Project in Terms of Legislations of Myanmar and the JICA Guidelines" by Local Consultant
- Q & A Section
- Closing speech by the Township Officer of GAD

2) Opening Speech by Loikaw Township Officer of GAD

U Aung Ko Latt, the GAD Officer gave the opening speech about the project and work for environmental and social considerations including IEE and second stakeholder meeting. He explained the purpose of the meeting and to emphasize the importance of the participation with peoples of local communities and officers of related departments. He also requested to local community to be patient for the delay in some times of implementation of development programs by the local government and departments because of the budget situation of the Kayah State.

3) A Brief Explanation on "the Rehabilitation the Project and Work for Environmental and Social Considerations" by JICA Survey Team

Mr. Matsunaga, sub-team leader of JICA Survey Team briefly explained the purpose and scope of the JICA project, "Preparatory Survey for the Project of Hydropower Plant Rehabilitation in Myanmar by comparing to the case of dilapidation and exchange of a mobile **phone** and battery" Rehabilitation is necessary for the sustainable use in a longer term. In addition, *Mr. Okuzawa, a team member* emphasized the importance of information disclosure and public participation in the work for environmental and social aspects of the project.

4) A brief explanation on "Existing Situation of HPP and Need of Rehabilitation" by Baluchaung No.1 Hydropower Station Manager

Mr.Than Win, Baluchaung No.1 Hydropower Station Manager explained the history since 1992 and features of the Baluchaung No.1 HPP. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power

generation capacity due to dilapidation by continuous operation for more than 25 years.

5) A brief explanation on "Importance of Environmental and Social Aspect for the Project to comply with both Myanmar legislations and the JICA Guidelines by Local Consultant

Dr. Khin Lay Swe, *Local Consultant* emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and existing Myanmar legislations. Then, Dr. explained the summary of the IEE level study for the possible impacts of this project on the people and environment. The impacts were estimated by different project stages, such as planning, construction, operation and after operation. Environmental issues, such as land use and topography, air and water pollution, soil contamination, solid wastes problem, etc. For the social environment and social services, township level social infrastructure, local economy, livelihoods, situation of gender and children, vulnerable groups -the poor, refugees, and indigenous of ethnic people etc. were identified and evaluated. The results suggested that there will be no significant negative impact of the rehabilitation project on the environment and the community.

In addition, Dr. emphasized the roles of community participation and information disclosure and thanked all participants for their cooperation for successful completion of the project. Dr. also requested the audience to give advice and suggestions on the project implementation.

6) Q&A section

- *Daw Khin Win*, from the Law Ka Htoo village said that he was worrying about the possibility of some negative impact from project activities. Particularly, it may affect the women and children. If it is likely to occur, women from targeted villages are willing to participate in monitoring activities of the project

- *U Mya Saung*, from the Sal Mile village said that at present they can receive the supplied water from dam, but sometime insufficient. He wanted to know whether the Project have a plan to supply water more regularly and sufficiently for target villages.

- *U Than Win*, the Station Manager answered that there are many governmental organizations relevant to electric power supply and distribution under the MOEE. The EPGE, which he belongs, is in charge of power generation. Regarding with power distribution, the responsibility is of another organization and he cannot make any decision for distribution of electric power. But He agreed that the villages near the dam should receive enough power supply and irrigation water with priority,

- *U Saw Eal*, villager of Law Ka Htoo, explained that location of existing Baluchaung No.1 HPP is very close to his village. He said that last month some members relating to EPGE made a survey in their village to set up a transformer for more distribution of electricity to his village. He asked EPGE and related departments whether the program is possible to realize soon or not"

- *U Than Win*, Station Manager answered that at present he could not answer that question. Because his duty is just for the power generation and does not directly concern with this. But he hoped that it will become in reality soon.

- *U Par Ral*, a villager from Kan Ni village, expressed a welcome to the rehabilitation project. At the same time, he requested EPGE and related department of local government to provide electric power supply to local communities in a sufficient power.

- *World Vision Myanmar (INGO)*, asked "Why SHM was not held in city hall of Kayah State? He suggested this project was related to the whole community and country, not only with the surroundings of the project site"

- *Dr. Khin, Local Consultant*, answered that "SHM is mainly based on the target community and environment which will be affected by the project. The surrounding villages near the project site will have more interest on the project and possible impacts and they need to know about the project"

- *U Kyaw Tun*, village tract administrator of Law Pi Ta Village Tract requested to related department and GAD officials to consider for the local community who are residing near the HPP. The villagers are willing to participate for the rural development activities to join hands with the government. They will follow the leadership of related department personnel for implementation activities.

1) Opening remarks by GAD Officer

2) Presentation by Station Manager of HPP

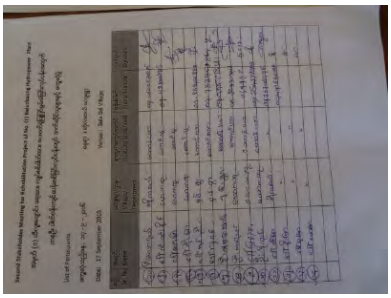
3) Presentation by the Local Consultant

4) Question and Comment by Participant - 1

5) Question and Comment by Participant - 2

6) Question and Comment by Participant - 3

7) Question and Comment by Participant - 4



8) Participants list

9) Participants came by motor bikes and cars as well as by walk

Source: JICA Survey Team

Photo 16.7-2 2nd Stakeholder Meeting for Rehabilitation Project of Baluchaung No.1 HPP

16.7.2 Sedawgyi Hydropower Plant

First stakeholder meeting was held on June 25th Saturday 2016 to disseminate outline the rehabilitation project plan and second stakeholder meeting was held on September 10th Saturday 2016 to inform the results of the IEE.

(1) Fist Stakeholder Meeting

1) Outline of the Meeting

a) Date and Time – June 25th, Saturday 2016 (From 10AM to 12AM)

b) Venue – Gway Pin village, Madaya Township, Pyin Oo Lwi District, Mandalay Region

c) Participants – 95 persons (Including village chiefs and peoples, Local Government Officers, HPP employees).

d) Meeting Agenda:

- Opening Speech by Madaya Township Officer of GAD
- Brief Explanation of the Rehabilitation the Project and Work for Environmental and Social Considerations by JICA Survey Team leader and a member in charge of Environmental and Social Considerations
- Existing Situation of Sedawgyi HPP and Need of Rehabilitation by Sedawgyi Hydropower Station Manager
- Necessity of Environmental and Social Considerations for the Project in Terms of Legislations of Myanmar and the JICA Guidelines the by Local Consultant
- Q & A Section
- Closing speech by the Township Officer of GAD

2) Opening Speech by Madaya Township Officer of GAD

U Soe Win, *the GAD Officer* gave the opening speech about of the project and work for environmental and social considerations including IEE, and emphasized the importance of the participation with peoples of local communities and officers of related departments. He also mentioned that existing multi-purpose Sedawgyi Dam have been contributing to the benefit to living and livelihood activities of communities with providing sufficient water resources for paddy land and farmland by irrigation dam as well as electric power supply by hydropower generation plant since 1989. As results, local economy of Madaya Township in agricultural and other sectors developed significantly.

3) Brief Explanation of the Rehabilitation the Project and Work for Environmental and Social Considerations

Mr. Sano, team leader of JICA Survey Team, team leader briefly explained the purpose and scope of the JICA project, "Preparatory Survey for the Project of Hydropower Plant Rehabilitation in the Myanmar". In addition, *Mr. Okuzawa, a Team member* also mentioned the importance of information disclosure and public participation in the work for environmental and social aspects of the project.

4) Existing Situation of Sedawgyi HPP and Need of Rehabilitation

Mr. Nyi Nyi Aung, Sedawgyi Hydropower Station Manager explained the history since 1989 and features of the Sadawgyi HPP. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power generation capacity due to dilapidation by continuous operation for more than 25 years.

5) Importance of Environmental and Social Aspect for the Project to comply with both Myanmar legislations and the JICA Guidelines

Dr. Khin Lay Swe, Local Consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and Myanmar legislations. Then, Dr. explained an IEE level study was required and now the study is in progress according to the JICA Guidelines. At the same time, Dr. also explained that any project is required to obtain prior permission, i.e. ECC from MONREC prior to implementation according to recently enacted EIA Procedure 2015 of Myanmar. In addition, Dr. insisted roles of community participation and information disclosure in the project by using power point and hand out paper

6) Q&A section

- *U Kyaw Naing*, the village leader from the village tract of Sale village, asked EPGE and JICA Survey Team to install more distribution network of electric power to rural village near the hydropower station.

- *U Nyi Nyi Aun*g, Station Manager respond to the question, there are many departments related to electric power supply including EPGE under the management of MOEE. He belongs to EPGE and he cannot make the decision for distribution of electric power. However, he can understand of community's needs. He suggested that the community should ask to related department for their needs.

- *U Mg Mg Naing*, a business man from the village of Gway Pin, said the Sedawgyi Dam has been contributing the benefit of local community not only in agriculture sector but also in electric power supply. However, unfortunately due to construction of the dam, some displacement of peoples and houses occurred, and cattle were damaged. Thus, he would like to suggest to the project rehabilitation for HPP for making proper management to avoid displacement and damage to animals and structures as well as to ensure safety.

- *U Hla Thaung*, a farmer from the village of Gway Pin, expressed a welcome to the rehabilitation project. At the same time he requested to the Survey Team to inform possible impacts and mitigation measures to local people, because he would like to know the impacts and prepare necessary means in future.

1a) Venue - Primary School of Gwan Pin Village

2) Most of Village Peoples using by Motorbikes

3) Pre-meeting with GAD Officer

4) Presentation by Station Manager

5) Photos of Sedawgyi HPP

6) Presentation by Local Consultant

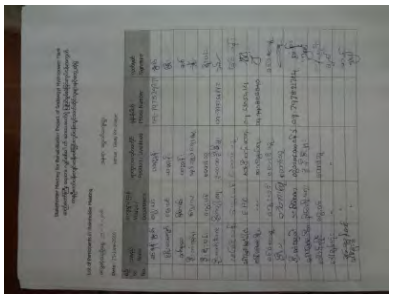
7) Presentation by Village Chief-1

8) Presentation by Village Chief-2

9) Participants - 1

10) Participants - 2

11) Closing remark by GAD Officer



12) Participants List

Source: JICA Survey Team

Photo 16.7-3 1st Stakeholder Meeting for Rehabilitation Project of Sedawgyi HPP

(2) Second Stakeholder Meeting

1) Outline of the Meeting

a) Date and Time– September 10th, Saturday 2016 (From 9 AM to 11 AM)

b) Venue – Yay Nan Thar village, Madaya Township, Pyin Oo Lwin District, Mandalay Region

c) Participants – 195 persons (Including village chiefs and villagers, Local Government Officers, HPP employees).

d) Meeting Agenda:

- Opening Speech by Madaya Township Officer of GAD
- A Brief Explanation of the Project and Work for Environmental and Social Considerations by JICA Survey Sub Team Leader and a leader of Environmental and Social Considerations.
- A Brief Explanation on Existing Situation of Sedawgyi HPP and Needs of Rehabilitation by Sedawgyi Hydropower Station Manager
- A Brief Explanation on the Necessity of Environmental and Social Considerations for the Project in Terms of Legislations of Myanmar and the JICA Guidelines by a Local Consultant
- Q & A Section
- Closing speech by the Township Officer of GAD

2) Opening Speech by Madaya Township Officer of GAD

U Soe Win, the GAD Officer gave an opening speech about of the project and work for environmental and social considerations including IEE. He emphasized the importance of the participation of local communities and officials of related departments. He also mentioned that existing multi-purpose Sedawgyi Dam have been contributing to the benefit to the living and livelihood activities of communities with providing sufficient water for paddy land and farmland irrigation as well as electric power supply from hydropower generation plant since 1989. As results, local economy of Madaya Township in agricultural and other sectors have been developed significantly.

3) Brief Explanation on Rehabilitation the Project and Work for Environmental and Social Considerations by JICA Survey Team

Mr. Matsunaga, sub-team leader of JICA Survey Team briefly explained the purpose and scope of the JICA project, “Preparatory Survey for the Project of Hydropower Plant Rehabilitation in Myanmar. He explained the important needs of rehabilitation work for and hydropower by giving an example of a mobile phone and its battery" Then, *Mr. Okuzawa, a team member* **insisted** the importance of information disclosure and public participation in the work for environmental and social aspects of the project.

4) Brief Explanation on “Existing Situation of Sedawgyi HPP and Need of Rehabilitation” by Sedawgyi Hydropower Station Manager

Mr. Nyi Nyi Aung, Sedawgyi Hydropower Station Manager explained the history of the

hydropower since 1989 and mentioned the current features of the Sedawgyi HPP. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and no increase of power generation capacity. The rehabilitation work is necessary to perform urgently because of the continuous operation for more than 25 years without performing any such rehabilitation work.

5) Brief Explanation on "Importance of Environmental and Social Aspect for the Project to comply with both Myanmar legislations and the JICA Guidelines by Local Consultant

Dr. Khin Lay Swe, Local consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and existing Myanmar legislations. Then, Dr. explained the summary of the IEE level study for the possible impacts of this project on the people and environment. The impacts were estimated by different project stages, such as planning, construction, operation and after operation. Environmental issues, such as land use and topography, air and water pollution, soil contamination, solid wastes problem, etc. For the social environment and social services, township level social infrastructure, local economy, livelihoods, situation of gender and children, vulnerable groups of the poor, refugees, and indigenous of ethnic people etc. were identified and evaluated.. The results suggested that there will be no significant negative impact of the rehabilitation project on the environment and the community.

Currently, the study is in progress and the report of the study team will be timely completed. Dr. expected the ECC will be approved by the ECD, MONREC. In addition, Dr. insisted the roles of community participation and information disclosure and thanks all participants for their cooperation for successful completion of the project.

6) Q&A section

- *U Maung Soe*, the village leader of Yay Nan Thar village, discussed on the current situation of the dam. He said that the dam is under threat because of the high sedimentation problem caused by gold mining activities in the upper part of the dam. The timber extraction of the watershed area which is damaging the dam day by day. It looks like a flat pan since the situation of sedimentation is more and more prominent. It is thought to be a cause for serious flooding paddy fields and settlements of low land area in rainy season. He asked concerned departments and JICA Survey Team to find ways and means of the improvement of dam situation in a timely manner. Proper management of Sedawgyi Dam and its watershed system is very important for all villages to make their livelihood sustainable.

- *U Nay Win*, the villager of Yay Nan Thar village asked to Irrigation Department. "Is there will sufficient water supply to villages while the project starts?"

- *U Than Htain*, *officer of the Department of Irrigation* answered that there will be no concern with the rehabilitation process and irrigation, so that no disturbances on irrigation schedules of the rice fields. He added that the Irrigation Department was ready to distribute for water supply to the villages same as before.

- *U Kyaw Naing*, a farmer from Sa Lay village, asked to the local consultant's presentation. In the presentation it was shown for the environmental study results that air pollution is expected to be no problem for the villagers. But he worries about solid waste, and noise and vibration produced by the project operation. He wants to know how to control that problem.

- *Dr. Khin Lay Swe* interpreted the question to the JICA Survey Team. Then, Mr. Matsunaga answered that waste water will not be released to the dam canal and river. In addition, Dr. answered that generated solid waste will be kept and stored in closed containers before release to environment. As for noise and vibration, it may occur in a very small intensity, if any.


1) Venue – Community hall, Yay Nan Thar village


2) Registration of participants


3) Opening remarks by Madaya Township GAD Officer


4) Presentation by Station Manager of Sedawgyi HPP


5) Presentation by Local Consultant


6) Presentation by participant -1


7) Presentation by participant -2


8) Partcipants of the Meeting


9) Participants came by motor bikes and cars as well as by walk

Source: JICA Survey Team

Photo 16.7-4 Second Stakeholder Meeting for the Rehabilitation Project of Sedawgyi HPP

16.8 Confirmation of Environmental and Social Considerations with the JICA Environmental Checklist

Confirmation of environmental and social considerations were carried out by reflecting the results of baseline data survey and IEE level study as well as the details of the proposed project plan to items cited in JICA Environmental Checklist for Hydropower/Dam/Reservoir sector one by one. Results of the confirmation for both Baluchaung No.1 and Sedawgyi HPPs are shown together in Table 16.8-1.

Table 16.8-1 Results of Confirmation with JICA Environmental Checklist for Hydropower/Dam/Reservoir

Category	Environmental Item	Main Check Items	Yes /No	Reasons
1 Permits and Explana-tion	(1) EIA and Environmental permits	(a) Have EIA reports been already prepared in official process?	Y	1) An IEE level study has been carried out by the JICA Survey Team in 2016. 2) EPGE has submitted the Project Proposal to MONREC to obtain ECC in July according to the Environmental Assessment Procedure 2015. 3) After reviewing in MONREC the project was required to prepare EMP. In this regard, EPGE prepared the EMP to submit to MONREC for getting the ECC.
		(b) Have EIA reports been approved by authorities of the host country's government?	Y	
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	N	EPGE submitted required EMP Report to MONREC to obtain ECC at the end of October 2016. After reviewing MONREC will issue ECC to EPGE.
		(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?		ECC to be issued by MONREC does not cover matters of land acquisition and resettlement, which are under control of Ministry of Home Affairs, although neither land acquisition nor resettlement is anticipated.
	(2) Explanation to the Public	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	Y	Stakeholder meetings were held two times for each HPP site. (1) Rehabilitation of Baluchaung No.1 HPP (BC1) 1) 1st stakeholder meeting was held on July 2nd, Saturday 2016 with participation of 66 persons (Including village chiefs and peoples, Local Government Officers, HPP employees). EPGE explained an outline of the Project plan and answered to questions and comments from the stakeholders. 2) 2nd stakeholders meeting was held on September 17th, Saturday 2016 with participation of 65 persons (Including village chiefs and peoples, Local Government Officers, HPP employees) In the meeting EPGE and local consultant explained the results of IEE level study to get comments and opinions from participants. (2) Rehabilitation of Sedawgyi HPP (SDW) 1) 1st SHM was held on June 25th Saturday 2016 with participation of 95 persons (Including village chiefs and peoples, Local Government Officers, HPP employees) EPGE explained an outline of the Project plan and answered to questions and comments from the stakeholders. 2) 2nd stakeholders meeting was held on September 10th Saturday 2016 with participation of 195 persons (Including village chiefs and villagers, Local Government Officers, HPP employees). In the meeting EPGE and local consultant explained the results of IEE level study to get comments and opinions from participants.

Category	Environmental Item	Main Check Items	Yes /No	Reasons
1 Permits and Explana-tion	(2) Explanation to the Public	(b) Have the comments from the stakeholders (such as local residents) been reflected to the project design?	Y	Comments from stakeholder will be reflected to the EMP and the project design for both HPPs.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	Y	"With project" including 8 power generation alternatives and "Without project" were compared in view of environmental and social considerations.
2 Pollution Control	(1) Air Quality	Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards?	Y	1) Air pollutant emission such as PM and NOx are anticipated by operation of construction machines and vehicles for construction work as well as by traffic of trucks delivering replaced equipment and device. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling, structure construction are not expected. In addition, traffic volume of access roads by trucks delivering replaced facilities, equipment and devices are in a small number. Further, surrounding areas farmland and a lone straggling village. Therefore, possible impacts will be in a small scale and temporary.
	(2) Water Quality	(a) Does the water quality of dam pond/ reservoir comply with the country's ambient water quality standards? Is there a possibility that proliferation of phytoplankton and zooplankton will occur?	Y	(1) In Myanmar at present ambient water quality standards have not been established. (2) Discharge of wastewater by rehabilitation work is anticipated by operation of construction machines and vehicles for rehabilitation work even in a little amount.
		(b) Does the quality of water discharged from the dam pond/reservoir comply with the country's ambient water quality standards?	Y	No change from existing condition in quantity and quality of water intake and sluice from dam by hydropower generation is anticipated in rehabilitation work and operation of power generation.
		(c) Are adequate measures, such as clearance of woody vegetation from the inundation zone prior to flooding planned to prevent water quality degradation in the dam pond/reservoir?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
		(d) Is there a possibility that reduced the river flow downstream will cause water quality degradation resulting in areas that do not comply with the country's ambient water quality standards? (HP &AILI)	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
		(e) Is the discharge of water from the lower portion of the dam pond/reservoir (the water temperature of the lower portion is generally lower than the water temperature of the upper portion) planned by considering the impacts to downstream areas?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
	(3) Solid Wastes	(a) What kind of wastes will be generated by implementation of rehabilitation project? Are generated wastes by rehabilitation properly treated and disposed of in accordance with the country's regulations?	Y	(1) In Myanmar regulation of solid waste management in national level has not been established. (2) Through construction work, generation of solid wastes such as general waste, industrial waste and hazardous waste is anticipated by replacement and repair of facilities, equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities. (3) Industrial waste: Materials that make up the wastes are metals (mainly steel), rubbers, woods, plastics, ceramics, etc. In addition, it is anticipated generation of wasted oil including dilapidated insulator oil (about 2.5 m^3) by the replacement of transformers in Sedawgyi HPP. Some parts of replaced facilities and equipment made of steel, ceramics, woods will be reused and recycled as materials for other houses and facilities. (4) Hazardous waste: In case of Baluchaung No.2 generation of hazardous PCB containing solid wastes was reported through replacement of dilapidated transformers. In case of both Baluchaung No.1 and Sedawgyi HPP other insulator oils other than PCB

Category	Environmental Item	Main Check Items	Yes /No	Reasons
				were used for transformers. However, it is also anticipated that generation of solid waste containing hazardous material such as mercury and lead even in very small amount, and asbestos through exchange of dilapidated equipment and/or devices with new ones.
		(b) Are generated hazardous and dangerous wastes properly segregated from other wastes, stabilized, treated, and disposed in accordance with the country's standards?	Y	1) In Myanmar regulation of hazardous waste management including treatment and final disposal is not established yet. 2) Solid waste contaminated with hazardous materials will be segregated, transferred and stored with the name plate in sealed containers or leak-proof plastic bags, which are installed in the special warehouse with roof and wall within the Plant site.
		(c) Are earth and sand generated by excavation properly treated and disposed of in accordance with the country's regulations?	Y	In Myanmar regulation of solid waste is not established yet. In addition, basically generation of earth and sand is not anticipated by the rehabilitation work.
	(3) Soil Contamination	(a) Are adequate measures taken to prevent contamination of soil and groundwater by leachates from the waste disposal sites?	Y	All the hazardous materials containing solid wastes will be properly segregated, transferred and stored in closed containers made of concrete materials.
	(4) Noise and Vibration	Is there a possibility that noise generated from the project related sources, such as vehicles traffic will affect ambient noise?	Y	Although construction work will be carried out within the plant site, generation of noise and vibration is anticipated by operation of construction machines and vehicles for construction work as well as by traffic of trucks delivering replaced equipment and device. However, possible impacts due to noise and vibration will be in a small scale and temporary.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	N	All the activities for rehabilitation will be carried out within existing HPP site, where no Environmentally sensitive areas are found. Thus, no negative impact is expected due to the project.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	N	The project site does not encompass areas such as primeval forests, tropical rain forests, ecologically valuable habitats.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	N	The project site does not encompass areas such as primeval forests, tropical rain forests, ecologically valuable habitats.
		(c) Is there a possibility that the project will adversely affect downstream aquatic organisms, animals, plants, and ecosystems? Are adequate protection measures taken to reduce the impacts on the ecosystem?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
		(d) Is there a possibility that installation of structures, such as dams will block the movement of the migratory fish species (such as salmon, trout and eel those move between rivers and sea for spawning)? Are adequate measures taken to reduce the impacts on these species?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures, such as weirs will adversely affect the surface and groundwater flows (especially in "run of the river generation" projects)?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
	(4) Topography and Geology	(a) Is there a possibility that reductions in sediment loads downstream due to settling of suspended particles in the reservoir will cause impacts, such as scouring of the downstream riverbeds and soil erosion? Is there a possibility that sedimentation of the reservoir will cause loss of the storage capacity, water logging upstream, and formation of sediment deposits at the reservoir entrance? Are the possibilities of the impacts studied, and adequate prevention measures taken?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.

Category	Environmental Item	Main Check Items	Yes /No	Reasons
		(b) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas (especially in run of the river generation projects and geothermal power generation projects)?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
4 Social Environment	(1) Involuntary Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	N	All the activities for rehabilitation will be carried out within existing HPP site. Thus, neither land acquisition nor resettlement is expected.
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	N	
		(c) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	N	
		(d) Is the compensations going to be paid prior to the resettlement?	N	
		(e) Is the compensation policies prepared in document?	N	
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	N	
		(g) Are agreements with the affected people obtained prior to resettlement?	N	
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	N	
		(i) Are any plans developed to monitor the impacts of resettlement?	N	
	(2) Living Condition and Livelihood	(a) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
		(b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood of local people?	N	All the activities for rehabilitation will be carried out within existing HPP site. Therefore, it is anticipated no change of land use.
		(c) Is there any possibility that the project facilities adversely affect the traffic systems?	Y	All the activities for rehabilitation will be carried out within existing HPP site. However, during construction stage there is a possibility to cause inconvenience to local traffic condition due to traffic of construction vehicles and trucks delivering replaced equipment and device.
		(d) Is there any possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
		(e) Is the minimum flow required for maintaining downstream water uses secured?	Y	Rehabilitation work will be carried out within existing HPP site and water uses during operation will not be changed from existing situation.
		(f) Is there any possibility that reductions in water flow downstream or seawater intrusion will have impacts on downstream water and land uses?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there will be no change in condition of HPP operation for power generation.
		(g) Is there any possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, *filariasis*) will be introduced?	N	

Category	Environmental Item	Main Check Items	Yes /No	Reasons
		(h) Is there any possibility that fishery rights, water usage rights, and common usage rights, etc. would be restricted?	N	
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, there are found no cultural, religious and historical heritage sites in and nearby. Thus, negative impact is not anticipated.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	N	Construction work will be limited to exchange of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing HPP site. Thus, negative impact on landscape is not anticipated.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	Y	Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, there is found no situation for necessary considerations with the poor and vulnerable peoples such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and Township area. However, if proper care and management by local government and relevant organization are not given to them, discontent and some conflict may give rise.
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	Y	
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	Y	Measures to abide Law on labour and the proposed Law on Occupational Health and Safety will be incorporated into the EMP and to be monitored in the construction work
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	Y	Following tangible considerations will be incorporated in EMP and EMoP: (i) Any worker and personnel who enter into construction sites have to bear safety shoes and hats for construction works. (ii) Site manager of the contractor must conduct morning assembly every day by collecting all the labourers and give instructions to them on safety control of construction site and thoroughly conduct safety management of the site. (iii) In the construction site where heavy machines for construction are operated, intrusiveness except concerned parties should be banned. (iv) Consider safety handling and storage in airtight containers of hazardous and dangerous materials.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	Y	Preparation of environmental and safety management plan, and conducting education of traffic safety and public and occupational health to workers and staff. (d) Proper management and education of guards and/or relevant personnel not to infringe safety and security of residents and staff and workers.
		(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	Y	In the project plan measures to control security guards not to violate safety of project site and residents, is incorporated, if any.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Y	Following measures will be incorporated into EMP and to be monitored in the rehabilitation work. (1) Air pollution: (i) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (ii) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (iii) Monitor air pollutants emission and ambient air quality, if necessary. (2) Water pollution: (i) Proper treatment of water pollutants generated from construction work. 2) Surface run-off from the construction site shall be directed to silt traps or sedimentation basin before reuse or discharge with help of channels.

Category	Environmental Item	Main Check Items	Yes /No	Reasons
				(3) Soil contamination: (i)To keep clean storage sites of construction equipment, (ii) To install storage tank for preventing spill and leakage of lubricating oil and asphalt emulsifier etc. (iii) Training of workers for proper handling of toxic materials. (4) Noise pollution: (i) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (ii) Use equipment with low-noise and vibration. (iii) Installation of soundproof walls/acoustic enclosures and provision of buffer zones. (5)Waste: (i) Consider ways to minimize waste generation in the rehabilitation work plan. (ii) Enlightenment and education of rehabilitation workers for waste management based on 3R principle (reduce, reuse, recycle). (iii) Solid waste generated will be carried out by proper segregation, collection, treatment, reuse and recycle. Then remained waste will be transferred to designated dumping site for final disposal. (iv) Hazardous waste contained in a small amount of mercury, lead, asbestos will be segregated, transferred and stored in sealed containers installed designated facilities within or near the site.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	N	All the activities for rehabilitation will be carried out within existing HPP site. In addition, no valuable natural environment (ecosystem) is distributed in surrounding areas Thus, no negative impact is anticipated due to the project.
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	Y	To avoid or minimize traffic disturbance and nuisance to local people and communities, following measures will be conducted: 1) Prior to construction work, inform contents of the construction work and schedule, 2) Time shift of construction work. 3) Education of traffic safety and manner to construction workers and drivers, 4) Raise the traffic signal and arrange watchmen on approach road. 5) Equip sheet cover to prevent scattering dust from the bed of truck. 6) Setting staff in charge of complaints.
	(2) Accident Prevention Measures	(a) Is a warning system established to alert the inhabitants to water discharge from the dam?	Y	Warning system was already established.
	(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Y	In the project plan environmental monitoring program is incorporated in the project plan.
		(b) What are the items, methods and frequencies of the monitoring program?	Y	In the EMoP, items relating to expected negative impacts as well as necessary permissions are selected and indicator, methods and frequencies as well as responsible institutions are described.
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	Y	In the EIA Procedures MONREC is responsible for implementing the project monitoring. However, to date institutional arrangement of the monitoring framework including budget has not been established yet in MONREC Thus, an in the Project plan the monitoring will be implemented under adequate monitoring framework under the consultation with MONREC and/ or referring to the JICA Guidelines by EPGE itself.
		(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	Y	According to the EMP and EMoP of the project, environmental monitoring will be carried out to comply with both Myanmar legislations and the JICA Guidelines. In the implementation if there will be uncertainty, consult with ECD and other related organizations to obtain their instruction.

Category	Environmental Item	Main Check Items	Yes /No	Reasons
6 Note		(a) Where necessary, pertinent items described in the Roads, Railways and Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).	N	Not necessary.
		(b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	N	Not necessary.
	Reference to Checklist of Other Sectors	(b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	N	Not necessary.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	Y	Negative impact on global warming is not expected due to following reasons. 1) Construction stage: Generation of GHG such as CO_2 due to construction vehicles and machines .is expected in a small scale and temporary. Thus, impact on global warming and climate change is negligible. 2) Operation stage: Rehabilitation of both HPPs may give rise more efficient and stable electric power supply. This will enhance to generate much lower emission of CO_2.

Source: JICA Survey Team

16.9 Supporting Activities to EPGE to obtain ECC from MONREC

16.9.1 Reason to obtain ECC from MONREC

Project for Rehabilitation of existing Baluchaung No.1 and Sedawgyi HPPs is required to comply with both the JICA Guidelines and Myanmar legislations.

According to the JICA Guidelines an IEE level study was required. Thus, the study was conducted by the JICA Survey Team and results are shown in the above documents from Sections 16.1 to 16.8 of Chapter 16.

In addition, as mentioned in Section 16.1 (3), according to the EIA Procedure 2015, any project in Myanmar is required to obtain prior permission, i.e. ECC from MONREC before implementation (before commencement of construction work).

Procedures of obtaining the ECC from MONREC is as follows:

(a) The proponent, EPGE prepares the Project Proposal for Rehabilitation of Baluchaung No.1 and Sedawgyi HPPs to MONREC through MOEE.

(b) After accepting the Project Proposal, MONREC (ECD is in charge of the work) will review and carry out screening to decide necessary environmental assessment study, i.e. EIA, IEE or EMP within 15 working days.

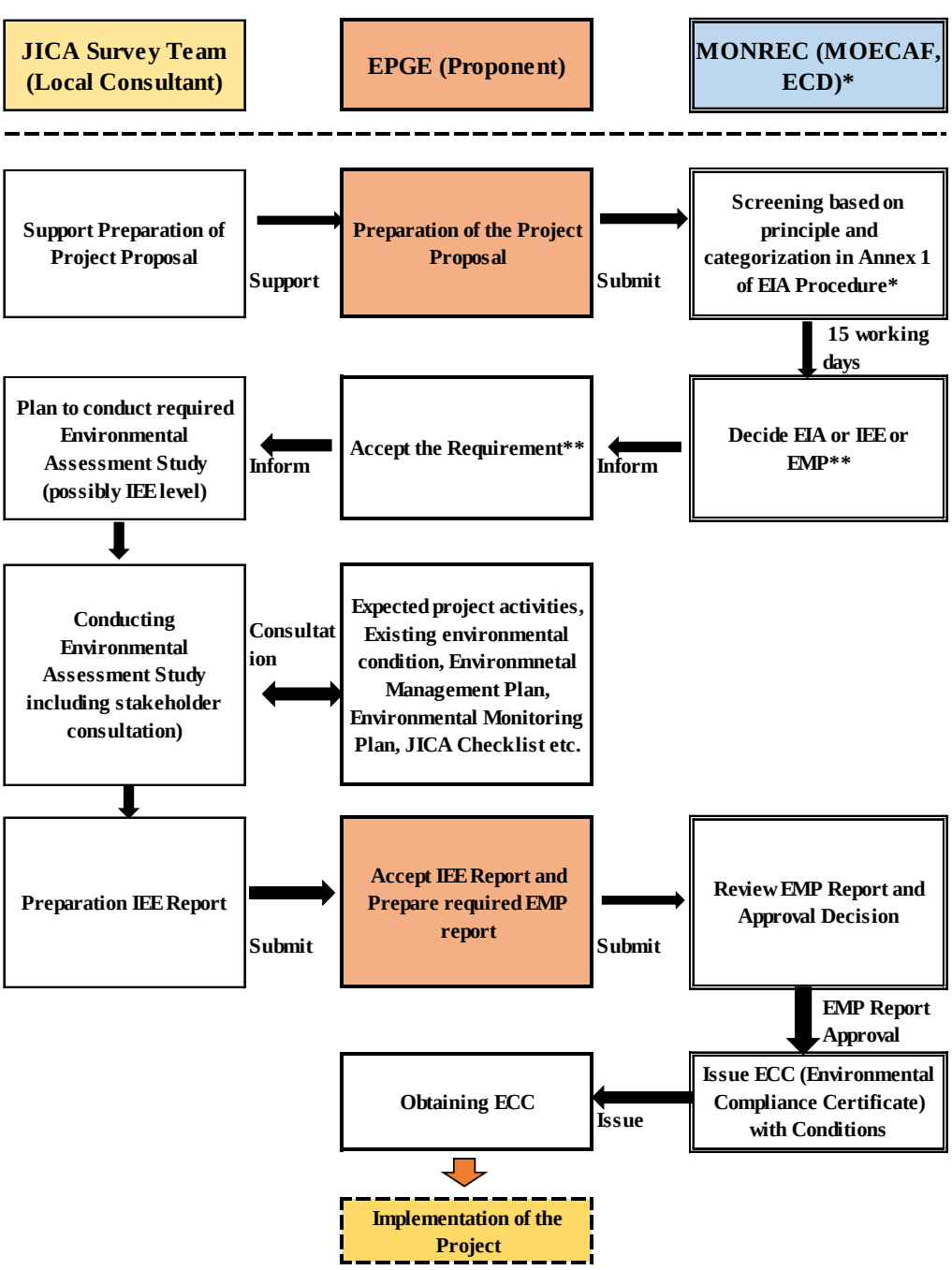
(c) After the screening, MONREC (ECD) informed to the proponent (EPGE) required environmental assessment study through MOEE.

(d) EPGE will conduct required environmental assessment study and submit the Report to MONREC.

(e) After accepting the Report, MONREC will review the Report to comply with the requirement and decide whether issuing the ECC or not.

(f) For implementation of the Project it is necessary to obtain the ECC from MONREC at latest before commencement of construction work.

Schematic procedures of supporting activities by JICA Preparatory Study Team to EPGE to obtain the ECC from MONREC are shown in Fig. 16.9-1.



Note 1: * MONREC (former MOECAF), ECD, ECC, EIA Procedure - Environmental Assessment Procedure 2015.
Note 2: ** It was informed that tentatively EMP is required for the Project from MONREC (as of September 30th 2015)

Source: JICA Survey Team

Fig. 16.9-1 Schematic Procedures Supporting Activities by JICA Survey Team for EPGE to obtain the ECC

16.9.2 Progress of the Processes as the end of October 2016

Progress of the procedures are as follows as of the end of October 2016.

(a) The Project Proposal was submitted to MONREC by EPGE through MOEE in July 2106.

(b) According to hearing to Director of ECD in charge of reviewing and screening, formal letter will be sent to MOEE from ECD within a few weeks (as of September 29th 2016).

(c) After the screening, MONREC informed to EPGE that the Project is required to prepare EMP for each HPP.

(d) EPGE requested the JICA Study Team to prepare EMP by the letter on October 12th 2016.

(e) JICA Study Team prepared the EMP for Rehabilitation Project of Baluchaung No.1 HPP and Sedawgyi HPP separately and submitted to EPGE on October 18th 2016.

(f) EPGE submitted to MONREC through MOEE at the end of October 2016.

(g) ECD (MONREC) is reviewing and examining the EMPs for decision of approval to provide the ECC to EPGE. According to the EIA Procedure, it takes at least 30 working days after submission of the EMPs by EPGE.

EMP documents submitted to EPGE are shown in Annex 16.1-1 and 16.1-2.
Official letter from MONREC regarding Project Proposal Screening to obtain ECC is shown in Annex 16.2.

CHAPTER 17

CONCLUSIONS AND RECOMMENDATIONS

Chapter 17 Conclusions and Recommendations

17.1 Conclusions

Major rehabilitation equipment and facilities selected based on site inspection and relevant data/information for Baluchaung No.1 and Sedawgyi HPPs (Hydropwoer Plants) are summarized in Table 17.1-1 and Table 17.1-2.

The following contents described in Final report were discussed with EPGE (Electric Power Generation Enterprise) and finalized.

- Final selection of equipment / facilities to be rehabilitated
- Basic design of equipment / facilities to be rehabilitated
- Rehabilitation work plan and schedule
- Rehabilitation work cost estimate
- Project procurement plan (package)
- Project implementation plan and schedule
- Project cost estimate
- Project implementation structure plan

Rehabilitation of existing Baluchaung No.1 and Sedawgyi HPPs is to be conducted through replacement, repair or addition of equipment and facilities without expansion of area / facilities and no increase in power discharge. So, there will be no changes in the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities such as farming and livestock, and living conditions of residents in surrounding area are required.

The Project Proposal was submitted to MONREC (Ministry of Natural Resource and Environmental Conservation) by EPGE through MOEE (Ministry of Electricity and Energy) in July 2016. After the screening and verification of this rehabilitation project, MONREC issued official letter to EPGE that the Project is required to prepare EMP (Environmental Management Plan) for each HPP in October 2016. In this connection, EPGE submitted EMP to MONREC through MOEE at the end of October 2016.

Table 17.1-1 Summary of Major Rehabilitation Equipment/Facilities (Baluchaung No.1 HPP)

Rehabilitation item		Action	Q'ty	Remarks
Turbine	Turbine Runner	R/A	1 set	The existing spare runner for one unit. A new runner for another unit.
	Guide Vane	R/A	1 set	One new complete set for one unit. One complete existing set for another unit, if the component condition is good. If the condition is unfavorable, additional one complete set will be ordered for another unit.
	Guide Vane Bearing and Stem Bush	R	2 sets	for 2 units
	Shear Pin	R	2 sets	for 2 units
	Gate Servomotor	P	2 sets	only for consumable parts
	Guide Bearing	R	2 sets	for 2 units
	Shaft Sleeve	R	2 sets	for 2 units
	Head Cover	P	2 sets	only for wearing parts
	Stay Ring	P	2 sets	only for wearing parts
	Inlet Valve	P	2 sets	only for wearing parts
	Inlet Valve Servomotor	P	2 sets	only for wearing parts
	Cooling Water Supply System	P/R	1 set	One set for the plant system for local On-Off switches. A dusting screen device for the inlet of cooling water pipe is to be provided.
	Water Drainage System	P/R	1 set	One set for the plant system for local control panels and local On-Off switches. Water level detecting equipment is to be replaced.
	Pressure Oil Supply System	P/R	1 set	One set for the plant system. Oil sump tanks and air compressor sets are to be replaced. Local On-Off switches are to be replaced.
	Overhead Crane	P/R	1 set	Parts to be repaired and/or replaced are to be checked and specified by a supervisor of the crane manufacturer.
Generator	Stator winding	R	2 sets	
	Rotor winding	R	2 sets	
	Guide bearing	R	2 sets	
	Thrust bearing	R	2 sets	to plastic bearing
	Oil cooler	R	2 sets	
	Air cooler	R	2 sets	
	Excitation system	R	2 sets	to brushless (AC) excitation system
Control and Protection System	Operation Board	R	1 set	Updated to total digital system without SCADA system
	Speed Governor System	R	1 set	Updated to integrated GOV / AVR system
	Automatic Voltage Regulator	R	1 set	Updated to integrated GOV / AVR system
	Protection Relay (Analog Type)	R	1 set	Updated to digital type
	SSG Speed Monitor	R	1 set	Replaced with new components
	Fire Alarm System	R	1 set	Replaced with new components
	Control Cable	R	1 set	Replaced with new cables
S/S and T/L facilities	132kV Circuit Breaker	R	1 set	3 phase, 145kV, 800 A, 20kA (1sec)
	11 kV Main and Local Cubicle	R	12 panels	All panels will be replaced with VCB.
	LV Switchgear	R	1 lot	400V, Indoor, type, ACB or MCCB
	DC battery	R	2 sets	Lead acid, valve-regulated type, 300AH
	DC Battery Charger	R	2 set	Input: AC 400V, Output: DC230V
	Emergency Diesel Generator Set	R	1 set	300 kVA, 50Hz, 400/230V
	T/L Protection Panel	R	1 set	Over current/ground fault relay is equipped as back-up.

Rehabilitation item		Action	Q'ty	Remarks
Gate and Penstock, Civil and Communication Facilities	Dawtacha Intake Dam (DTC)	R	5 sets	Position Meters for Spillway Gate Hoist
		R	7 sets	A/D Converters for Intake Gate
		R	12 sets	Digital Indicators for Remote Control Panel
		R	2 sets	Water Level Gauges for Headrace and Reservoir
		R	2 sets	Fixed Type Radio Stations for DTC-BHP1 and DTC-MBY
		R	1 set	Mobile Handset Transceiver for DTC
	Regulation Pondage (PDG)	P	1 set	Main Valve Hoist for Sand Flash Gate
		R	1 set	Water Level Gauge for Upstream #1
	Low Pressure Pipe Line	R	10 sets	Seals for Expansion Joint
	Penstock	R	1 set	Seal for Expansion Joint
	Powerhouse (BHP1)	R	1 set	Position Meter for Hoist of Emergency Discharge Valve
		R	1 lot	Consumable Materials for Emergency Discharge Valve
		R	1 set	Fixed Type Radio Station for BHP1-DTC
		R	1 set	Mobile Handset Transceiver for BHP1
	Mobye Dam (MBY)	R	4 sets	Brake Motors for Spillway Gate Hoist
		R	1 set	Water Level Gauge for Reservoir
		R	1 set	Rain Gauge for MBY
		R	1 set	Fixed Type Radio Station for MBY-DTC
		R	1 set	Mobile Handset Transceiver for MBY
	Loikaw City Gauging Station (LKW)	R	1 set	Water Level Gauge for LKW
		R	1 set	Mobile Handset Transceiver for LKW

Note; R: Replacement, P: Repair, A: Addition, I: Inspection

Table 17.1-2 Summary of Major Rehabilitation Equipment/Facilities (Sedawgyi HPP)

Rehabilitation item		Action	Q'ty	Remarks
Turbine	Turbine Runner Vane	R	2 sets	Newly developed by CFD, and turbine model test is required.
	Turbine Runner Hub	R	2 sets	ditto
	Guide Vane	R	2 sets	ditto
	Guide Vanes Stem Bush	R	2 sets	All bushes are to be replaced
	Inner Head Cover	R	2 sets	Newly developed by CFD, and turbine model test is required.
	Turbine Guide Bearing	R	2 sets	Replaced for segment-type bearings
	Shaft Sleeve	R	2 sets	(one of wearing parts)
	Shaft Sealing Box	R	2 sets	Newly designed device is to be applied
	Runner Vane Return Mechanism	R	2 sets	In harmony with the rehabilitation of generator exciter and digitalized governor system.
	Pressure Oil Supply Pipe for Runner Vane Servomotor	R/A	2 sets	Components related to the new runner are to be replaced. The other existing components are to be used.
	Cooling Water Supply System	P/R	1 set	One set for the plant system Pump sets, motor-driven valves and local control panels are to be replaced. Existing hand-operated strainers are to be replaced to new motor-driven ones. Small exposed water pipes are to be replaced to stainless steel ones.
	Water Drainage System	P/R	1 set	One set for the plant system All drainage pumps, local control panels and water level detectors are to be replaced.
	Pressure Oil Supply System	P/R	1 set	One set for the plant system Oil sump tank set, air compressor sets, local control panels, etc. are to be replaced.
	Overhead Crane	P/R	1 set	Parts to be repaired and/or replaced are to be checked and specified by a supervisor of the crane manufacturer.
Generator	Stator winding	R	2 sets	
	Rotor winding	R	2 sets	
	Guide bearing	R	2 sets	
	Thrust bearing	R	2 sets	to plastic bearing
	Air cooler	R	2 sets	
	Brake system	R	2 sets	
	Lubrication oil cooling system	R	2 sets	
	Excitation system	R	2 sets	to brushless (AC) excitation system
	Neutral grounding device	R	2 sets	Neutral grounding transformers are to be replaced.
Control and Protection System	Total digital system (SCADA)	R	1 set	Updated to total digital system including SCADA function
	Automatic Voltage Regulator	R	1 set	Updated to all-in-one protective control unit and exciter control panel
	Generator Vibration Monitor	R	1 set	Replaced with new components
	Control Cable	R	1 set	Replaced with new cables
	Ventilation System	R	1 set	3 air-intake units, 3 air-exhaust units (roof-mounted), and intake/exhaust control panels are updated.
	Governor Control Equipment	R	1 set	Updated to digital PID-GOV system
	Air Conditioning System	R	1 set	Replaced with new components

Rehabilitation item		Action	Q'ty	Remarks
S/S and T/L facilities	Generator Transformer	R	7 sets	5.1MVA/set, 132/11 kV, incl. Spare Tr.
	Switch Equipment (All)	R	1 lot	132 kV CB: 5sets, 132 kV DS: 7 sets, CT: 12 pcs, CVT: 9 pcs, LA: 12 pcs
	132/11 kV Powerhouse Service Trans	A	1 set	132/11 kV, 5 MVA, 50 Hz, ONAN
	11 kV Vacuum Circuit Breaker	R	10 panels	Metal-enclosed panel with VCB, DS, CT, VT and SA.
	11 kV Phase Shift Transformer	R	1 set	11/11 kV, 5 MVA, 50 Hz, ONAN
	Powerhouse Service Transformer	R	2 sets	Indoor type, 11/0.4 kV, 500 kVA, cast-resin mold
	Emergency Diesel Generator Set	R	1 set	300 kVA, 50Hz, 400/230V
	Plant DC Battery Bank	R	2 sets	Lead acid, valve-regulated type, 300AH
	DC Battery Charger	R	2 set	Input: AC 400V, Output: DC230V
	400 V House Service Equipment	R	1 lot	400V, Indoor, type, ACB or MCCB
Gate and Penstock, Civil and Communication Facilities	Penstock Gate Facilities	R	2 sets	Gate Leafs for Penstock Gate No.1 and No.2
		R	2 sets	Guide Frames for Penstock Gate No.1 and No.2
		R	2 sets	Hydraulic Hoists for Penstock Gate No.1 and No.2
		R	2 sets	Local Control Panels for Penstock Gate No.1 and No.2
	Powerhouse	A	2 sets	Water Level Gauges for Reservoir and Tailrace

Note; R: Replacement, P: Repair, A: Addition, I: Inspection

17.2 Recommendations

17.2.1 Recommendations on the Project Implementation

(1) Facilitation for Repair Works of Civil Facilities at Sedawgyi HPP by ID-MOALI

As mentioned in Chapter 8 and 9, it is necessary to implement repair works for water leakage in order to conduct the field survey and preliminary design of penstock gates. In order to start the preliminary design on schedule, repair works must be completed in 2017. Because maintenance gates are under the jurisdiction of ID (Irrigation Department) of MOALI (Ministry of Agriculture, Livestock and Irrigation), it is strongly recommended for MOEE to facilitate ID to implement repair works certainly.

In addition it is also necessary to implement repair works for spillway gate. Currently, six (6) spillway gates are in operation and one (1) gate is not in operation due to the trouble. Although it is possible to discharge the design flood, it is expected to implement repair works to secure the reliability for dame safety. Therefore it is also recommended for MOEE to facilitate ID to do it, too.

(2) Enhancement of Power System surrounding Baluchaung HPPs

As mentioned in Chapter 11, generated electricity at Baluchaung HPPs is transmitted through the 230kV T/L (Transmission Line) of Baluchaung No.2 HPP – Taungoo (existing) and 132kV T/L of Baluchaung No.2 – Kalaw (exiting). Although currently, T/L capacity is enough, it will be overloaded after the completion of rehabilitation works of Tigyit Coal TPP (Thermal Power Plant).

Now, new 230kV T/L of Baluchaung No.2 – Shwemyo are planned to be commissioned soon. After the commissioning of this T/L, capacity is enough to transmit electricity generated at Baluchaung HPPs. Therefore it is recommended for MOEE to start the operation of 230kV T/L of Baluchaung No.2 – Shwemyo certainly for the improvement of reliability of power system surrounding Baluchaung HPPs.

(3) Allocation of EPGE Personnel and Budget for the Project Implementation

Rehabilitation works will be implemented by workers and engineers from EPGE under the supervising by the Contractor. As rehabilitation works will be implemented at Baluchaung No.1 HPP and Sedawgyi HPP in parallel, it is necessary for EPGE to allocate the budget and personnel during the rehabilitation works.

(4) Environmental and Social Considerations

1) ECC (Environmental Compliance Certificate) from ECD (Environmental Conservation Department) of MONREC is required for implementation of the Project, therefore EPGE shall submit EMP to ECD through MOEE in order to get ECC well in advance before commencement of the Project.

2) There is no staff and section in charge of environmental matters in EPGE, therefore it is necessary to set up organizations and staff in charge of proper management and control issues of environmental and social considerations in EPGE.

3) EPGE shall consider information disclosure and public participation throughout the whole stages of the power projects in order that the project can be appropriately accepted to

relevant stakeholders including communities.

17.2.2 Recommendation for EPGE

(1) Operation and Maintenance of rehabilitation equipment / facilities

So far replacement timing of aged deteriorated equipment / facilities has been determined by uniform replacement cycle. Recently diagnosing technologies of equipment / facilities are being developed in order to find out proper timing of replacement of equipment / facilities. This new method is adopted to diagnosing of static coil of generators, main transformers, power cables and so on. It is very useful to transfer these diagnosing technologies to Myanmar. In this connection, it is recommended to provide training program to learn these technologies and attend actual practice in Japan

(2) Financial and Budgetary Situation of the Organizations under MOEE

1) As Chapter 15 analyzed the past financial performance and the future prospect of the organizations in charge of generation, transmission, and distribution of electricity under the MOEE, the tariff had not been sufficient to cover the necessary cost for the operation of these organizations, which forced the government to continue to provide the subsidy to make up for the loss. Furthermore, it is expected that there will remain the gap between 1) the cost required for the operation and maintenance and 2) the tariff in the foreseeable future, though the gap is likely to become narrow.

2) From the financial perspective, the tariff level should be adjusted to reflect the required cost and the reasonable profit in the long run, with the advice of the Electricity Regulatory Commission, which is expected to be newly established under the new Electricity Law as the regulatory body in the power sector. For this purpose, the relevant regulations on tariff determination and procedure needs to be formulated and enforced.

3) In the short- and middle-term approach, the government needs to continue to provide subsidy for not only maintaining the proper operation and maintenance of generation, transmission, and distribution, but also upgrading the existing facilities and equipment and adding the new ones until the organizations in charge can generate the necessary profit to be used for this purpose.

ANNEXES

Annex 4 : Rehabilitation of Turbine and Auxiliary Equipment

Annex 5 : Rehabilitation of Generator and Auxiliary Equipment

Annex 6 : Rehabilitation of Control and Protection System

Annex 7 : Rehabilitation of Relevant Substation and Transmission Line Facilities inside Power Plants

Annex 8 : Rehabilitation of Gates and Penstock

Annex 9 : Rehabilitation of Civil Facilities

Annex 11 : Power System Analysis for required Expansion of Transmission Line

Annex 16 : Environmental and Social Considerations

ANNEX 4

REHABILITATION OF TURBINE AND AUXILIARY EQUIPMENT

(1) Check List (Baluchaung No.1 Hydropower Plant)

(2) Check List (Sedawgyi Hydropower Plant)

(3) Measurement on the Clearance of Mechanical Components (Baluchaung No.1 Hydropower Plant)

(4) Measurement on the Clearance of Mechanical Components (Sedawgyi Hydropower Plant)

【Turbine】 Site Inspection Check List

[Plant Name]: Baluchaun No.1 [Unit No].: #1 & #2

Inspection Date; February 2016, "1 – 11"

Note : Good・○ Bad・× ※・specially noted

Equipment	Majour Class	Sub-class 1	Sub-class 2	Inspection Item		Inspection Point	Method	Results		Photo	Remarks
								Unit-1	Unit-2		
Turbine	Turbine Interior	Casing (Inner portion)	Casing Body	Casing Interior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, Foreign Materials, etc.	Visual Inspection	○	○	○	No damage and defectc
			Man Hole	Surface, Packing	Visual Condition	Water Leak, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	ditto
			Stay Ring	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	ditto
			Stay Vanes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	ditto
		Guide Vanes		Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	No damage and defect
				Seat Plates	Visual Condition	Defects, Erosion and Corrosion, etc.	Visual Inspection	○	○	○	ditto
				Side Gaps	Visual Condition	Upper and lower clearance conditions	Visual Inspection	※	※	○	Upper and lower gap measurement; approx.0.7mm (average), which is larger than the design value of 0.3mm Foreign materials such as plastic film and grass, etc. were tucked at side gaps
		Runner	Runner Vanes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	×	×	○	Cavitation erosion at below portions (1) Runner vane trailing edge area on suction surface; max. depth of 3–5mm (2) Runner vane leading edge area on suction surface near runner band; max. depth of 5–7mm
			Runner Cone/Hub	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	×	×	○	Cavitation erosion at the portion of runner band outer periphery; max. depth of 5–8mm
			Runner Liner	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	n.a.	n.a	-	
			Seal Rings	Surface, Seal Gaps	Visual Condition	Gap Condition, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	No damage and defect
		Draft Tube	Upper Draft Tube	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	No damage and defect
			Air Admi. Pipes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	No damage and defect
			Discharge Ring	Surface	Visual Condition	Peripheral Gap, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	※	※	○	Slight cavitation pitting on the surface just downstream of the root of air pipe
	Turbine Exterior	Casing (Exposed portion)	Casing Body	Casing Exterior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	No damage and defect
			Man Hole	Surface	Visual Condition	Bolting condition, openab;e/closable condition, damages, etc.	Visual Inspection	○	○	○	No damage and defect

Gude Vane Servomotor	Body	General	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Oil piping	General	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	○	○	○	Generally, no damage and defect, no oil leakage, but slight oil leakage at one of flange connections of oil piping of the left servomoter of #2
	Connecting Device	General	Visual Condition	BacklLash, Damages, Bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
G.V. Mecha-nism	Mechanism parts	General	Visual Condition	Back lash, Damage, Bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Shear Pin	General	Visual Condition	Setting condition, Damage, lead wire condition, etc.	Visual Inspection	※	※	○	No experience of shear pin fracture, but some troubles of the limit switch atached to a shear pin
	Sliding parts	Surface	Visual Condition	Damages, lubricating condition, etc.	Visual Inspection	○	○	○	No damage and defect
Turbine Shaft		Surface	Visual Condition	Damages, Bolting conditiond, etc.	Visual Inspection	○	○	○	No damage and defect, but slight rust on thesurface was found
Turbine Bearing	Oil tank	General	Visual Condition	Oil/Water leakage, Damage, bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Temp. device	General	Visual Condition	Mounting condition, Lead wire condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Oil/Water pipings	General	Visual Condition	Oil/Water leakage, Damage, bolting condition, etc.	Visual Inspection	※	※	○	Heavily rusted portions were found on water pipes
Head Cover		Surface	Visual Condition	Damage, Water leakage, Accumulation of earth/sand, Bolting condition	Visual Inspection	○	○	○	No damage and defect, but thin soil film covered the upper surface of the cover
Pipings (in turbine pit)	Oil/Water/ Air pipings	General	Visual Condition	Oil/Water/Air leakage, damage, Fixing condition, etc.	Visual Inspection	※	※	○	Heavily rusted portions were found on the outer surfaces of water pipes
Electrical Wirerings (in turbine pit)		General	Visual Condition	Damage, Fixing condition, etc.	Visual Inspection	○	○	○	No damage and defect
Runner Vane Operating Mechanism		General	Visual Condition	Return lod/wire condition, Damage, bolting condition, etc.	Visual Inspection	n.a.	n.a.	-	

		Others									
【Special Note】	The inspection was carried out by S. Kushimoto,										

【Turbine】 Site Inspection Check List

[Plant Name]: Sedawgyi [Unit No].: #1 & #2

Inspection Date; February 2016, " 15 – 25"

Note : Good・○ Bad・× ※・specially noted

Equipment	Majour Class	Sub-class 1	Sub-class 2	Inspection Item		Inspection Point	Method	Results		Photo	Remarks
								Unit-1	Unit-2		
Turbine	Turbine Interior (Note-1)	Casing (Inner portion)	Casing Body	Casing Interior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, Foreign Materials, etc.	Visual Inspection	–	※	○	No damage and defect, but many potions having rust blisters were found. No foreign material are in the casing.
			Man Hole	Surface, Packing	Visual Condition	Water Leak, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	–	○	○	No damage and defect
			Stay Ring	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	–	※	○	No damage and defect, but many potions having rust blisters were found.
			Stay Vanes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	–	○	○	No damage and defect
		Guide Vanes		Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	–	○	○	No damage and defect
				Seat Plates	Visual Condition	Defects, Erosion and Corrosion, etc.	Visual Inspection	–	○	○	ditto
				Side Gaps	Visual Condition	Upper and lower clearance conditions	Visual Inspection	—	※	○	Upper and lower gap measurement; .1.5– 2.0mm (average), which is larger than the design value of 0.5mm No Foreign material were tucked at side gaps.
		Runner	Runner Vanes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	—	×	○	Cavitation erosion at below portions (1) At around runner vane periphral inlet portion on suction surface; heavy erosion having max. depth of 10– (14)mm (2) And portions having cavitation erosion, max. depth of 1– 3mm, on the fin surface near the portions of (1). (3) Slightly cavitated portions at the root of vanes on the disk surfaces, suction surface
			Runner Cone/Hub	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	—	○	○	No damage and defect
			Runner Liner	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	—	n.a	-	
			Seal Rings	Surface, Seal Gaps	Visual Condition	Gap Condition, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	–	n.a	-	
		Draft Tube	Upper Draft Tube	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	–	○	○	No damage and defect
			Air Admi. Pipes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	n.a	n.a	-	
			Discharge Ring	Surface	Visual Condition	Peripheral Gap, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	—	※	○	Some abration signatures on the surface facing the runner vane outer periphery were found. The measuring results of gaps between runner vane peripheries and the corresponding surface of discharge ring were scattered between 0.55– 5.34mm. The design gap is 2mm
	Turbine Exterior	Casing	Casing Body	Casing Exterior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	○	○	○	No damage and defect

(Exposed portion)	**Man Hole**	Surface	Visual Condition	Bolting condition, openab;e/closable condition, damages, etc.	Visual Inspection	○	○	○	No damage and defect
Gude Vane Servomotor	**Body**	General	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Oil piping	General	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Connecting Device	General	Visual Condition	BacklLash, Damages, Bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
G.V. Mecha–nism	**Mechanism parts**	General	Visual Condition	Back lash, Damage, Bolting condition, etc.	Visual Inspection	※	※	○	Generally no damage and defect, but excess water leakage from the shaft seal packing of some guide vane stems
	Shear Pin	General	Visual Condition	Setting condition, Damage, lead wire condition, etc.	Visual Inspection	※	※	○	No experience of shear pin fracture, but some troubles of malfunction alert by the fracture detector atached to the shear pin portion occurred.
	Sliding parts	Surface	Visual Condition	Damages, lubricating condition, etc.	Visual Inspection	○	○	○	No damage and defect
Turbine Shaft		Surface	Visual Condition	Damages, Bolting conditiond, etc.	Visual Inspection	※	※	○	No damage and defect on the turbine shaft itself, but the oil level gauge of the oil tank attached on the turbine shaft became deteriorated.
Turbine Bearing	**Oil tank**	General	Visual Condition	Oil/Water leakage, Damage, bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
	Temp. device	General	Visual Condition	Mounting condition, Lead wire condition, etc.	Visual Inspection	○	○	○	No damage and defect, but its deterioration might be developed.
	Oil/Water pipings	General	Visual Condition	Oil/Water leakage, Damage, bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
Head Cover		Surface	Visual Condition	Damage, Water leakage, Accumulation of earth/sand, Bolting condition	Visual Inspection	○	○	○	No damage and defect, and considerably clean despite of the long operation
Pipings (in turbine pit)	**Oil/Water/ Air pipings**	General	Visual Condition	Oil/Water/Air leakage, damage, Fixing condition, etc.	Visual Inspection	※	※	○	No damage and defect, but the inside of small water pipes might be deteriorated.
	Drainage Pumps	General	Visual Condition	Operating conditions, etc.	Visual Inspection	×	×	○	One of two pumps was gamaged and out of service, both units.
Electrical Wirerings (in turbine pit)		General	Visual Condition	Damage, Fixing condition, etc.	Visual Inspection	○	○	○	No damage and defect

		Runner Vane Operating Mechanism		General	Visual Condition	Return lod/wire condition, Damage, bolting condition, etc.	Visual Inspection	○	○	○	No damage and defect
		Others									
【Special Note】		The inspection was carried out by S. Kushimoto,									
		〈Note−1〉 The inspection of the turbine interior of unit−#1 was not carried out because of much water leakage from the intake stop log.									

Baluchaun No.1 Hydropower Plant / Turbine internal inspection

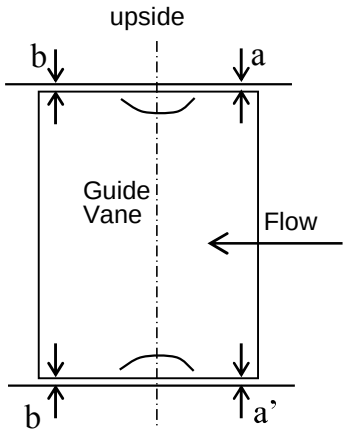
Measurement on the clearance of mechanical components

Note) The measurement was carried out by the staff of Baluchaun (1) plant according to the suggestion by the JICA study team during the turbine internal inspection on 3 Feb. 2016 for unit #2.

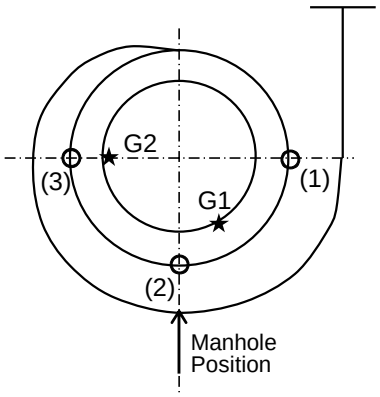
1. Guide vane clearance at the top and bottom portion

(unit: mm)

Position	Unit #1			Unit #2		
	Location			Location		
	(1)	(2)	(3)	(1)	(2)	(3)
a	0.90	0.90	0.90	0.90	0.70	0.90
a'	1.40	1.20	1.40	0.90	0.90	0.90
b	0.15	0.20	0.15	0.10	0.10	0.10
b'	0.70	0.60	0.70	0.70	0.70	0.70

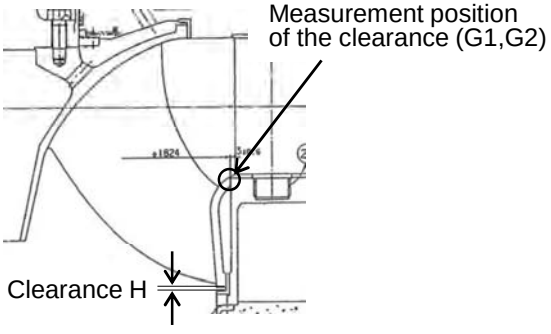


Side view of guide vane



Planar positions of measuring points

3. Clearance between the runner periphery and the inner surface of discharge ring



(unit: mm)

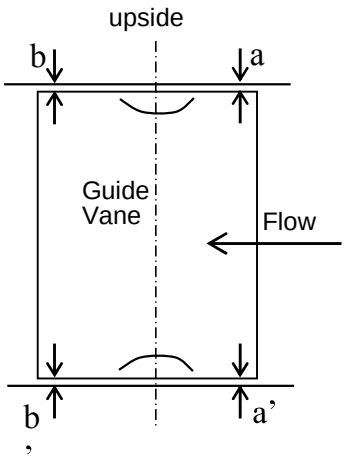
Position		Measurement
	G design value	3±0.6
Unit #2	G1	2.5
	G2	2.8
	H design value	13
Unit #2	H	14
Unit #1	H	15

Sedawgyi Hydropower Plant / Turbine internal inspection

Measurement on the clearance of mechanical components (for Unit #2)

Note) The measurement was carried out by the staff of Sedawgyi plant according to the suggestion by the JICA study team during the turbine internal inspection on 16 Feb. 2016.

1. Guide vane clearance at the top and bottom portion



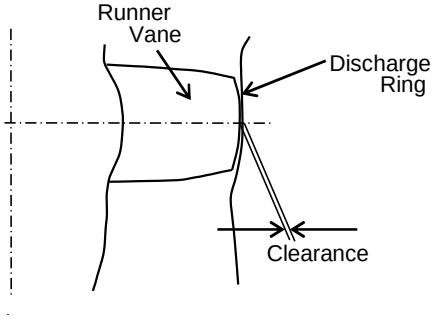
No	Wicket Gate No	a	a'	a+a'	b	b'	b+b'
1	1	1.45	1.86	3.31	0.4	2.01	2.41
2	2	1.05	3.28	4.33	0.08	1.5	1.58
3	3	0.75	2.55	3.3	0.75	2.25	3
4	4	1	2.9	3.9	0.18	1.45	1.63
5	5	1.2	2.75	3.95	0.45	2.45	2.9
6	6	1.32	3.25	4.57	0.5	2.4	2.9
7	7	1.28	3.1	4.38	0.6	3.2	3.8
8	8	1.37	3.55	4.92	0.5	3.05	3.55
9	9	1.3	3.05	4.35	0.5	0.8	1.3
10	10	1.1	2.15	3.25	0.55	2.7	3.25
11	11	1.5	1.9	3.4	0.5	0.4	0.9
12	12	1.5	1.4	2.9	0.45	0.2	0.65
13	13	1.65	1.4	3.05	0.38	0.75	1.13
14	14	1.7	1	2.7	0.4	2.85	3.25
15	15	1.96	2.25	4.21	0.3	2.5	2.8
16	16	1.95	2.7	4.65	0.15	2.5	2.65
17	17	1.8	2.71	4.51	0.45	3.1	3.55
18	18	1.5	3.23	4.73	0.38	2.85	3.23
19	19	1.1	3.1	4.2	0.9	2.7	3.6
20	20	1.25	3.35	4.6	0.7	2.4	3.1

2. Guide vane clearance at the contact portion in fully closed position

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Upper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3. Clearance between the runner periphery and the inner surface of discharge ring

No	Runner	Clearance
1	B1-3	3.4 mm
2	B2-3	2.15 mm
3	B3-3	0.55 mm
4	B4-3	2.15 mm
5	B5-3	5.34 mm
6	B6-3	3.4 mm



ANNEX 5

REHABILITATION OF GENERATOR AND AUXILIARY EQUIPMENT

(1) Check List (Baluchaung No.1 Hydropower Plant)

(2) Check List (Sedawgyi Hydropower Plant)

(3) Measurement of Insulation Resistance for Generator

(4) Vibration Measurement

Check List on Generator　Plant Name；Baluchaung No.1　Unit No；1　Date；February 8, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Generator	Generator			General	Oil leakage, Water leakage	レ		
		Stator		Core, Frame	Transformation, Dust, Looseness, Rust, etc.	レ	○	no abnormal condition
				Coil	Damage, Transformation, Looseness, oil, etc.	レ	○	ditto
		Rotor		Pole	Damage, Crack, etc.	レ	○	ditto
		Air cooler		Air cooler	Water leakage, Looseness, etc.	レ	○	frequent water leakage, not much rust inside of cooling water piping
		Oil Cooler		Oil Cooler	oil leakage, Water Leakage, Looseness, etc.	レ		no abnormal condition
		Oil lifter	Pump	Pump	Running condition, oil Leakage. Looseness, etc.	△	○	detrioration of pump/motor and control equipment.
			Motor	Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc.	△		
			Controller	Controller	Looseness, Damage of contact, etc.	△		
			Piping, Valve	Piping, Valve	Oil leakage, etc.	レ		
		Break		Break	Air leakage, oil leakage, etc.	レ	○	
				Break ring	Crack, Transformation, etc.	△	○	several slide scaring
				Shoe	Wear, Transformation, etc.	レ	○	
			Controller	General	Looseness, Transformation. Damage, etc.	△	○	detrioration of control equipment
				Limit SW	Damage, Transformation, Looseness, etc.	△	○	
			Air tank	General	Leakage, Crack, etc.	レ	○	no spare valve
		Lower bracket		General	Damage, Crack, Looseness, etc.	レ		no abnormal condition
		Upper bracket		General	Damage, Crack, Looseness, etc.	×	○	oil leakage from welding points, oil leakage from upper bearing tank
		Shaft		Shaft, Coupling	Crack, Damage, Looseness, etc.	レ	○	no abnormal condition
		Thrust bearing		Oil tank	Water Contamination, Oil leakage. etc.	△	○	oil leakage on upper bracket

			Thermo sensor	Condition, Damage, etc.	レ		
		Guide bearing	Oil tank	Looseness, Damage, Water Leakage, Oil Leakage, etc.	△	○	oil leakage on lower bracket
			Thermo sensor	Condition, damage, etc.	レ		
		Collector	Collector ring	Damage, Looseness, Cable condition, etc.	×	○	rough surface of sliprings, much carbon powder, much oil leakage from uppert bearing tank, damaged lead wire of carbon brush
			Rotating part	Looseness, Crack, Damage, etc.	レ		
		Speed signal generator	General	Lead wire damage, looseness, etc.	レ	○	no abnormal condition
			Axis, gear	Crack, Damage, Looseness, etc.	レ		
		Relay	Flow	Damage, Looseness, Overheat, etc.	レ	○	no abnormal condition
			Oil level	Looseness, Oil leakage, etc.	△	○	lower bearing oil level is not read (not functional)
			Temperature	Looseness, Oil leakage, etc.	レ	○	no abnormal condition
Remarks							

Check List on Generator　Plant Name；Baluchaung No.1　Unit No；2　Date；February 3, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Generator	Generator			General	Oil leakage, Water leakage	レ		
		Stator		Core, Frame	Transformation, Dust, Looseness, Rust, etc.	レ	○	no abnormal condition
				Coil	Damage, Transformation, Looseness, oil, etc.	レ	○	ditto
		Rotor		Pole	Damage, Crack, etc.	レ	○	ditto
		Air cooler		Air cooler	Water leakage, Looseness, etc.	△	○	frequent water leakage, not much rust inside of cooling water piping
		Oil Cooler		Oil Cooler	oil leakage, Water Leakage, Looseness, etc.	レ		no abnormal condition
		Oil lifter	Pump	Pump	Running condition, oil Leakage. Looseness, etc.	△	○	detrioration of pump/motor and control equipment.
			Motor	Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc.	△		
			Controller	Controller	Looseness, Damage of contact, etc.	△		
			Piping, Valve	Piping, Valve	Oil leakage, etc.	レ		
		Break		Break	Air leakage, oil leakage, etc.	レ	○	
				Break ring	Crack, Transformation, etc.	△	○	several slide scaring
				Shoe	Wear, Transformation, etc.	レ	○	
			Controller	General	Looseness, Transformation. Damage, etc.	△	○	detrioration of control equipment
				Limit SW	Damage, Transformation, Looseness, etc.	△	○	
			Air tank	General	Leakage, Crack, etc.	レ	○	no spare valve
		Lower bracket		General	Damage, Crack, Looseness, etc.	レ		no abnormal condition
		Upper bracket		General	Damage, Crack, Looseness, etc.	△	○	oil leakage from upper baering tank
		Shaft		Shaft, Coupling	Crack, Damage, Looseness, etc.	レ	○	no abnormal condition
		Thrust bearing		Oil tank	Water Contamination, Oil leakage. etc.	△	○	oil leakage on upper bracket
				Thermo sensor	Condition, Damage, etc.	レ		

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
		Guide bearing		Oil tank	Looseness, Damage, Water Leakage, Oil Leakage, etc.	△	○	oil leakage on lower bracket
				Thermo sensor	Condition, damage, etc.	レ		
		Collector		Collector ring	Damage, Looseness, Cable condition, etc.	×	○	rough surface of sliprings, much carbon powder, much oil leakage from uppert bearing tank
				Rotating part	Looseness, Crack, Damage, etc.	レ		
		Speed signal generator		General	Lead wire damage, looseness, etc.	レ	○	no abnormal condition
				Axis, gear	Crack, Damage, Looseness, etc.	レ		
		Relay		Flow	Damage, Looseness, Overheat, etc.	レ	○	no abnormal condition
				Oil level	Looseness, Oil leakage, etc.	△	○	lower bearing oil level is not read (not functional)
				Temperature	Looseness, Oil leakage, etc.	レ	○	no abnormal condition
Remarks								

Check List on Excitation System　Plant Name；Baluchang No.1　　Unit No；1　　Date；February 8, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Excitation system	Exciter	Field circuit breaker		Mechanical part	Wear, Looseness, Breakage, Lubulication oil, etc.	レ	○	no abnormal condition, no spare(FCB)
				Indicator	Damage, etc.	レ		
				Close/open coil	Stain, Damage, Overheat, Looseness, etc.	レ		
				Wire, Terminal	Looseness, Overheat, etc.	レ		
		Excitation transformer		Conductor	Stain, Damage, Overheat, Looseness, etc.	レ	○	
				Insulator	Stain, Damage, etc.	△		Stain
				Meter	Damage, Oil leakage, etc.	レ		
Remarks								

Check List on Excitation System　Plant Name；Baluchang No.1　　Unit No；2　　Date；February 3, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Excitation system	Exciter	Field circuit breaker		Mechanical part	Wear, Looseness, Breakage, Lubulication oil, etc.	レ	○	no abnormal condition, no spare(FCB)
				Indicator	Damage, etc.	レ		
				Close/open coil	Stain, Damage, Overheat, Looseness, etc.	レ		
				Wire, Terminal	Looseness, Overheat, etc.	レ		
		Excitation transformer		Conductor	Stain, Damage, Overheat, Looseness, etc.	△	○	Damage on lead
				Insulator	Stain, Damage, etc.	△		Stain
				Meter	Damage, Oil leakage, etc.	レ		
Remarks		FCB(41) frequent troubles						

Check List on Neutral Grounding Device　Plant Name；Baluchaung No.1　Unit No；1　Date；February 8, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Neutral Grounding Device	Neutral Grounding Device			General	Crack, Breakage, Looseness, Rust, etc. on main devices	レ	○	no abnormal condition
					Damage, Looseness, etc. of grounding wire	レ		
					Crack, Damage Transformation, Stain, Rust, etc. of resistance device	レ		
Remarks								

Check List on Neutral Grounding Device　Plant Name；Baluchaung No.1　Unit No；2　Date；February 3, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Neutral Grounding Device	Neutral Grounding Device			General	Crack, Breakage, Looseness, Rust, etc. on main devices	レ	○	no abnormal condition
					Damage, Looseness, etc. of grounding wire	レ		
					Crack, Damage Transformation, Stain, Rust, etc. of resistance device	レ		
Remarks								

Check List on Generator　　Plant Name；Sedawgyi　　Unit No；1　　Date；February 22, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Generator	Generator			General	Oil leakage, Water leakage	レ		
		Stator		Core, Frame	Transformation, Dust, Looseness, Rust, etc.	レ	○	no abnormal condition
				Coil	Damage, Transformation, Looseness, oil, etc.	レ	○	ditto
		Rotor		Pole	Damage, Crack, etc.	レ	○	ditto
		Air cooler		Air cooler	Water leakage, Looseness, etc.	レ	○	a little bit rust inside of cooling water piping
		Oil lifter	Pump	Pump	Running condition, oil Leakage. Looseness, etc.	△	○	detrioration of pump/motor and control equipment.
			Motor	Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc.	△		
			Controller	Controller	Looseness, Damage of contact, etc.	△		
			Piping, Valve	Piping, Valve	Oil leakage, etc.	レ		
		Break		Break	Air leakage, oil leakage, etc.	レ	○	
				Break ring	Crack, Transformation, etc.	△	○	a little bit hot spots
				Shoe	Wear, Transformation, etc.	△	○	brake ring contact with the protection material to prevent scattering of the break
			Controller	General	Looseness, Transformation. Damage, etc.	△	○	detrioration of control equipment
				Limit SW	Damage, Transformation, Looseness, etc.	△	○	
			Air tank	General	Leakage, Crack, etc.	レ	○	
		Lower bracket		General	Damage, Crack, Looseness, etc.	△	○	oil leakage from lower baering tank
		Upper bracket		General	Damage, Crack, Looseness, etc.	△	○	oil leakage from upper baering tank
		Shaft		Shaft, Coupling	Crack, Damage, Looseness, etc.	レ	○	no abnormal condition
		Thrust bearing		Oil tank	Water Contamination, Oil leakage. etc.	△	○	oil leakage on upper bracket
				Thermo sensor	Condition, Damage, etc.	レ		

		Guide bearing	Oil tank	Looseness, Damage, Water Leakage, Oil Leakage, etc.	△	○	oil leakage on lower bracket
			Thermo sensor	Condition, damage, etc.	レ		
		Collector	Collector ring	Damage, Looseness, Cable condition, etc.	×	○	different from original carbon brush, no spare brush, much carbon powder, not fuctional earthing brush and mecanical speed switch
			Rotating part	Looseness, Crack, Damage, etc.	レ		
		Speed signal generator	General	Lead wire damage, looseness, etc.	×	○	4 of 6 sensors are not functinal
			Axis, gear	Crack, Damage, Looseness, etc.	レ		
		Relay	Flow	Damage, Looseness, Overheat, etc.	×	○	not functional
			Oil level	Looseness, Oil leakage, etc.	△	○	gauge without numerals
			Temperature	Looseness, Oil leakage, etc.	×	○	not functional
		Oil heat exchanger	Heat exchanger	Water leakage, Oil Leakage. Looseness, etc.	レ	○	
			Pump	Running condition, oil Leakage. Looseness, etc.	×		1 of 2 pumps has abnormal vibration. much oil leakage
			Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc.	×		1 of 2 pumps has abnormal vibration. much oil leakage
			Controller	Looseness, Damage of contact, etc.	×		detrioration of control equipment, loss of pressure gauge
			Piping	Water leakage. Oil leakage, etc.	△		much oil leakage
			Sump tank	Water leakage, Oil Leakage. Looseness, etc.	レ		
		Generator Heater	Controller	Looseness, Damage of contact, etc.	レ	○	detrioration of control equipment
Remarks							

Check List on Generator　　Plant Name；Sedawgyi　　Unit No；2　　Date；February 16, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Generator	Generator			General	Oil leakage, Water leakage	レ		
		Stator		Core, Frame	Transformation, Dust, Looseness, Rust, etc.	レ	○	no abnormal condition
				Coil	Damage, Transformation, Looseness, oil, etc.	レ	○	ditto
		Rotor		Pole	Damage, Crack, etc.	レ	○	ditto
		Air cooler		Air cooler	Water leakage, Looseness, etc.	レ	○	a little bit rust inside of cooling water piping
		Oil lifter	Pump	Pump	Running condition, oil Leakage. Looseness, etc.	△	○	was clogged. detrioration of pump/motor and control equipment.
			Motor	Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc.	△		
			Controller	Controller	Looseness, Damage of contact, etc.	△		
			Piping, Valve	Piping, Valve	Oil leakage, etc.	レ		
		Break		Break	Air leakage, oil leakage, etc.	レ	○	
				Break ring	Crack, Transformation, etc.	△	○	several hot spots
				Shoe	Wear, Transformation, etc.	△	○	partial loss of protection material to prevent scattering of the break powder
			Controller	General	Looseness, Transformation. Damage, etc.	△	○	detrioration of control equipment
				Limit SW	Damage, Transformation, Looseness, etc.	△	○	
			Air tank	General	Leakage, Crack, etc.	レ	○	
		Lower bracket		General	Damage, Crack, Looseness, etc.	△	○	oil leakage from lower baering tank
		Upper bracket		General	Damage, Crack, Looseness, etc.	△	○	oil leakage from upper baering tank
		Shaft		Shaft, Coupling	Crack, Damage, Looseness, etc.	レ	○	no abnormal condition
		Thrust bearing		Oil tank	Water Contamination, Oil leakage. etc.	△	○	oil leakage on upper bracket
				Thermo sensor	Condition, Damage, etc.	レ		

		Guide bearing	Oil tank	Looseness, Damage, Water Leakage, Oil Leakage, etc.	△	○	oil leakage on lower bracket
			Thermo sensor	Condition, damage, etc.	レ		
		Collector	Collector ring	Damage, Looseness, Cable condition, etc.	×	○	rough surface of lower slipring., different from original carbon brush, no spare brush, much carbon powder, not fuctional earthing brush and mecanical speed switch
			Rotating part	Looseness, Crack, Damage, etc.	レ		
		Speed signal generator	General	Lead wire damage, looseness, etc.	×	○	3 of 6 sensors are not functinal
			Axis, gear	Crack, Damage, Looseness, etc.	レ		
		Relay	Flow	Damage, Looseness, Overheat, etc.	×	○	not functional
			Oil level	Looseness, Oil leakage, etc.	△	○	gauge without numerals
			Temperature	Looseness, Oil leakage, etc.	×	○	not functional
		Oil heat exchanger	Heat exchanger	Water leakage, Oil Leakage. Looseness, etc.	レ	○	
			Pump	Running condition, oil Leakage. Looseness, etc.	×		1 of 2 pumps has abnormal vibration. much oil leakage
			Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc.	×		1 of 2 pumps has abnormal vibration. much oil leakage
			Controller	Looseness, Damage of contact, etc.	△		detrioration of control equipment
			Piping	Water leakage. Oil leakage, etc.	△		much oil leakage
			Sump tank	Water leakage, Oil Leakage. Looseness, etc.	レ		
		Generator Heater	Controller	Looseness, Damage of contact, etc.	レ	○	detrioration of control equipment
Remarks							

Check List on Excitation System　Plant Name；Sedawgyi　　Unit No；1　　Date；February 23, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Excitation system	Exciter	Field circuit breaker		Mechanical part	Wear, Looseness, Breakage, Lubulication oil, etc.	レ	○	no abnormal condition, no spare(FCB)
				Indicator	Damage, etc.	レ		counter(4045)
				Close/open coil	Stain, Damage, Overheat, Looseness, etc.	レ		
				Wire, Terminal	Looseness, Overheat, etc.	レ		
		Excitation transformer		Conductor	Stain, Damage, Overheat, Looseness, etc.	レ	○	
				Insulator	Stain, Damage, etc.	△		Stain
				Meter	Damage, Oil leakage, etc.	レ		
		Generator cubicle		Conductor	Stain, Damage, Overheat, etc.	×	○	repaired power cables (2 lines)
				Insulator	Stain, Damage, etc.	レ		
				PT, CT, SA, AR	Stain, Damage, etc.	レ		
				Wire, Terminal	Looseness, Overheat, etc.	レ		
Remarks								

Check List on Excitation System　Plant Name；Sedawgyi　　Unit No；2　　Date；February 17, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Excitation system	Exciter	Field circuit breaker		Mechanical part	Wear, Looseness, Breakage, Lubulication oil, etc.	レ	○	no abnormal condition, no spare(FCB)
				Indicator	Damage, etc.	レ		counter(4768)
				Close/open coil	Stain, Damage, Overheat, Looseness, etc.	レ		
				Wire, Terminal	Looseness, Overheat, etc.	レ		
		Excitation transformer		Conductor	Stain, Damage, Overheat, Looseness, etc.	レ	○	
				Insulator	Stain, Damage, etc.	△		Stain
				Meter	Damage, Oil leakage, etc.	レ		
		Generator cubicle		Conductor	Stain, Damage, Overheat, etc.	レ	○	
				Insulator	Stain, Damage, etc.	レ		
				PT, CT, SA, AR	Stain, Damage, etc.	レ		
				Wire, Terminal	Looseness, Overheat, etc.	レ		
Remarks								

Check List on Neutral Grounding Device　Plant Name；Sedawgyi　Unit No；1　Date；February 23, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Neutral Grounding Device	Neutral Grounding Device			General	Crack, Breakage, Looseness, Rust, etc. on main devices	レ	○	no abnormal condition
					Damage, Looseness, etc. of grounding wire	レ		
					Crack, Damage Transformation, Stain, Rust, etc. of resistance device	レ		
Remarks	Neutral transformer is dry type. The replacement will be considered.							

Check List on Neutral Grounding Device　Plant Name；Sedawgyi　Unit No；2　Date；February 17, 2016

Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Neutral Grounding Device	Neutral Grounding Device			General	Crack, Breakage, Looseness, Rust, etc. on main devices	レ	○	no abnormal condition
					Damage, Looseness, etc. of grounding wire	レ		
					Crack, Damage Transformation, Stain, Rust, etc. of resistance device	レ		
Remarks	Neutral transformer is dry type. The replacement will be considered.							

Measurement of Insulation Resistance for Generator

Plant Name ; Baluchaung No.1

Unit No. ; 2

Date ; February 2nd , 2016

Temperature ; １９． ６℃

Humidity ; ４７％

１． Insulation Resistance

	Insulation Resistance (MΩ)	Remarks
Stator Winding	4000 MΩ over (at 56 sec.)	DC 1000V Megger 1 Min.
Rotor Winding	23.7 MΩ	DC 500V Megger 1 Min.

Criteria ;

Stator Winding ; ≧１０MΩ

Rotor Winding ; ≧1 MΩ

２． Polarization Index (P.I.) of Stator Winding

Time	Insulation Resistance (MΩ)
1 min.	４０００MΩ over
2 min.	４０００MΩ over
3 min.	４０００MΩ over
4 min.	４０００MΩ over
5 min	４０００MΩ over
6 min.	４０００MΩ over
7 min.	４０００MΩ over
8 min.	４０００MΩ over
9 min.	４０００MΩ over
10 min.	４０００MΩ over

Criteria ; ≧２． ５

＊ It is estimated that P.I. is more than 2.5 from the test result.

Measurement of Insulation Resistance for Generator

Plant Name ; Baluchaung No.1

Unit No. ; 1

Date ; February 18, 2016

Temperature ; ２１．０℃

Humidity ; ３９％

１．Insulation Resistance

	Insulation Resistance (MΩ)	Remarks
Stator Winding	4000 MΩ over (at 50 sec.)	DC 1000V Megger 1 Min.
Rotor Winding	2000 MΩ over (at 7 sec.)	DC 500V Megger 1 Min.

Criteria ;

Stator Winding ; ≧１０MΩ

Rotor Winding ; ≧1 MΩ

２．Polarization Index (P.I.) of Stator Winding

Time	Insulation Resistance (MΩ)	Time	Insulation Resistance (MΩ)
10 sec.	１４２０MΩ	1 min.	４０００MΩ over
20 sec.	２２００MΩ	2 min.	４０００MΩ over
30 sec.	２７５０MΩ	3 min.	４０００MΩ over
40 sec.	３４４０MΩ	4 min.	４０００MΩ over
50 sec.	４０００MΩ over	5 min	４０００MΩ over
		6 min.	４０００MΩ over
		7 min.	４０００MΩ over
		8 min.	４０００MΩ over
		9 min.	４０００MΩ over
		10 min.	４０００MΩ over

Criteria ; ≧２．５

＊ It is estimated that P.I. is more than 2.5 from the test result.

Measurement of Insulation Resistance for Generator

Plant Name ; Sedawgyi

Unit No. ; 2

Date ; February 15 , 2016

Temperature ; ２７． ５℃

Humidity ; ４９％

１． Insulation Resistance

	Insulation Resistance（ＭΩ）	Remarks
Stator Winding	２２００ＭΩ	DC 1000V Megger 1 Min.
Rotor Winding	６２０ＭΩ	DC 500V Megger 1 Min.

Criteria ;

Stator Winding ; ≧１０ＭΩ

Rotor Winding ; ≧１ＭΩ

２． Polarization Index (P.I.) of Stator Winding

Time	Insulation Resistance（ＭΩ）	時間	Insulation Resistance（ＭΩ）
10 sec.	６８９ＭΩ	3 min.	４０００ＭΩ over
20 sec.	１０７０ＭΩ	4 min.	４０００ＭΩ over
30 sec.	１３２０ＭΩ	5 min	４０００ＭΩ over
40 sec.	１６６０ＭΩ	6 min.	４０００ＭΩ over
50 sec.	１９１０ＭΩ	7 min.	４０００ＭΩ over
1 min.	２２００ＭΩ	8 min.	４０００ＭΩ over
1min30sec	３０００ＭΩ	9 min.	４０００ＭΩ over
2 min.	３７００ＭΩ	10 min.	４０００ＭΩ over
2min13sec	４０００ＭΩ over		

Criteria ; ≧２． ５

＊ It is estimated that P.I. is more than 2.5 from the test result.

Vibration Measurement

Plant Name ; Baluchaung No.1
Unit No. ; 1
Date ; February, 1th, 2016
Temperature ; ２６．２℃
Humidity ; ２５％

	Measurement Portion		25% output	50% output	75% output	100 % output
Vibration (mm)	Upper Bracket	1 （V）	5.4 / 100	5.9 / 100	3.4 / 100	4.8 / 100
		2 （H）	3.4 / 100	4.1 / 100	4.2 / 100	3.9 / 100
		3 （H）	4.0 / 100	3.9 / 100	3.2 / 100	3.0 / 100
	Turbine Head Cover	5 （V）	88 / 100	38 / 100	18 / 100	17 / 100
		5 （H）	4.7 /100	4.1 / 100	3.1 / 100	2.9 / 100
Shaft Vibration (mm)	Upper Shaft		8 / 100	8 / 100	6 / 100	5 / 100
	Turbine Shaft		7 / 100	7 / 100	6 / 100	5 / 100

(Measurement Portion)
Upper Bracket 1 ; Penstock side
Upper Bracket 2 ; Penstock side
Upper Bracket 3 ; Downstream side of river
Turbine head cover 5 ; Penstock side
(Legend) V ; Vertical H ; Horizontal

Vibration Measurement

Plant Name ; Baluchaung No.1
Unit No. ; 2
Date ; February, 8, 2016
Temperature ; ２４．８℃
Humidity ; ３３％

	Measurement Portion		25% output	50% output	75% output	100 % output
Vibration (mm)	Upper Bracket	1 (V)	5.7 / 100	3.8 / 100	3.7 / 100	3.8 / 100
		2 (H)	2.5 / 100	1.8 / 100	1.6 / 100	1.9 / 100
		3 (H)	2.8 / 100	2.1 / 100	1.8 / 100	1.8 / 100
		3 (V)	6.1 / 100	4.1 / 100	4.7 / 100	3.4 / 100
	Turbine Head Cover	5 (V)	199 / 100	74 / 100	63 / 100	6.8 / 100
		5 (H)	4.0 /100	3.6 / 100	3.6 / 100	2.1 / 100
Shaft Vibration (mm)	Upper Shaft		7 / 100	6 / 100	5 / 100	5 / 100
	Turbine Shaft		7 / 100	7 / 100	5 / 100	4 / 100

(Measurement Portion)
Upper Bracket 1 ; Penstock side
Upper Bracket 2 ; Penstock side
Upper Bracket 3 ; Downstream side of river
Turbine head cover 5 ; Penstock side
(Legend) V ; Vertical H ; Horizontal

Vibration Measurement

Plant Name ; Sedawgyi
Unit No. ; 1
Date ; February, 15, 2016
Temperature ; ２７． ７℃
Humidity ; ４９％

	Measurement Portion		25% output	50% output	75% output	100 % output
Vibration (mm)	Upper Bracket	1 （V）	4.2 / 100	3.8 / 100	3.8 / 100	4.7 / 100
		2 （H）	1.8 / 100	2.0 / 100	2.1 / 100	2.1 / 100
		3 （V）	5.5 / 100	5.4 / 100	5.2 / 100	5.8 / 100
		3 （H）	2.1 / 100	1.6 / 100	1.6 / 100	2.2 / 100
	Lower Bracket	4 （V）	4.5 / 100	2.4 / 100	2.2 / 100	3.0 / 100
		4 （H）	0.8 / 100	0.6 / 100	0.9 / 100	1.4 / 100
	Turbine Head Cover	5 （V）	6.4 / 100	2.8 / 100	3.5 / 100	3.8 / 100
		5 （H）	2.5 / 100	1.6 / 100	2.1 / 100	3.3 / 100
Shaft Vibration (mm)	Turbine Shaft		5 / 100	5 / 100	4 / 100	4 / 100

(Measurement Portion)
Upper Bracket １ ; Penstock side
Upper Bracket ２ ; Penstock side
Upper Bracket ３ ; Downstream side of river
Lower Bracket ４ ; Penstock side
Turbine head cover ５ ; Upstream side of river
(Legend) Ｖ ; Vertical Ｈ ; Horizontal

Vibration Measurement

Plant Name ; Sedawgyi
Unit No. ; ２
Date ; February, 19, 2016
Temperature ; ２５．８℃
Humidity ; ５３％

	Measurement Portion		25% output	50% output	75% output	100 % output
Vibration (mm)	Upper Bracket	１（V）	2.8 / 100	4.0 / 100	2.8 / 100	2.8 / 100
		２（H）	1.7 / 100	1.4 / 100	1.3 / 100	1.1 / 100
		３（V）	2.8 / 100	2.5 / 100	3.9 / 100	2.8 / 100
		３（H）	1.9 / 100	1.7 / 100	1.4 / 100	2.0 / 100
	Lower Bracket	４（V）	4.4 / 100	2.3 / 100	1.9 / 100	2.6 / 100
		４（H）	1.0 / 100	0.7 / 100	0.9 / 100	0.9 / 100
	Turbine Head Cover	５（V）	5.1 / 100	2.1 / 100	3.3 / 100	2.9 / 100
		５（H）	2.2 / 100	1.5 / 100	1.8 / 100	1.8 / 100
Shaft Vibration (mm)	水車軸		5 / 100	4 / 100	4 / 100	5 / 100

（Measurement Portion）
Upper Bracket １ ; Penstock side
Upper Bracket ２ ; Penstock side
Upper Bracket ３ ; Downstream side of river
Lower Bracket ４ ; Penstock side
Turbine head cover ５ ; Upstream side of river
（Legend） Ｖ ; Vertical　Ｈ ; Horizontal

Measurement of Insulation Resistance for Generator

Plant Name ; Sedawgyi

Unit No. ; 1

Date ; February 18 , 2016

Temperature ; ２７． ８℃

Humidity ; ４９％

１． Insulation Resistance

	Insulation Resistance（ＭΩ）	Remarks
Stator Winding	２４４０ＭΩ	DC 1000V Megger 1 Min.
Rotor Winding	９６． ９ＭΩ	DC 500V Megger 1 Min.

Criteria ;

Stator Winding ; ≧１０ＭΩ

Rotor Winding ; ≧１ＭΩ

２． Polarization Index (P.I.) of Stator Winding

Time	Insulation Resistance（ＭΩ）	時間	Insulation Resistance（ＭΩ）
10 sec.	６５７ＭΩ	2 min.	４０００ＭΩ over
20 sec.	１１１０ＭΩ	3 min.	４０００ＭΩ over
30 sec.	１４５０ＭΩ	4 min.	４０００ＭΩ over
40 sec.	１７８０ＭΩ	5 min	４０００ＭΩ over
50 sec.	２１２０ＭΩ	6 min.	４０００ＭΩ over
1 min.	２４４０ＭΩ	7 min.	４０００ＭΩ over
1min30sec	３３００ＭΩ	8 min.	４０００ＭΩ over
1min53sec	４０００ＭΩ over	9 min.	４０００ＭΩ over
		10 min.	４０００ＭΩ over

Criteria ; ≧２． ５

＊ It is estimated that P.I. is more than 2.5 from the test result.

ANNEX 6

REHABILITATION OF CONTROL AND PROTECTION SYSTEM

(1) Check List (Baluchaung No.1 Hydropower Plant)

(2) Check List (Sedawgyi Hydropower Plant)

Preparatory Survey On Hydropwer Plants Rehabilitation Project In The Republic Of The Union Of Myanmar
Baluchang No.1 Hydropower Plant

Check List of Site Investigation
(Protective and Control Equipment)

Investigation date 1-11, February 2016

Hydro Power Group
Power System Engineering
THE KANSAI ELECTRIC POWER

Table of Contents

(1.Control Equipment 1) Check List of Site Investigation

【date】 3-11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo	Remarks
Control Equipment (Control Panel)	Control Equipment (Control Panel) (CON)			Control cubicle	Visual Inspection	Board installation state	×	1～13	・Mechanical type meter and operation switch ・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dust accumulation ・Aging degradation
						Installation state of connector and terminal	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Cooling fan for power supply unit	×		
						Installation state of connector and terminal at power unit section	×		
				Relay Unit	Visual Inspection	Board installation state	×	1～13	・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dust accumulation ・Mechanical type meter and operation switch ・Aging degradation.
						Installation state of connector and terminal	×		
						Indicator	×		
						Electrolytic capacitor	×		
						Contact point	×		
	Control cable and Wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～13	・Dusts accumulation on wires and terminal
				Control cable		Terminal and cable	×		・Dusts accumulation on control cables

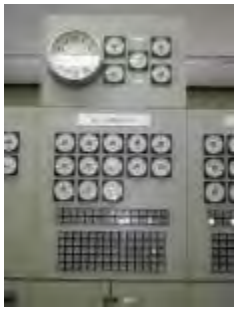
(Remarks)

CONTROL DESK	Manufactured in 1988	AUTOMATIC CNTROL	Manufactured in 1988
132kV LINE PANEL	Manufactured in 1988	No.1 AUTO CONTROL	1988
No.2 GENERATOR PANEL	1988	No.2 AUTO CONTROL	1988
No.1 GENERATOR PANEL	1988	AUTO MATIC SYNCHRONIZER	1988
STATON SERUICE PANEL	1988	TEMPERATURE RECORDER	1988
11KV FEEDER PANEL	1988	WATER LEVEL GOVVERNOR	1988

(Control room)
EMERGENCY DISCHARGE OUTLET REMOTE CONTROL PANEL
Manufactured in 1988

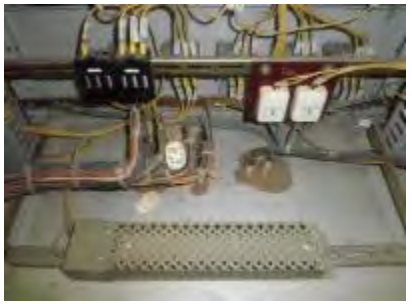
(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment) Overall	(Control Equipment) Details	(Control Equipment) Details	Remarks
CON 1				･Mechanical type meter and operation switch ･Manufactured in 1988 (28 year-old) ･No inspection record after COD ･Trouble record of "77E" switch of unit 2 ･Dusts accumulation ･Aging degradation
CON 2				･Mechanical type meter and operation switch ･Manufactured in 1988 (28 year-old) ･Dusts accumulation ･Aging degradation
CON 3				･Mechanical type meter and operation switch ･Manufactured in 1988 (28 year-old) ･No inspection record after COD ･Dusts accumulation ･Aging degradation
CON 4				･Mechanical type meter and operation switch ･Manufactured in 1988 (28 year-old) ･No inspection record after COD ･Dusts accumulation ･Aging degradation

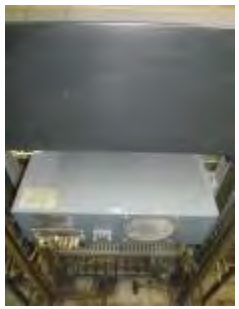
(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment) Overall	(Control Equipment) Details	(Control Equipment) Details	Remarks
CON 5				・Mechanical type meter and operation switch ・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation
CON 6				・Mechanical type meter and operation switch ・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation
CON 7				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays
CON 8				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment) Overall	(Control Equipment) Details	(Control Equipment) Details	Remarks
CON 9				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays
CON 10				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays
CON 11				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays
CON 12				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment) Overall	(Control Equipment) Details	(Control Equipment) Details	Remarks
CON 13				・Manufactured in 1988 (28 year-old) ・No inspection record after COD ・Dusts accumulation ・Aging degradation of timer and auxiliary relays

(2.Control Equipment 2) Check List of Site Investigation

【date】 3-8, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (HAC)	Remarks
Control Equipment (Control Panel)	Control Equipment (Control Panel) (CON)	Control Power Unit (Control Power Panel) (CON-H)	AC Control Power Unit (Control Power Panel) (CON-HAC)	Overall	Visual Inspection	State of bus	○		
						Installation state of teminal block	×	1、2	・Manufactured in 1988 (28 year-old) ・Rust on the cover of isolation transformer in the back of Unit 1 panel ・Rust on the VT terminal block on the Unit 2 Panel ・Degradaded MCCB on the panel ・Deformed insulating rubber in MCCB on the panel ・Dust accumulation
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor			
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	○		
				Relay Unit	Visual Inspection	Board installation state	○		
						Installation state of connector and terminal	○		
						Indicator	×	3	・Mechanical type voltage relay unit ・Manufactured in 1988 (28 year-old) ・Dusts accumulation in the voltage relay unit
						Electrolytic capacitor	×		
						Contact point	×		
	Control cable and Wiring (Control Panel)			Wiiring	Visual Inspection	Installation state of internal wire	×	4	・Dusts accumulation on wiring, terminal and control cable
				Control Cable		Terminal and cable	×		

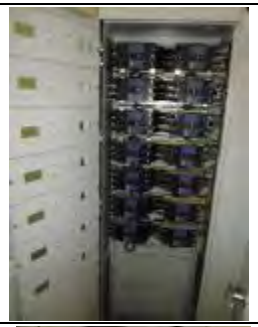
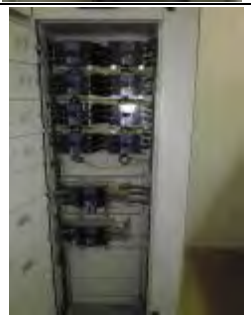
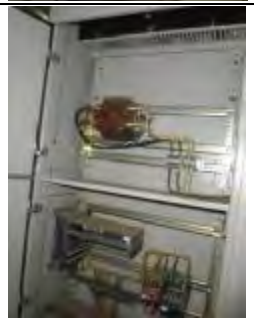
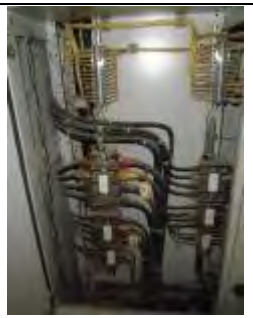
(Remarks)

AC PANEL No.1 Manufactured in 1988

AC PANEL No.2 Manufactured in 1988

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment 2) Overall	(Control Equipment 2) Details	(Control Equipment 2) Details	Remarks
HAC 1				・Manufactured in 1988 (28 year-old) ・Rust on the cover of isolation transformer in the back of unit 1 panel ・Degraded MCCB on the panel ・Deformed insulating rubber in MCCB on the panel ・Dust accumulation
HAC 2				・Manufactured in 1988 (28 year-old) ・Rust on the VT terminal on the unit 2 panel ・Deformed insulating rubber in MCCB on the panel ・Dusts accumulation
HAC 3				・Manufactured in 1988 (28 year-old) ・Mechanical type voltage relay unit ・Dusts accumulation in the voltage relay unit
HAC 4				・Manufactured in 1988 (28 year-old) ・Dusts accumulation on wires, terminals and control cables

(3.Control Equipment 3) Check List of Site Investigation

【date】 3-8, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (HDC)	Remarks
Control Equipment (Control Panel)	Control Equipment (Control Panel) (CON)	Control Power Unit (Control Power Panel) (CON-H)	DC Control Power Unit (Control Power Panel) (CON-HAC)	Overall	Visual Inspection	The state of bus	○		
						Installation state of teminal block	×	1,2	・Manufactured in 1988 (28 year-old) ・Degraded MCCB on the panel ・Deformed insulating rubber in MCCB on the panel ・Dust accumulation
						Mounting state of timer and auxiliary relays			
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor			
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	○		
				Relay Unit	Visual Inspection	Board installation state			
						Installation state of connector and terminal			
						Indicator			
						Electrolytic capacitor			
						Contact point			
	Control cable and Wiring (Control Panel)			Wiiring	Visual Inspection	Installation state of internal wire	×	3	・Dust accumulation on wires, terminals and control cables
				Control Cable		Terminal and cable	×		

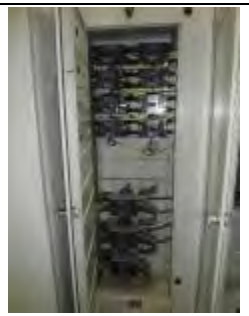
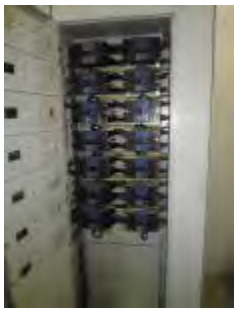
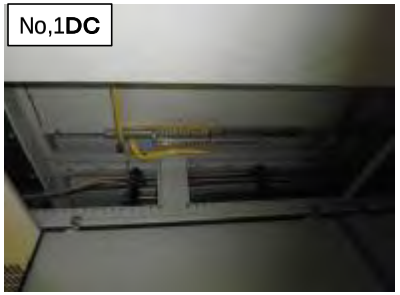
(Remarks)

DC PANEL No.1 Manufactured in 1988

DC PANEL No.2 Manufactured in 1988

(Site Photo) Check List of Site Investigation

【date】
3-8, Feb

NO.	(Control Equipment 3) Overall	(Control Equipment 3) Details	(Control Equipment 3) Details	Remarks
HDC 1				・Manufactured in 1988 (28 year-old) ・Degraded MCCB on the panel ・Deformed insulating rubber on MCCB on the panel ・Dust accumulation
HDC 2				・Manufactured in 1988 (28 year-old) ・Degraded MCCB on the panel ・Deformed insulating rubber on MCCB on the panel ・Dust accumulation
HDC 3				・Manufactured in 1988 (28 year-old) ・Dust accumulation on wires, terminals and control cables

(4.Control Equipment 4) Check List of Site Investigation

【date】 3-11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

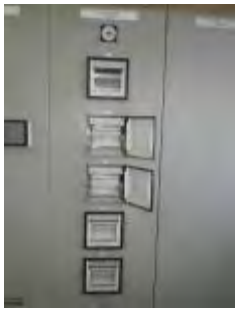
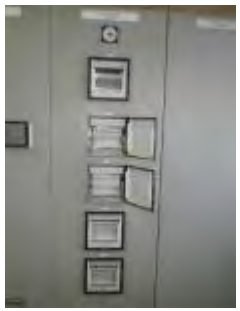
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (RD)	Remarks
Control Equipment (Control Panel)	Automatic Recording System (Recording System) (RD)	Switching Board (SWB)		Overall	Visual Inspection	State of looseness and others of wires	×	1～6	・Manufactured in 1988 (28 year-old) ・Broken meters ・Dust accumulation
						Grounding wire	×		
						Grounding wire should be free from wire break; Grounding wire tightening check	×		
						Indicator, indicating lamp, and selector switch	×		
						Visual Inspection of the parts where defect was detected during patrol and by alarm.	×		
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	×		
						Power supply unit	×		
				Relay Unit	Visual Inspection	Installation state of connector and terminal			
						Indicator should be free from crack and damage.			
		Recording Machine (RM)		Overall	Visual Inspection	State of recording sysytem operation and indication	×	1～6	・Broken meters
						Dust accumulation is not allowed in the recording machine and wiring.	×		・Dust accumulation
		Resistor Temperature Detector (RDT)		Overall	Visual Inspection	State of wire, terminal, and element etc.			
	Control cable and Wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	7,8	Dust accumulation
				Control Cable		Terminal and cable	×		Dust accumulation

(Remarks)

TEMPERATURE RECORDER PANEL	Manufactured in 1988
132kV LINE PANEL	1988
No,1 GENERATOR PANEL	1988
No,2 GENERATOR PANEL	1988
STATON SERUICE PANEL	1988

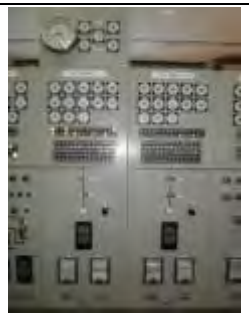
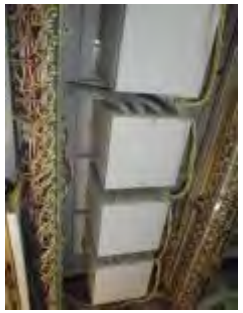
(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment 4) Overall	(Control Equipment 4) Details	(Control Equipment 4) Details	Remarks
RD 1				･Manufactured in 1988 (28 year-old) ･Improper indication on the current meter ･Malfunctions on water level recorder
RD 2				･Manufactured in 1988 (28 year-old) ･Malfunctions on temperature recorder for unit 1
RD 3				･Manufactured in 1988 (28 year-old) ･Malfunctions on temperature recorder for unit 2
RD 4				･Manufactured in 1988 (28 year-old) ･Malfunctions on voltage, frequency and power recorder in 132kV system panel *Since ex-power meter is only for power transmitting, digital meter for power transmision and receiving is installed.

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

NO.	(Control Equipment 4) Overall	(Control Equipment 4) Details	(Control Equipment 4) Details	Remarks
RD 5				・Manufactured in 1988 (28 year-old) ・Malfunction of active and reactive power meter in generator panel of unit 1and 2
RD 6				・Manufactured in 1988 (28 year-old) ・Malfunction of voltage recorder on station service panel
RD 7				・Manufactured in 1988 (28 year-old) ・Dust accumulation on the internal wirings and control cables
RD 8				・Manufactured in 1988 (29 year-old) ・Dust accumulation on the internal wirings and control cables

(5.Protective Device) Check List of Site Investigation

【date】 3-11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (MPR)	Remarks
Machine Protection Relay (analogue, static type)	Machine Protection Relay (MPR)			Overall	Visual Inspection	Board installation state	×	1～5	・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation on overall relay units ・No maintenance record after COD ・No spare part for each relay unit ・Aging degradation
						Installation state of connector and terminal	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Cooling fan for power supply unit	×		
						Installation state of connector and terminal at power unit section	×		
				Relay Unit	Visual Inspection	Board installation state	×	6	・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation ・Oil leakage from electrolytic capacitor ・No maintenance record ・No spare part for each relay unit ・Aging degradation
						Installation state of connector and terminal	×		
						Indicator	×		
						Electrolytic capacitor	×		
						Contact point	×		
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～5	Dust accumulation
				Control Cable		Terminal and cable	×		Dust accumulation

(Remarks)

132kV LINE PANEL	Manufactured in 1988
No,2 GENERATOR PANEL	1988
No,1 GENERATOR PANEL	1988
STATON SERUICE PANEL	1988
11KV FEEDER PANEL	1988

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

Photo No,	(Protective Device) Overall	(Protective Device) Details	(Protective Device) Details	Remarks
MPR 1				・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation on overall relay units. ・No maintenance record after COD ・No spare part for each relay unit ・Aging degradation
MPR 2				・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation on overall relay units. ・No maintenance record after COD ・No spare part for each relay unit ・Aging degradation
MPR 3				・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation on overall relay units. ・No maintenance record after COD ・No spare part for each relay unit ・Aging degradation
MPR 4				・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation on overall relay units. ・No maintenance record after COD ・No spare part for each relay unit ・Aging degradation

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

Photo No,	(Protective Device) Overall	(Protective Device) Details	(Protective Device) Details	Remarks
MPR 5				・Analog type relay unit ・Manufactured in 1988 (28 year-old) ・Dust accumulation on overall relay units. ・No maintenance record after COD ・No spare part for each relay unit ・Aging degradation
MPR 6				・Manufactured in 1988 (28 year-old) ・Oil leakage from electrolytic capacitor ・Analog type relay unit ・Aging degradation

(6.Excitation System (AVR)) Check List of Site Investigation

【date】 3-11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

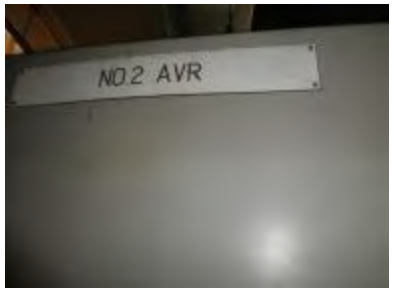
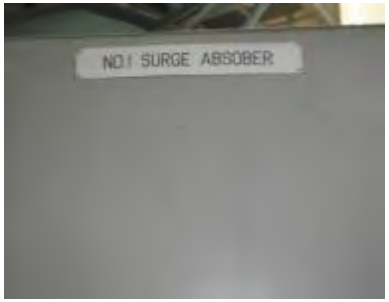
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result Unit 1	Result Unit 2	Photo No, (AVR)	Remarks
Excitation System (Control Panel)	Excitation System (EX)	Relay (Ry)		Control Panel	Visual Inspection	Board installation state	×	×	3	・Analog type relay ・Manufactured in 1989 (27 year-old) ・No spare part.
						Installation state of connector and terminal	×	×		
						Electrolytic capacitor	×	×		
		Thyristor (THY)		Arrestor, Thyristor, Rectifier, Capacitor	Visual Inspection	Fouling, damage and errosion of elements; Looseness of terminal; Overheat	×	×	2	・Fouling on thrystor ・No spare part
				vitreous enamel resistor		Fouling and damage of elements; Looseness of terminal; Overheat	×	×		・Dust accumulation
				パルスTr		Fouling and damage; Looseness of terminal; Overheat	×	×		・Dust accumulation
				Fuse		Conduction; Looseness of terminal	×	×		・Dust accumulation
				Grounding device		Grounding wire break; Removed grounding metal fitting	○	○		
				Arrestor		Grounding wire break; Looseness of grounding metal fitting	○	○		
			Cooling Device (COOL)	Cooling Fan	Visual Inspection	Fouling and damage; Looseness of terminal; Overheat	×	×	2	・Replaced cooling fan ・No spare part ・Dust accumulation without dust -proof
		Regulators Automatic Voltage Regulator (AVR) Automatic Power Factor Regulator (APFR) Power System Stabilizer (PSS) Field Circuit Breaker (41)		Printed board	Visual Inspection	Fouling and damage; Overheat	×	×	1,4	・Manufactured in 1989 (27 year-old) ・Analog type meters exceeding durable life ・Transistor type regulators exceeding durable life ・Spring type field CB whose arc-extinguishing chamber is vitreous enamel resistor type ・Dust accumulation
				90R and 70R Limit Switch		Operation state; Looseness of terminal	×	×		
				Selenium Arrestor and Resistor		Fouling and damage of elements; Looseness of terminal; Overheat	×	×		
				Fuse		Conduction; Looseness of terminal; Overheat	×	×		
				Deterioration Detective Device		Fouling and damage; Wire break of detection lamp	×	×		
				Auxiliary relay		Operation state; Overheat; Looseness of terminal	×	×		
				Insuration Transformer		Fouling and damage; Overheat	×	×		
				Cooling Fan		Fouling and damage; Looseness of terminal; Overheat	×	×		
				Instrument		Operation state; damage; Looseness of terminal	×	×		
				Grounding device		Grounding wire break; Removed grounding metal fitting	○	○		
						Grounding wire break; Looseness of grounding metal fitting	○	○		
				Control, PT and CT Circuit		Fouling, overheat, deformation and looseness of terminal on control and PCT circuit.	×	×	4	・Dust accumulation
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	×	4	・Dust accumulation
				Control cable		Terminal and cable	×	×		・Dust accumulation

(Remarks)

No.1 AVR PANEL	Manufactured in 1989	No.2 AVR PANEL	Manufactured in 1989
No.1 THYRISTOR PANEL	1989	No.2 THYRISTOR PANEL	1989
No.1 SURGE ABSORBER PANEL	1989	No.2 SURGE ABSORBER PANEL	1989
No.1 FCB PANEL	1989	No.2 FCB PANEL	1989

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

Photo No,	(AVR) Overall	(AVR) Detail 1	(AVR) Detail 2	Remarks
AVR 1				・Manufactured in 1989 (27 year-old) ・Replaced power unit ・Analog type meter exceeding durable life ・Transistor type regulators exceeding durable life
AVR 2				・Manufactured in 1989 (27 year-old) ・Meters exceeding the durable life ・Replaced cooling fan ・No dust-proof cover ・No spare part
AVR 3				・Manufactured in 1989 (27 year-old) ・Analog type voltage detection relay ・Aging degradation ・No spare part
AVR 4				・Manufactured in 1989 (27 year-old) ・Spring type field CB whose arc-extinguishing chamber is vitreous enamel resistor type ・No spare part. ・Dust accumulation on cotrol cables

(7.Speed Governor (GOV)) Check List of Site Investigation

【date】 3-11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result Unit 1	Result Unit 2	Photo No, (Reg) (ACT)	Remarks
Speed Governor (Control Panel)	Speed Governor (GOV)	Regulator Panel (Reg)		Overall	Visual Inspection	Power unit, NFB	×	×	Reg 1～3	・Manufactured in 1988 (28-year-old) ・No counter measure against small animals (Power Unit) ・Replaced No.1 power unit (in 1994) ・electrolytic capacitor and cooling fan exceeding the durable life ・No spare part. ・Analog type devices ・No spare part for detecting unit
						Control, detection and Regulation unit	×	×		
						Indicated value of meters	×	×		
						Motors for Regulator (77M, 65M)	×	×		
						Input/Output unit	×	×		
						Cable and terminal	×	×		
						Indication panel/lamp	×	×		
						Regulator	×	×		
						Arrestor circuit and fuse	×	×		
						Installation state of prinnted board	×	×		
						Restoration unit	×	×		
						Grounding wire	×	×		
		Actuator (ACT)		Overall	Visual Inspection	Pilot Valve	×	×	Act 1、2	・Grease adhering to the operation unit in actuator panel ・Deterioration of operating oil ・No maintenance record of coupling and return units in actuator panel after COD
						Primary distribution valve	×	×		
						Secaondary distribution valve	×	×		
						Auxiliary servomotor	×	×		
						hydraulic booster	×	×		
						Coupling unit	×	×		
						Return unit	×	×		
						Meters	×	×		
		Relay Unit (Ry)		Overall	Visual Inspection	Board installation state	×	×	Reg 2	・Machine type alarm indicators exceeding the durable life
						Installation state of connector and terminal	×	×		
						Indicator	×	×		
						Electrolytic capacitor	×	×		
						Contact point	×	×		
	Control cable and wiring (Control Panel)			Wiring Control Cable	Visual Inspection	Installation state of internal wire	×	×	Reg 4 Act 3	・Dust accumulation on control cables ・No counter measure against small animals
						Terminal and cable	×	×		

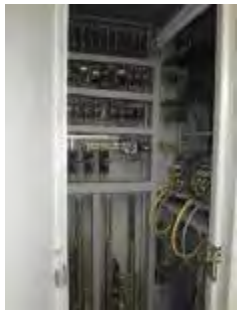
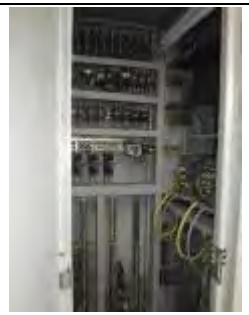
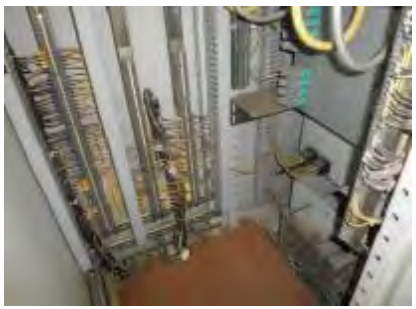
(Remarks)

GOV-Reg: No,1 GOVERNOR RegULATOR PANEL Manufactured in 1988 GOV-Act:No,1 GOVERNOR PANEL Manufactured in 1988

No,2 GOVERNOR RegULATOR PANEL 1988 No,2 GOVERNOR PANEL 1988

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

Photo No,	(GOV-Reg) Overall	(GOV-Reg) Detail 1	(GOV-Reg) Detail 2	Remarks
Reg 1				・Manufactured in 1988 (28 year-old) ・Small animal in Gov-Reg Panel ・Replaced No.1 power unit (in 1994) ・No spare part for detecting unit
Reg 2				・Regulators of variable resistor, exceeding the durable life ・Mechanical indicators exceeding the durable life
Reg 3				・No.1 regulator; manufactured in 1994 (22 year-old) ・No.2 regulator; manufactured in 1988 (28 year-old) ・Electrolytic capacitor and cooling fan in power unit exceeding the durable life.
Reg 4				・No counter measure against the small animal in the back of GOV-Reg Panel ・Dusts accumulation on control cables

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

Photo No,	(GOV-Act) Overall	(GOV-Act) Detail 1	(GOV-Act) Detail 2	Remarks
Act 1				・Grease adhering to the operation unit in actuator panel ・Deterioration of operating oil
Act 2				・No maintenance record of coupling and return units in actuator panel after COD
Act 3				・Heater in Gov-Act panel exceeding the durable life. ・Rust on the terminal ・Dust accumulation on control cable ・Crowded terminal for grounding wire ・No counter measure against small animals

(8.Turbine Control Cubicle) Check List of Site Investigation

【date】 3-11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result Unit 1	Result Unit 2	Photo No, (WAC)	Remarks
Automatic Turbine Control Equipment (Control Panel)	Automatic Turbine Control Equipment (Turbine Control Cubicle) (WAC)			Overall	Visual Inspection	Terminal and wiring	×	×	1	・Manufactured in 1988 (28 year-old)
						Meter	×	×		・Meters and strainers exceeding the durable life
						Distribution valve	×	×		
						Grounding wire	×	×		・No spare part of meters and strainer
		Solenoid Valve (SOLE)		Overall	Visual Inspection	Main body and coil	×	×	2	・Manufactured in 1988 (28 year-old)
						Grounding fitting	×	×		・No spare part ・No dust-proof cover
						Grounding wire	×	×		・Dust accumulation
		Strainer (STRA)		Overall	Visual Inspection	Dust accumulation and oil leakage	○	○		
		Relay (Ry)		Relay Unit	Visual Inspection	Board installation state	×	×	3	・Manufactured in 1988 (28 year-old) ・Bourdon tube pressure gauge for Hydraulic relays exceeding the durable life ・No spare part
						Installation state of connector and terminal	×	×		
						Indicator should be free from crack and damage.	×	×		
						Electrolytic capacitor	×	×		
						Contact point	×	×		
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	×	4	・Poor appearance
				Control Cable		Terminal and cable	×	×		

(Remarks)

No.1 TURBINE CONTROL PANEL

No.2 TURBINE CONTROL PANEL

Both are manufactured in 1988.

(Site Photo) Check List of Site Investigation

【date】
3-11, Feb

Photo No,	(Turbine Control Cubicle) Overall	(Turbine Control Cubicle) Detail 1	(Turbine Control Cubicle) Detail 2	Remarks
WAC 1				・Manufactured in 1988 (28 year-old) ・Meters and switches exceeding the durable life ・No spare part of meters and switches ・Dust accumulation ・No dust-proof cover
WAC 2				・Manufactured in 1988 (28 year-old) ・Solenoid valve exceeding the durable life ・No spare part ・No dust-proof cover. ・Dust accumulation
WAC 3				・Manufactured in 1988 (28 year-old) ・Bourdon tube pressure gauge for hydraulic relays exceeding the durable life ・No spare part
WAC 4				・Manufactured in 1989 (27 year-old) ・Crowded terminal for grounding wire

(9.Water Level Regulator) Check List of Site Investigation

【date】 5, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

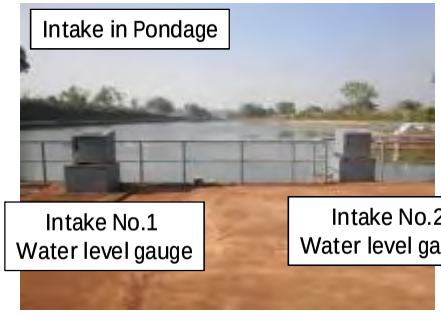
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (WLR)	Remarks
Water Level Regulator (Control Panel)	Water Level Regulator (WLR)	Water Level Gauge (WLVG)		Water Level Detector	Visual Inspection	Float type	×	4	・Fallen off float ・No operation as a water level detector
						Pressure type			
						Ultrasonic wave type			
						Breakwater pipe	×	4	・Corrosion and deformation
		Control Unit (CON)		Overall	Visual Inspection	Data Transmission Line	×	1	・Manufactured in 1988 (28 year-old) ・No input from water level detector. ・Dust accumulation on the control cables and others ・Corrosion on grounding terminal. ・The Governor free operation is only available because of the broken water level detector.
						Power Unit	×		
						Convertor, Inverter and Board	×		
						Rylay and Timer	×		
						Water Level Indicator	×		
						Grounding wire	×		
		Transmission Equipmen (CDT)		Transmission Equipment (CDT)	Visual Inspection	Power Unit and NFB	×	2,3	・Manufactured in 1988 (28 year-old) ・No input from water level detector ・Dust accumulation ・Corrosion on grounding terminal
						Control Unit, Detective Unit and Data Transmission Unit	×		
						Grounding wire	×		
		Frozenness and dew condensation prevention equipment		Overall	Visual Inspection	Heater Circuit	×	1～4	・Corrosion
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～4	・Dust accumulation on the control cables and others
				Control Cable		Terminal and cable	×		

(Remarks)

WATER LEVEL GOVERNOR PANEL	Manufactured in 1988
CDT PANEL(POWER HOUSE EQUIPMENT)	1988
CDT PANEL (INTAKE EQUIPMENT)	1988
No.1 WATER LEVEL GAUGE OF INTAKE (WL1: 0-1m/4-20mA)	1988
No.2 WATER LEVEL GAUGE OF INTAKE (WL1: 0-4.9m/4-20mA)	1988

(Site Photo) Check List of Site Investigation

【date】
5, Feb

Photo No,	(Water Level Regulator) Overall	(Water Level Regulator) Detail 1	(Water Level Regulator) Detail 2	Remarks
WLR 1				・Manufactured in 1988 (28 year-old) ・No input from water level detector ・Dust accumulation on the control cables and others ・Corrosion on grounding terminal ・The water level regulating operation is not available.
WLR 2				・Manufactured in 1988 (28 year-old) ・No input from water level detector ・Dust accumulation on the control cables and others ・Corrosion on grounding terminal ・The water level regulating operation is not available.
WLR 3				・Manufactured in 1988 (28 year-old) ・No input from water level detector ・Dust accumulation on the control cables and others ・Corrosion on grounding terminal ・The water level regulating operation is not available.
WLR 4				・Manufactured in 1988 (28 year-old) ・Fallen off float ・Corrosion and deformation ・Dust accumulation on the control cables and others ・It does not work as water level gauge.

(10.Auxiliary Equipment Control) Check list of site investigation

【date】 3-10, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (C/C)	Remarks
Auxiliary Equipment Control (Control Panel)	Auxiliary Equipment Control (Control Center) (C/C)			Overall	Visual Inspection	State of bus	×	1～4	・Manufactured in 1988 (28 year-old) ・No maintenance record after COD ・Dust accumulation. ・Aging degradation of MCCB and switch ・Meters and operating switches are mechanical type and have aging degradation.
						Installation state of teminal block	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	×		
				Relay Unit	Visual Inspection	Board installation state			
						Installation state of connector and terminal			
						Indicator			
						Electrolytic capacitor			
						Contact point			
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	2～4	・Dust accumulation on internal wiring and teminal
				Control Cable		Terminal and cable	×		・Dust accumulation on control cables

(Remarks)

No,1 UNIT MCC PANEL (3 PANELS)	Manufactured in 1988
No,2 UNIT MCC PANEL (3 PANELS)	1988
COMON UNIT MCC PANEL(2 PANELS)	1988

(Site Photo) Check List of Site Investigation

【date】
3-10, Feb

Photo No,	(C/C) Overall	(C/C) Detail 1	(C/C) Detail 2	Remarks
C／C 1				・Manufactured in 1988 (28 year-old) ・Aging degradation of timer, auxiliary relay, MCCB and switches. ・Dust accumulation on the machines and wirings
C／C 2				・Manufactured in 1988 (28 year-old) ・Rust on the terminal ・No terminal cover ・Dust accumulation on the machines and wirings
C／C 3				・Manufactured in 1988 (28 year-old) ・Rust on the terminal ・No terminal cover ・Dust accumulation on the machines and wirings
C／C 4				・Manufactured in 1988 (28 year-old) ・Rust on the terminal ・No terminal cover ・Dust accumulation on the machines and wirings

(11.Fire Extinguishing System) Check List of Site Investigation

【date】 3-10, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (FAL)	Remarks
Fire Alarm System (Control Panel)	Fire Alarm System (Cenral Control Center) (FAL)			Overall	Visual Inspection	Power Unit	×	1	・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Dust accumulation. ・Malfunctions of indicators
						Installation state of board	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch、	×		
		Detector (Sensor)	Smoke Detector (Sensor)	Overall	Visual Inspection	Installation state of detector	×	3	・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Dust accumulation.
						Free from malfunction	×		
			Heat Detector (Sensor)			Installation state of detector			
						Free from malfunction			
			Optical Detector (Sensor)			Installation state of detector			
						Free from malfunction			
		Indivisual Alarm (Indicator and buzzer)		Overall	Visual Inspection	Power Unit	×	2	・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Dust accumulation ・No record of alarm indication ・The connection to central control center is unknown.
						Installation state of alarm indication	×		
						Operation state of alarm indication	×		
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～3	・Dust accumulation on internal wiring and teminal
				Control Cable		Terminal and cable	×		・Dust accumulation on control cables
Fire Extinguisher (Mobile type)	Fire Extinguisher (Mobile type)			Overall	Visual Inspection	Free from cracks, damage and leakage	×	4	・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・No record of replacement of extinguishing compositions
						Fire hose	×		
						Periodic replacement of fire extinguishing compositions	×		

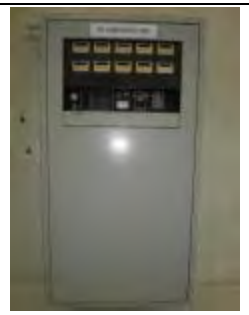
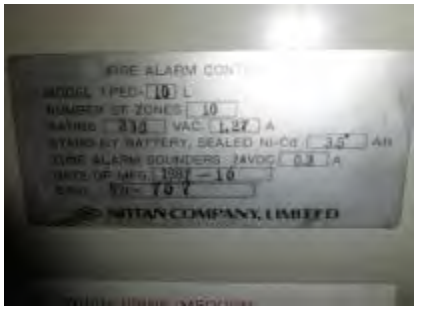
(Remarks)

FIRE ALARM CONTROL PANEL Manufactured in 1987

Fire Extinguisher: BC50, ABC20 Manufactured in 1987

(Site Photo) Check List of Site Investigation

【date】
3-10, Feb

Photo No,	(Fire Extinguishing System) Overall	(Fire Extinguishing System) Detail 1	(Fire Extinguishing System) Detail 2	Remarks
FAL 1				・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Aging degradation
FAL 2				・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Aging degradation ・The connection to central control center is unknown.
FAL 3				・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Aging degradation
FAL 4				・Manufactured in 1987 (29 year-old) ・No maintenance record after COD ・Aging degradation

(12.Water Level Gauge) Check List of Site Investigation

【date】 11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (WLVG)	Remarks
Water Level Gauge (Water Level Gauge Unit) (Civil Equipment)	Water Level Gauge (WLVG)	Water Level Gauge (Main Body)		Detector	Visual Inspection	Float type	×	1～5	・Corrosion and Deformation
						Pressure type			
						Ultrasonic wave type			
						Breakwater pipe	×	1～5	・Corrosion and Deformation
		Control Equipment (CON)		Overall	Visual Inspection	Data Transmission Line			
						Power Unit			
						Convertor, Inverter and Board			
						Rylay and Timer			
						Water Level Indicator			
						Grounding wire			
		Data Transmissio n Equipment (CDT) (VHF)		Data Transmission Equipment (CDT)	Visual Inspection	Power Unit and NFB			
						Control Unit, Detective Unit and Data Transmission Unit			
						Grounding wire			
		Frozenness and dew condensation prevention equipment		Overall	Visual Inspection	Heater Circuit			
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～5	・Dust accumulation on internal wiring and teminal
				Control Cable		Terminal and cable	×		・Dust accumulation on control cables

(Remarks) Civil Equipment

Water Level gauge at Mobye Dam (1 unit) Manufactured in 1988

Water Level gauge at Loikaw City Gauging Station (1 unit) 1988

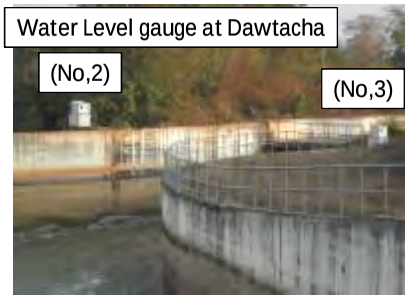
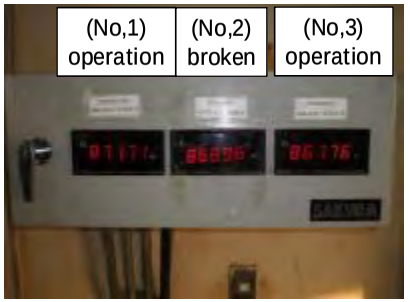
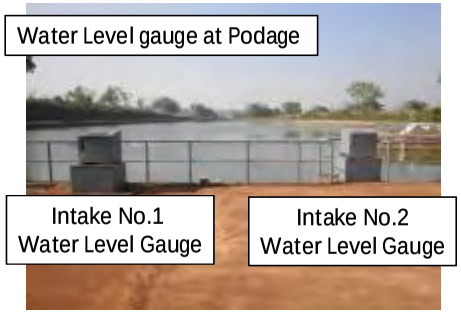
Water Level gauge at Dawtacha (Intake: 1 place, Outlet 2 units) 1988

Water Level gauge at Podage (2 units) 1988

Water Level gauge at outlet of Baluchang No.1 (1 unit) 1988

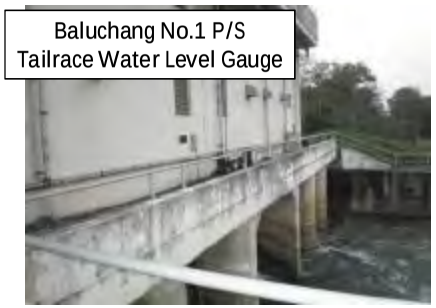
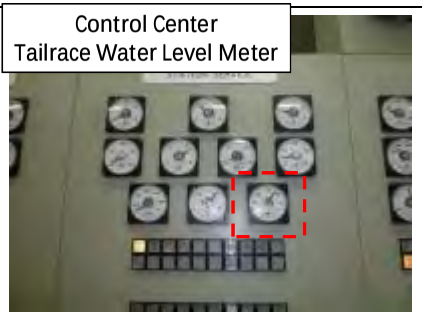
(Site Photo) Check List of Site Investigation

【date】
11, Feb

Photo No,	(Water Level Gauge) Overall	(Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	Remarks
WLVG 1				・Manufactured in 1988 (28 year-old) ・Missing probe ・Broken water level indicator ・Dust accumulation on controll cables and others
WLVG 2				・Manufactured in 1988 (28 year-old) ・Rust on main body ・No data transmission from water level gauge ・Dust accumulation on controll cables and others
WLVG 3				・Manufactured in 1988 (28 year-old) ・Rust on main body ・Broken No.2 indicator ・Dust accumulation on controll cables and others
WLVG 4				・Manufactured in 1988 (28 year-old) ・Fallen off float ・Corrosion and deformation ・No operation as water level gauge ・Dust accumulation on controll cables and others

(Site Photo) Check List of Site Investigation

【date】
11, Feb

Photo No,	(Water Level Gauge) Overall	(Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	Remarks
WLVG 5	 Baluchang No.1 P/S Tailrace Water Level Gauge		 Control Center Tailrace Water Level Meter	・Manufactured in 1988 (28 year-old) ・Rust on main body ・Dust accumulation on controll cables and others

(13.Communication Equipment) Check List of Site Investigation

【date】 11, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

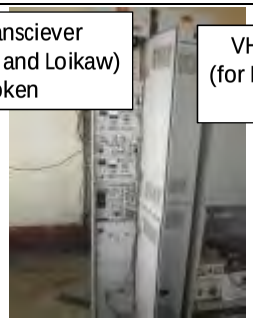
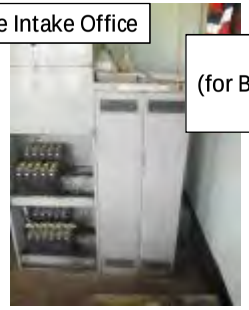
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Result	Photo No, (TC)	Remarks
Communication Equipment (TC) (Communication Equipment)	Communication Equipment (TC)	Data Transmission Equipment (CDT) (VHF)		Overall	Visual Inspection	Power Unit and NFB	×	1～5	・Manufactured in 1988 (28 year-old) ・Aging degradation ・No operaion as a communication tool ・Corrosion and rust on cables and grounding wire
						Control Unit, Detective Unit and Data Transmission Unit	×		
						Indicator, indicating lamp, and selector switch	×		
						Grounding wire	×		
		Control Equipment (TC－CON)		Overall	Visual Inspection	Data Transmission Line	×	1～5	・Manufactured in 1988 (28 year-old) ・Aging degradation ・No operaion as a communication tool ・Corrosion and rust on cables and grounding wire ・Degraded battery ・Some part of communication and control cables immersed ・Corrosion and rust on cables and grounding wire
						Power Unit	×		
						Convertor, Inverter and Board	×		
						Rylay and Timer	×		
						Indicator, indicating lamp, and selector switch	×		
						Grounding wire	×		
		Utility Pole and Steel Tower (TC－TW)		Overall	Visual Inspection	Steel tower for communication system			
						Utility pole for communication system	×	1～5	・Corrosion, deformation and rust
						lightning rod and grounding wire	×		・Melted lighting rod on utility pole
		Frozenness and dew condensation prevention equipment		Overall	Visual Inspection	Heater Circuit	×	1～5	・Corrosion, deformation and rust
	Communication, Control Cable and Wiring			Wiring	Visual Inspection	Installation state of internal wire	×	1～5	・Dust accumulation on control cables and others ・Some part of cables immersed
				Control Cable		Terminal and cable	×		

(Remarks) Communication Equipment

Mobye Reservoir Intake Office (1 VHF transciever)	Manufactured in1988
Loikaw City Gauging Station (VHF Transciever 1 unit)	1988
Dawtacha Intake Office (VHF Transciever 2 units)	1988
Podage Intake Office (CDT: 1unit)	1988
Baluchang No.1 P/S (VHF Transciever: 1unit, CDT: 2 units, PLC: 1 unit)	1988

(Site Photo) Check List of Site Investigation

【date】
11, Feb

Photo No,	(Water Level Gauge) Overall	(Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	Remarks
TC 1	Mobye Reservoir Intake Office 			・Manufactured in 1988 (28 year-old) ・Deformation and rust ・Degraded battery ・Some part of communication and control cables immersed ・Corrosion and dust accumulation on internal wiring ・Wrong communication and control cable
TC 2	Loikaw City Gauging Station 			・Manufactured in 1988 (28 year-old) ・Deformation and rust ・Melted lighting rod on utility pole ・No operation as a communication tool ・Corrosion and dust accumulation on internal wiring ・Wrong communication and control cable
TC 3	Dawtacha Intake Office 	VHF Transciever (for Mobye and Loikaw) broken VHF Transciever (for Baluchang No.1) operation 		・Manufactured in 1988 (28 year-old) ・Deformation and rust ・One broken VHF transciever ・Communication cable connector fallen off ・Corrosion and dust accumulation on internal wiring ・Wrong communication and control cable
TC 4	Podage Intake Office  CDT (for Baluchang No.1) broken			・Manufactured in 1988 (28 year-old) ・Deformation and rust ・No operation as a communication tool ・Wrong battery ・Dust accumulation on control cables and others

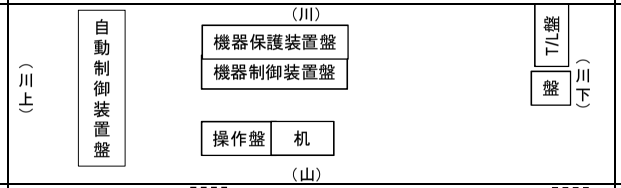
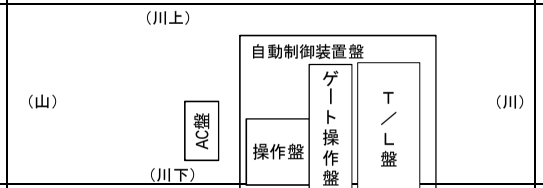
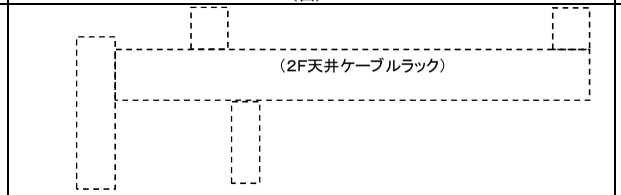
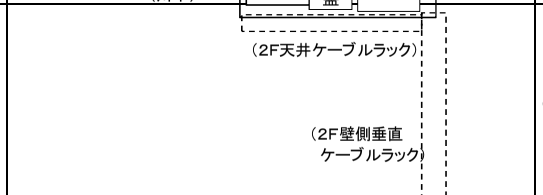
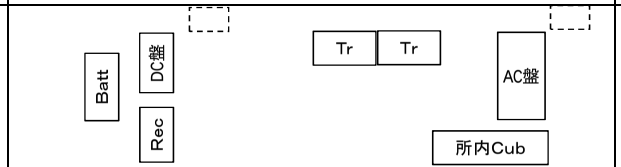
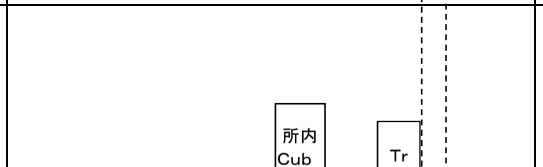
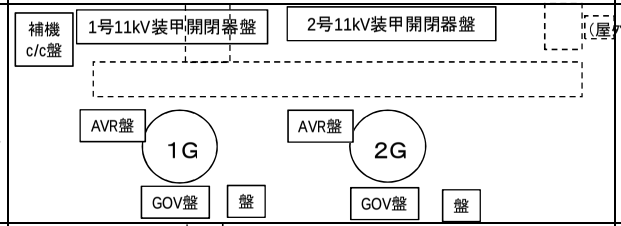
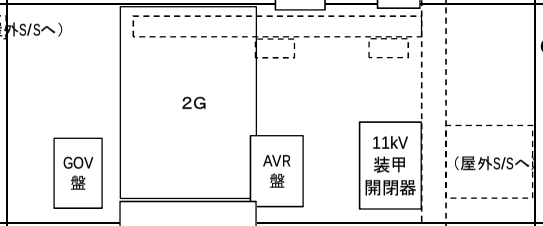
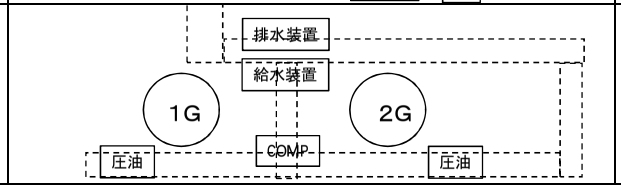
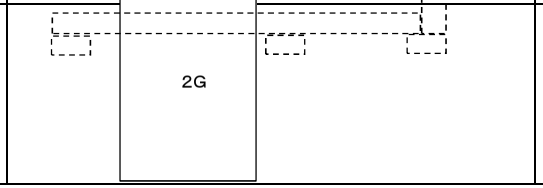
(Site Photo) Check List of Site Investigation

【date】
11, Feb

Photo No,	(Water Level Gauge) Overall	(Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	Remarks
TC 5				・Manufactured in 1988 (28 year-old) ・Deformation and rust ・No operation as a communication tool ・Broken CDT and PLC ・Dust accumulation on control cables and others

(14.Control Cable Route map) Check List of Site Investigation

【date】
5-11, Feb

Power House	Control Cable Route Floor View of Power House	Control Cable Route Cross Section of Power House	Number of cables	Length of cables	Photo No,	Remarks
3 F Control Room			Cables to Control Room about 640	Vertical Direction 1m Total on 3F 640m	3 F	3F : 1m * 640 cables = 640m
2 F Cable Room			Cables Passing Cable Room about 580	Horizontal Direction 15m Vertical Direction 3,4m Total on 2F 30,480m	2 F	Suppose cables connecting panels are 10%. 15m * 60 cables = 900 m 2F Passing: 15m * 3.4m * 580 cables = 29,580m 2F Total: 900m + 29.580m = 30,480m
1 F Station Service Cubicle etc.			Cables Passing 1F about 580	Vertical Direction 4.5m 1F Total 2,610m	1 F	1F Total: 4.5m * 580 cables = 2,610m
B 1 F Turbine Pit etc.			Cables Used on B1F about 200 Outdoor S/S almost 60	Horizontal Direction 21.5m Vertical Direction 5.1m B1F Total 11,932m	B1F	Number of cables to outdoor S/S : about 60 100m(distance to S/S) * 60 cables = 6,000m Number of cables used on B1F: about 200 21.5m * 200 cables = 4,300m Cables passing B1F: 5.1m * 320 cables = 1,632m Total: 6,000 + 4,300 + 1,632 = 11,932m
B 2 F Draft room etc.			Cables to B2F about 320	Horizontal Direction 25m Vertical Direction 2m B1F Total 16,000m	B2F	Number of cables used on B2F: about 320 25m * 2m * 320 cables = 16,000m Total Length of removed cables 640 + 30,480 + 2,610 + 11,932 + 16,000 =61,662m ⇒Suppose the error rate is 1.2 =73,994m ≒74,000m

(Remarks)

・Since all control cables are heavily degaraded such as corrosion, deformation and rust, the replacement is recommended.

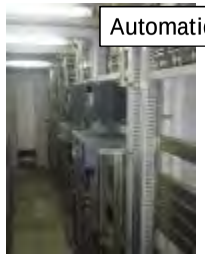
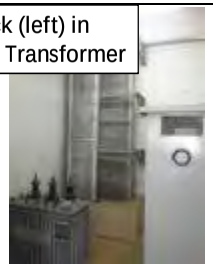
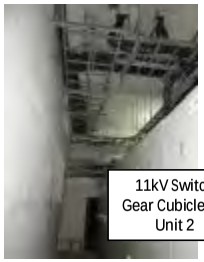
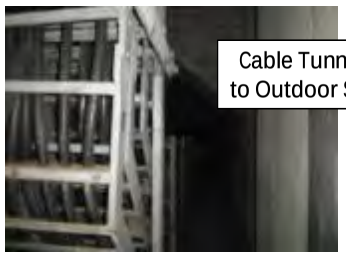
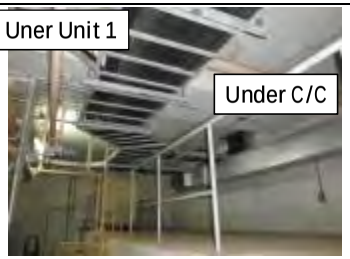
・Control Cables are manufactured by Mitsubishi Cable Industries, ltd. in 1988

(Total amount of estimated cables to remove)

1. The number of removed cables: about 640 cables
2. Total length of removed cables: about 74,000 m

(Site Photo) Check List of Site Investigation

【date】
5-11, Feb

Photo No	(Control Cable) Overall	(Control Cable) Detail 1	(Control Cable) Detail 2	Remarks
3 F	Protective Relay Panel Control Room 	Automatic Control Panel 	Gate Operating Panel 	
2 F	Under Automatic Control Panel 	Under Distribution Panel 	Under Operating Panel 	
1 F	Vertical Rack (left) in Station Service Transformer 	Vertical Rack (right) in Station Service Transformer 	Vertical Rack (left) in Station Service Transformer 	
B1F	C/C Panel   11kV Switch Gear Cubicle for Unit 2  11kV Switch Gear Cubicle for Unit 1  11kV Switch Gear Cubicle for Unit 2	Cable Tunnel to Outdoor S/S 	 Cable Tunnel to B1F of P/S
B2F	B2F Uner Unit 1  Under C/C	B2F Under Unit 2 	Under Unit 2 Speed Governor 	

Preparatory Survey On Hydropwer Plants Rehabilitation Project In The Republic Of The Union Of Myanmar

Sedawgyi Hydropower Plant

Check List of Site Investigation (Protective and Control Equipment)

Investigation date 15-26, February 2016

Hydro Power Group
Power System Engineering
THE KANSAI ELECTRIC POWER

Table of Contents

(1.Control Equipment 1) Check List of Site Investigation

【date】 15-24, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (CON)	Remarks
Control Equipment (Control Panel)	Control Equipment (Control Panel) (CON)			Control cubicle	Visual Inspection	Board installation state	×	1～8	・Manufactured in 1985 (31 year-old) ・No maintenance record after COD ・Dust accumulation ・Mechanical meters and operation switches ・Aging degradation ・Defects on the sequence of automatic generator stop
						Installation state of connector and terminal	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Cooling fan for power supply unit	×		
						Installation state of connector and terminal at power unit section	×		
				Relay Unit	Visual Inspection	Board installation state	×	1～8	・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Mechanical meters and operation switches ・Aging degradation
						Installation state of connector and terminal	×		
						Indicator	×		
						Electrolytic capacitor	×		
						Contact point	×		
	Control cable and Wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～8	・Dust accumulation on internal wires and terminals
				Control cable		Terminal and cable	×		・Dust accumulation on control cables

(Remark)

CONTROL DESK Manufactured in 1985

No.1 GENERATOR TRANSFORMER PANEL (2 panels) 1985

132kV MANDALAY FEEDER PANEL 1985

No.2 GENERATOR TRANSFORMER PANEL (2 panels) 1985

33kV FEEDER PANEL 1985

132kV KYAUKPAHTOE FEEDER PANEL 1985

WATER LEVEL MEASURING PANEL Manufactured in 1985

JOINT CONTROL PANEL 1985

SYNCHRONIZING DETECTION PANEL 1985

*It is requested that 33kV FEEDER PANEL is removed.

*It is requested that JOINT CONTRO PANEL is removed.

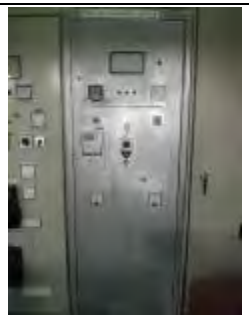
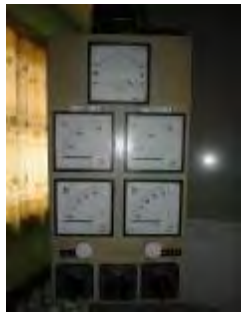
(Site Photo) Check List of Site Investigation

【date】
15-24, Feb

Photo	(Control Equipment) Overall	(Control Equipment) Detail	(Control Equipment) Detail	Remarks
CON 1				Operation Panel ・Mechanical meters and operation switches ・Manufactured in 1988 (28 year-old) ・No maintenace record after COD ・Defects on the sequence of automatic generator stop ・Aging degradation
CON 2				Genetaor Panel ・Mechanical meters and operation switches ・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Aging degradation
CON 3				132kV Mandalay Feeder Panel ・Mechanical meters and operation switches ・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Aging degradation
CON 4				33kV Feeder Panel (not used) ・Mechanical meters and operation switches ・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Aging degradation

(Site Photo) Check List of Site Investigation

【date】
15-24, Feb

Photo	(Control Equipment) Overall	(Control Equipment) Detail	(Control Equipment) Detail	Remarks
CON 5				132kV Kyaukpahtoe Feeder Panel ・Mechanical meters and operation switches ・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Aging degradation
CON 6				Synchronizing Detection Panel ・Mechanical meters and operation switches ・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Unavailable automatic synchroxizing function ・Aging degradation
CON 7				Water Level Measuring Panel ・No maintenace record after COD ・Dust accumulation ・Aging degradation on timer and auxiliary relay units
CON 8				Joint Control Panel (not used) ・No maintenace record after COD ・Dust accumulation ・Aging degradation on timer and auxiliary relay units

(2.Control Equipment 2) Check List of Site Investigation

【date】 3-8, Feb

O: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (HADC)	Remarks
Control Equipment (Control Panel)	Control Equipment (Control Panel) (CON)	Control Power Unit (Control Power Panel) (CON-H)	AC/DC Control Power Unit (Control Power Panel) (CON-HAC)	Overall	Visual Inspection	State of bus	×	1、2	・Manufactured in 1985 (31 year-old) ・Analog type meters of voltage and current ・Mechanical operation switches ・No maintenance record ・Aging degradation ・Dust accumulation
						Installation state of teminal block	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	×		
				Relay Unit	Visual Inspection	Board installation state			
						Installation state of connector and terminal			
						Indicator			
						Electrolytic capacitor			
						Contact point			
	Control cable and Wiring (Control Panel)			Wiiring	Visual Inspection	Installation state of internal wire	×	2	・Dust accumulation on internal wires and terminals ・Dust accumulation on control cables
				Control Cable		Terminal and cable	×		

(Remark)

AC/DC CONTROL POWER PANEL: DR GOHRE KG-BAD VILBEL PANEL Manufactured in 1985

(Site Photo) Check List of Site Investigation

【date】
16-23, Feb

Photo	(Control Equipment 2) Overall	(Control Equipment 2) Detail	(Control Equipment 2) Detail	Remarks
HADC 1				・Manufactured in 1985 (31 year-old) ・Analog type meters of voltage and current ・Mechanical operation switches ・Aging degradation
HADC 2				・Manufactured in 1985 (31 year-old) ・Aging degradation on MCCB ・Dust accumulation on internal wires and control cables

(3.Control Equipment 3) Check List of Site Investigation

【date】 16-24, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

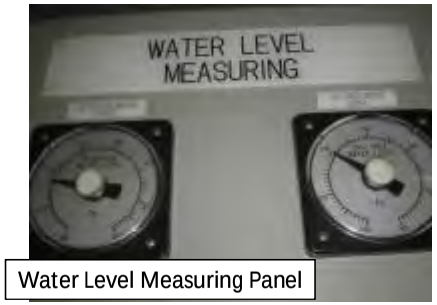
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (RD)	Remarks
Control Equipment (Control Panel)	Automatic Recording System (Recording System) (RD)	Switching Board (SWB)		Overall	Visual Inspection	State of looseness and others of wires	×	1～4	・Manufactured in 1985 (31 year-old) ・All recorders are broken ・Dust accumulation
						Grounding wire	×		
						Grounding wire should be free from wire break; Grounding wire tightening check	×		
						Indicator, indicating lamp, and selector switch	×		
						Visual Inspection of the parts where defect was detected during patrol and by alarm.	×		
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	×		
						Power supply unit	×		
				Relay Unit	Visual Inspection	Installation state of connector and terminal			
						Indicator should be free from crack and damage.			
		Recording Machine (RM)		Overall	Visual Inspection	State of recording sysytem operation and indication	×	1～4	・All recorders are broken
						Dust accumulation is not allowed in the recording machine and wiring.	×		・Dust accumulation
		Resistor Temperature Detector (RDT)		Overall	Visual Inspection	State of wire, terminal, and element etc.			
	Control cable and Wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～4	Dust accumulation
				Control Cable		Terminal and cable	×		Dust accumulation

(Remark)

WATER LEVEL MEASURING PANEL	Manufactured in 1985	No.1 GEN AUXILIARY RELAY PNEL	Manudactured in 1985
No.1 TURBINE GAUGE PANEL	1985	No.2 GEN AUXILIARY RELAY PANEL	1985
No.2 TURBINE GAUGE PANEL	1985		
No.1 GEN GAUGE PANEL	1985		
No.2 GEN GAUGE PANEL	1985		

(Site Photo) Check List of Site Investigation

【date】
16-24, Feb

Photo	(Control Equipment 3) Overall	(Control Equipment 3) Detail	(Control Equipment 3) Detail	Remarks
RD 1	 Water Level Measuring Panel	 Discharge Recorder	 Water Level Recorder for Dam and Tailrace	Gate operation panel in control room ・Manufactured in 1985 (31 year-old) ・Indicated incorrect value on water level meter of dam and tailrace ・Broken discharge recorder ・Broken water level recorder
RD 2			 Turbine Thermometer	Turbine gauge panel ・Manufactured in 1985 (31 year-old) ・Broken discharge meter ・Broken water temperature recorder
RD 3		 Generator Thermometer 1	 Generator Thermometer 2	Generator gauge panel ・Manufactured in 1985 (31 year-old) ・Broken generator thermometer 1 and 2
RD 4			 Vibrometer	Generator auxiliary relay panel ・Manufactured in 1985 (31 year-old) ・Broken Vibrometer

(4.Protective Device) Check List of Site Investigation

【date】 16-23, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (MPR)	Remarks
Machine Protection Relay (analogue, static type)	Machine Protection Relay (MPR)			Overall	Visual Inspection	Board installation state	×	1～5	・Analog type relay unit ・Manufactured in 1985 (31 year-old) ・Dust accumulation ・No maintenance record of relay unit ・No spare part of relay unit ・Aging degradation ・Analog type relay unit is broken and standby relay is used.
						Installation state of connector and terminal	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Cooling fan for power supply unit	×		
						Installation state of connector and terminal at power unit section	×		
				Relay Unit	Visual Inspection	Board installation state	×	1～5	・Analog type relay unit ・Manufactured in 1985 (31 year-old) ・Dust accumulation ・Oil leakage from electrolyte capacitor ・No maintenance record of relay unit ・No spare part of relay unit ・Aging degradation ・Analog type relay unit is broken and standby relay is used.
						Installation state of connector and terminal	×		
						Indicator	×		
						Electrolytic capacitor	×		
						Contact point	×		
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～5	Dust accumulation
				Control Cable		Terminal and cable	×		Dust accumulation

(Remark)

GENERATOR TRANSFORMER PANEL 1 (2 panels)	Manufactured in 19	Relay Unit : 64F、64R、95FF、86NE、86E、132kV51／64、11kV51／64、87GT、46
GENERATOR TRANSFORMER PANEL 2 (2 panels)	19	59、27、64G、40、40V、92GT、87G、51VR、92G、92C、40T
132kV MANDALAY FEEDER PANEL	19	67P(L1、L3)、67G、21、51／64
33kV FEEDER PANEL	198	132kV51／64、33kV51／64、67G *It is requested that 33kV feeder panel is removed.
132kV KYAUKPAHTOE FEEDER PANEL	19	67P(L1、L3)、67G、21、51／64

(Site Photo) Check List of Site Investigation

【date】
26-23, Feb

Photo	(Protective Device) Overall	(Protective Device) Detail	(Protective Device) Detail	Remarks
MPR 1				・Generator Transformer Panel 1 ・Abalog type relay unit ・Manufactured in 1985 (31 year-old) ・No maintenance record of relay unit ・No spare part of relay unit ・Aging degradation
MPR 2				・Generator Transformer Panel 2 ・Abalog type relay unit ・Manufactured in 1985 (31 year-old) ・No maintenance record of relay unit ・No spare part of relay unit ・Aging degradation
MPR 3				・132kV Mandalay Feeder Panel ・Abalog type relay unit ・Manufactured in 1985 (31 year-old) ・No maintenance record of relay unit ・No spare part of relay unit ・Aging degradation
MPR 4				・33kV Feeder Panel ・Abalog type relay unit ・Manufactured in 1985 (31 year-old) ・No maintenance record of relay unit ・No spare part of relay unit ・Aging degradation

(Site Photo) Check List of Site Investigation

【date】
16-23, Feb

Photo	(Protective Device) Overall	(Protective Device) Detail	(Protective Device) Detail	Remarks
MPR 5				・132kV Kyaukpahtoe Feeder Panel ・Abalog type relay unit ・Manufactured in 1985 (31 year-old) ・No spare part of relay unit ・Dust accumulation ・Analog type relay unit is broken and standby relay is used.

(5.Excitation System (AVR)) Check List of Site Investigation

【date】 16-24, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result Unit 1	Inspection Result Unit 2	Photo (AVR)	Remarks
Excitation System (Control Panel)	Excitation System (EX)	Relay (Ry)		Control Panel	Visual Inspection	Board installation state	×	×	1	・Manufactured in 1985 (31 year-old) ・Analog type relay ・No spare part
						Installation state of connector and terminal	×	×		
						Electrolytic capacitor	×	×		
		Thyristor (THY)		Arrestor, Thyristor, Rectifier, Capacitor	Visual Inspection	Fouling, damage and errosion of elements; Looseness of terminal; Overheat	×	×	2	・Fouling on thrystor ・No spare part
				vitreous enamel resistor		Fouling and damage of elements; Looseness of terminal; Overheat	×	×		・Dust accumulation
				パルスTr		Fouling and damage; Looseness of terminal; Overheat	×	×		・Dust accumulation
				Fuse		Conduction; Looseness of terminal	×	×		・Dust accumulation
				Grounding device		Grounding wire break; Removed grounding metal fitting	○	○		
				Arrestor		Grounding wire break; Looseness of grounding metal fitting	○	○		
			Cooling Device (COOL)	Cooling Fan	Visual Inspection	Fouling and damage; Looseness of terminal; Overheat	×	×	1	・Replaced cooling fan ・No spare part ・Dust accumulation without dust -proof cover
		Regulators Automatic Voltage Regulator (AVR) Automatic Power Factor Regulator (APFR) Power System Stabilizer (PSS) Field Circuit Breaker (41)		Printed board	Visual Inspection	Fouling and damage; Overheat	×	×	1, 3	・Manufactured in 1985 (31 year-old) ・Analog type meters exceeding durable life ・Transistor type regulators exceeding durable life ・Spring type field CB whose arc-extinguishing chamber is vitreous enamel resistor type ・Dust accumulation
				90R and 70R Limit Switch		Operation state; Looseness of terminal	×	×		
				Selenium Arrestor and Resistor		Fouling and damage of elements; Looseness of terminal; Overheat	×	×		
				Fuse		Conduction; Looseness of terminal; Overheat	×	×		
				Deterioration Detective Device		Fouling and damage; Wire break of detection lamp	×	×		
				Auxiliary relay		Operation state; Overheat; Looseness of terminal	×	×		
				Insuration Transformer		Fouling and damage; Overheat	×	×		
				Cooling Fan		Fouling and damage; Looseness of terminal; Overheat	×	×		
				Instrument		Operation state; damage; Looseness of terminal	×	×		
				Grounding device		Grounding wire break; Removed grounding metal fitting	○	○		
						Grounding wire break; Looseness of grounding metal fitting	○	○		
				Control, PT and CT Circuit		Fouling, overheat, deformation and looseness of terminal on control and PCT circuit.	×	×	1～3	・Dust accumulation
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	×	1～3	・Dust accumulation
				Control cable		Terminal and cable	×	×		・Dust accumulation

(Remark)

No. 1 AVR PANEL	Manufactured in 1985	No. 2 AVR PANEL	Manufactured in 1985
No. 1 THYRISTOR RECTIFIER PANEL	1985	No. 2 THYRISTOR RECTIFIER PANEL	1985
No. 1 FIELD SWITCH CUBICLE	1985	No. 2 FIELD SWITCH CUBICLE	1985

(Site Photo) Check List of Site Investigation

【datte】
16-24,Feb

Photo	(AVR) Overall	(AVR) Detail	(AVR) Detail	Remarks
AVR 1				AVR Panel ・Manufactured in 1985 (31 year-old) ・Analog type meters exceeding durable life ・Removed cooling fan because of failure ・No dust-prrof cover ・No spare part
AVR 2				No.1 Thyristor Rectifier ・Manufactured in 1985 (31 year-old) ・Thyristor exceeding the durable life ・Black smoked auxiliary relays ・No spare part
AVR 3				No.1 Field Switch Panel ・Manufactured in 1985 (31 year-old) ・Spring type field CB whose arc-extinguishing chamber is vitreous enamel resistor type ・Dust accumulation on control cables

(6.Speed Governor (GOV)) Check List of Site Investigation

【date】 16-25, Feb

O: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result Unit 1	Inspection Result Unit 2	Photo (Reg) (Act)	Remarks
Speed Governor (Control Panel)	Speed Governor (GOV)	Regulator Panel (Reg)		Overall	Visual Inspection	Power unit, NFB	×	×	Reg 1～3	・Manufactured in 1985 (31 year-old) ・Llack of ability to adjust the speed ・Dust accumulation ・Replaced power unit ・Aging degradation on power unit ・No spare part of power and detection unit ・All devices are analog type.
						Control, detection and Regulation unit	×	×		
						Indicated value of meters	×	×		
						Motors for Regulator (77M, 65M)	×	×		
						Input/Output unit	×	×		
						Cable and terminal	×	×		
						Indication panel/lamp	×	×		
						Regulator	×	×		
						Arrestor circuit and fuse	×	×		
						Installation state of prinnted board	×	×		
						Restoration unit	×	×		
						Grounding wire	×	×		
		Actuator (ACT)		Overall	Visual Inspection	Pilot Valve	×	×	Act 1～3	・Manufactured in 1985 (31 year-old) ・Grease adhering to the operation unit in actuator panel ・Deterioration of operating oil ・Removed power meter because of failure ・Incorrect value indicated by speed meter at the position "0" ・No maintenance record of coupling and return units in actuator panel after COD
						Primary distribution valve	×	×		
						Secaondary distribution valve	×	×		
						Auxiliary servomotor	×	×		
						hydraulic booster	×	×		
						Coupling unit	×	×		
						Return unit	×	×		
						Meters	×	×		
		Relay Unit (Ry)		Overall	Visual Inspection	Board installation state	×	×	Reg 2	・Operating switches, timers and auxiliary relays exceeding the durable life. ・Dust accumulation
						Installation state of connector and terminal	×	×		
						Indicator	×	×		
						Electrolytic capacitor	×	×		
						Contact point	×	×		
	Control cable and wiring (Control Panel)			Wiring Control Cable	Visual Inspection	Installation state of internal wire	×	×	Reg 3 Act 4	・Dust accumulation on control cables ・Oil adhering the cables
						Terminal and cable	×	×		

(Remark)

GOV-Reg Panel: No. 1 GOVERNOR REGULATOR PANEL Manufactured in 1985 GOV-Act PANEL: No. 1 GOVERNOR PANEL Manufactured in 1985

No. 2 GOVERNOR REGULATOR PANEL Manufactured in 1985 GOV-Act PANEL: No.2 GOVERNOR PANEL Manufactured in 1985

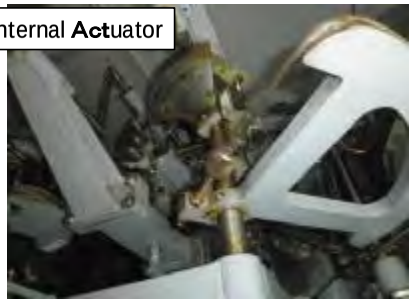
(Site Photo) Check List of Site Investigation

【date】
16-24, Feb

Photo	(GOV-Reg) Overall	(GOV-Reg) Detail	(GOV-Reg) Detail	Remarks
Reg 1		No.1 Reg 	No.2 Reg 	Power unit ・Manufactured in 1985 (31 year-old) ・Aging degradation ・No spare part of power unit ・Dust accumulation
Reg 2		No.1 Reg 	No.2 Reg 	Regulator setting device ・Regulators of variable resistor, exceeding the durable life ・Operation switches, timers and auxiliary relays exceeding the durable life
Reg 3		No.1 Reg 	No.2 Reg 	Internnal wires and control cables ・Dust accumulation

(Site Photo) Check List of Site Investigation

【date】
16-24, Feb

Photo	(GOV-Act) Overall	(GOV-Act) Detail	(GOV-Act) Detail	Remarks
Act 1				Governor Actuator Panel ・Manufactured in 1985 (31 year-old) ・Removed power meter because of failure ・Incorrect value indicated by speed meter at the position "0"
Act 2				Governor Actuator Panel ・Grease adhering to the operation unit in actuator panel ・Oil leakage ・Degraded operation oil
Act 3				Return Unit ・No maintenance record of coupling and return units in actuator panel after COD
Act 4				Internnal wires and control cables ・Dust accumulation

(7.Turbine Control Cubicle) Check List of Site Investigation

【date】 16-25, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result Unit 1	Inspection Result Unit 2	Photo (WAC)	Remarks
Automatic Turbine Control Equipment (Control Panel)	Automatic Turbine Control Equipment (Turbine Control Cubicle) (WAC)			Overall	Visual Inspection	Terminal and wiring	×	×	1～5	・Manufactured in 1985 (31 year-old) ・Meters and auxiliary relays exceeding the durable life ・No spare part of meters and switches
						Meter	×	×		
						Distribution valve	×	×		
						Grounding wire	×	×		
		Solenoid Valve (SOLE)		Overall	Visual Inspection	Main body and coil	×	×		・Dust accumulation
						Grounding fitting	×	×		
						Grounding wire	×	×		
		Strainer (STRA)		Overall	Visual Inspection	Dust accumulation and oil leakage	○	○		
		Relay (Ry)		Relay Unit	Visual Inspection	Board installation state	×	×	1～3	・Manufactured in 1985 (31 year-old) ・Aging degradation of meters, protective relays and auxiliary relays ・No spare part
						Installation state of connector and terminal	×	×		
						Indicator should be free from crack and damage.	×	×		
						Electrolytic capacitor	×	×		
						Contact point	×	×		
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	×	1～5	・The result of visual inspection is not acceptable.
				Control Cable		Terminal and cable	×	×		

(Remark)

No.1 TURBINE GAUGE PANEL	Manufactured in 1985	No.2 TURBINE GAUGE PANEL	Manufactured in 1985
No.1 GEN GAUGE PANEL	1985	No.2 GEN GAUGE PANEL	1985
No.1 ALARM AND ANNUNCIATOR PANEL	1985	No.2 ALARM AND ANNUNCIATOR PANEL	1985
No.1 TURBINE AUXILIARY RELAY PANEL	1985	No.2 TURBINE AUXILIARY RELAY PANEL	1985
No.1 GEN AUXILIARY RELAY PANEL	1985	No.2 GEN AUXILIARY RELAY PANEL	1985

(Site Photo) Check List of Site Investigation

【date】
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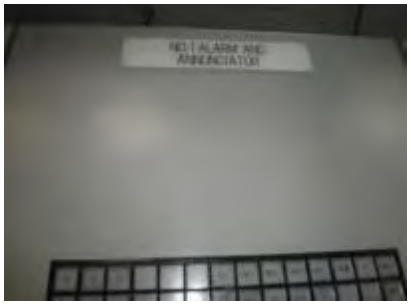
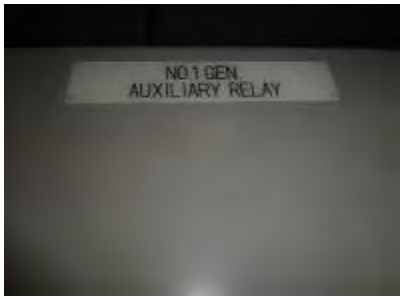
Photo	(Turbine Control Cubicle) Overall	(Turbine Control Cubicle) Detail	(Turbine Control Cubicle) Detail	Remarks
WAC 1				・Manufactured in 1985 (31 year-old) ・Meters and auxiliary relays exceeding the durable life ・Broken recorder ・No spare part on meters and switches ・Dust accumulation
WAC 2				・Manufactured in 1985 (31 year-old) ・Aging degradation of meters, protective relays and auxiliary relays ・No spare part of meters and switches ・Dust accumulation
WAC 3				・Manufactured in 1985 (31 year-old) ・Meters and auxiliary relays exceeding the durable life ・No spare part on meters and switches ・Dust accumulation
WAC 4				・Manufactured in 1985 (31 year-old) ・Meters and auxiliary relays exceeding the durable life ・No spare part on meters and switches ・Dust accumulation

(Site Photo) Check List of Site Investigation

【date】
16-25, Feb

Photo	(Turbine Control Cubicle) Overall	(Turbine Control Cubicle) Detail	(Turbine Control Cubicle) Detail	Remarks
WAC 5				・Manufactured in 1985 (31 year-old) ・Broken vibrometer ・Meters and auxiliary relays exceeding the durable life ・No spare part on meters and switches ・Dust accumulation

(8.Auxiliary Equipment Control) Check list of site investigation

【date】 17-24, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (C／C)	Remarks
Auxiliary Equipment Control (Control Panel)	Auxiliary Equipment Control (Control Center) (C/C)			Overall	Visual Inspection	State of bus	×	1～3	・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Mechanical meters and operation switches ・Aging degradation of MCCB and switches
						Installation state of teminal block	×		
						Mounting state of timer and auxiliary relays	×		
						Indicator, indicating lamp, and selector switch	×		
						Test terminals	×		
						Electrolytic capacitor	×		
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	×		
				Relay Unit	Visual Inspection	Board installation state	×	2	・Manufactured in 1985 (31 year-old) ・No maintenace record after COD ・Dust accumulation ・Aging degradation of meters, operation switches, protective relays, auxiliary relays and circuit breakers
						Installation state of connector and terminal	×		
						Indicator	×		
						Electrolytic capacitor	×		
						Contact point	×		
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire	×	1～3	・Dust accumulation on internal wires and terminals
				Control Cable		Terminal and cable	×		・Dust accumulation on control cables

(Remark)

Indoor Panel: 400V FEEDER-1 Manufactured in 1985
400V FEEDER-2 Manufactured in 1985
EDG FEEDER-3 Manufactured in 1985
No.1(11kV/400V) FEEDER-4 Manufactured in 1985
Outdoor S/S FEEDER-5 Manufactured in 1985
No.2 (11kV/400V) FEEDER-6 Manufactured in 1985
400V FEEDER-7 Manufactured in 1985
400V FEEDER-8 Manufactured in 1985

Outdoor Panel: 400V FEEDER-1 Manufactured in 1985

(Site Photo) Check List of Site Investigation

【date】
17-24, Feb

Photo	(C/C) Overall	(C/C) Detail	(C/C) Detail	Remarks
C／C 1		 FEEDER-1 FEEDER-2 FEEDER-7 FEEDER-8	 FEEDER-1 FEEDER-2 FEEDER-7 FEEDER-8	Auxiliary control center (C/C) ・Manufactured in 1985 (31 year-old) ・Aging degradation of MCCB,, timer, switches and auxiliary relays ・Dust accumulation
C／C 2		 FEEDER-3 FEEDER-4 FEEDER-5 FEEDER-6		EDG(11kV/400V) ・Manufactured in 1985 (31 year-old) ・Aging degradation of meters, operation switches, protective relays, auxiliary relay and circuit breaker
C／C 3	 Outdoor S/S Auxiliary Equipment C/C			Outdoor S/S auxiliary equipment control center ・Manufactured in 1985 (31 year-old) ・Aging degradation of MCCB, timer, switches and auxiliary relays ・Dust accumulation

(9.Fire Extinguishing System) Check List of Site Investigation

【date】 17-24, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (FAL)	Remarks
Fire Alarm System (Control Panel)	Fire Alarm System (Cenral Control Center) (FAL)			Overall	Visual Inspection	Power Unit			
						Installation state of board			
						Mounting state of timer and auxiliary relays			
						Indicator, indicating lamp, and selector switch、			
		Detector (Sensor)	Smoke Detector (Sensor)	Overall	Visual Inspection	Installation state of detector			
						Free from malfunction			
			Heat Detector (Sensor)			Installation state of detector			
						Free from malfunction			
			Optical Detector (Sensor)			Installation state of detector			
						Free from malfunction			
		Indivisual Alarm (Indicator and buzzer)		Overall	Visual Inspection	Power Unit			
						Installation state of alarm indication			
						Operation state of alarm indication			
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire			
				Control Cable		Terminal and cable			
Fire Extinguisher (Mobile type)	Fire Extinguisher (Mobile type)			Overall	Visual Inspection	Free from cracks, damage and leakage	○		
						Fire hose	×	1, 2	・Aging degradation of hose
						Periodic replacement of fire extinguishing compositions	○		

(Remark)

FIRE EXTINGUISHER: KS2SB(B・E) Manufactured in 1987 FIRE EXTINGUISHER: Pn6G(A・B・C・E) Manufactured in 1987 FIRE EXTINGUISHER: KS6SE(B・E) Manufactured in 1987

FIRE EXTINGUISHER: LW50(A・B) Manufactured in 1987 FIRE EXTINGUISHER: P50G(A・B・C・E) Manufactured in 1987 FIRE EXTINGUISHER: CO2(B・60kg) Manufactured in 1987

(Site Photo) Check List of Site Investigation

【date】
17-24, Feb

Photo	(Fire Extinguishing System) Overall	(Fire Extinguishing System) Detail	(Fire Extinguishing System) Detail	Remarks
FAL 1	KS2SB (B･E) 	Pn6GE (A･B･C･E) 	KS6SE (B･E) 	Fire Extinguisher ･Manufactured in 1987 (29 year-old) ･Replacement of extinguishing compositions 3years ago ･Aging degradation of hose
FAL 2	P50G (A･B) 	LW50 (A･B･C･E) 	CO2 (B･60kg) 	Fire Extinguisher ･Manufactured in 1987 (29 year-old) (only CO2 type is manufactured in 1986) ･Replacement of extinguishing compositions 4years ago ･Aging degradation of hose

(10. Ventilation System) Check List Site Investigation

【date】 23-25, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (DRS)	Remarks
Ventilation System	Ventilation System (DRS)	Suction System (DRS-IN) Exhaust System (DRS-OUT)	Control Panel (CON)	Overall	Visual Inspection	Installation state of termianl	×	2	・Manufactured in 1985 (31 year-old) ・Broken electrical components by lightening ・Corrosion and dust accumulation on wiring ・All electrical elements are not in operation. ・It does not work as control panel.
						Installation state of timer and auxiliary relay	×		
						Indicator, indicating lamp, and selector switch、	×		
						Installation state of NFB and MCCB	×		
			Relay (Ry)	Relay Unit	Visual Inspection	Board installation state	×	2	・Manufactured in 1985 (31 year-old) ・Broken electrical components by lightening ・All electrical elements are not in operation.
						Indicator	×		
						Contact point	×		
			FAN (FAN)	Overall	Visual Inspection	Installation state of motor	×	1	・Manufactured in 1985 (31 year-old) ・Dust accumulation on the fan and wires・Remote operation is not available from control panel.
						Installation state of fan	×		
						Power cable state	×		
			Suction Duct Exhaust Duct (DKT)	Overall	Visual Inspection	Installation state of duct	○		
						State of intake, outtake and filter	×	4	・Manufactured in 1985 (31 year-old) ・Fouling on ventilation duct and filter ・Some part of regulating valve are broken.
						State of flow regulating flow valve and switching lever	×		
		Control cable and wiring (Control Panel)		Wiring	Visual Inspection	Installation state of internal wire	×	1～3	・Dust accumulation on internal wires and terminals
				Control Cable		Terminal and cable	×		・Dust accumulation on control cables

(Remark)

VENTILATION CONTROL PANEL Manufactured in 1985

(Site Photo) Check List of Site Investigation

【date】
23-25, Feb

Photo	(Ventilation System) Overall	(Ventilation System) Detail	(Ventilation System) Detail	Remarks
DRS 1	Suction System 		2 Broken Machines 	Suction System (3 units) ・Manufactured in 1985 (31 year-old) ・Dust accumulation ・2 units are broken.
C／C 2	Ventilation Control Panel 			Ventilation Control Panel ・Manufactured in 1985 (31 year-old) ・Broken electrical components by lightening ・Corrosion and dust accumulation on wiring ・All electrical elements are not in operation. ・It does not work as control panel.
C／C 3	P/S Exhausting Fan Ceiling (3 units) 	1F Exhausting Fan 		Exhausting System (10 units) ・Manufactured in 1985 (31 year-old) ・10 fans in P/S ・Dust accumulation on the fan and wiring
C／C 4	P/S Suction Duct 	Broken Regulating Flow Valve 	Ventilation Duct and Filter 	Ventilation Duct ・Manufactured in 1985 (31 year-old) ・Broken regulating flow valve ・Fouling on ventilation duct and filter

【11. Air-conditioning System】 Check List of Site Investigation

【date】 23-25, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (AC)	Remarks
Air-Conditioning System	Air-Conditioning System (AC)	Air-Conditioning System (AC)	Control Panel (CON)	Overall	Visual Inspection	Installation state of termianl	×	2	・Manufactured in 1985 (31 year-old) ・Broken air-conditioning system ・Aging degradation of all electrical components in the cubicle ・It does not work as control panel
						Installation state of timer and auxiliary relay	×		
						Indicator, indicating lamp, and selector switch、	×		
						Installation state of NFB and MCCB	×		
			Water Cooling Medium (WEET)	Overall	Visual Inspection	Installation state of each device	×	1	
						State of pipings			
			Dry Cooling Medium (DRY)	Overall	Visual Inspection	Installation state of each device			
						State of pipings			
			Compressor (COMP)	Overall	Visual Inspection	Installation state of motor	×	1	・Manufactured in 1985 (31 year-old) ・Remote operation is not available from control panel ・Dust accumulation in the duct and on the cables
						Installation state of fan	×		
						State of power cable	×		
			Nozzle from Air-conditioning duct	Overall	Visual Inspection	Installation state of duct	-		*Duct is not able to check
						State of duct and filter	×	3	・Dust accumulation
		Control cable and wiring (Control Panel)		Wiring	Visual Inspection	Installation state of internal wire	×	2	・Dust accumulation on internal wires and terminals
				Control Cable		Terminal and cable	×		・Dust accumulation on control cables

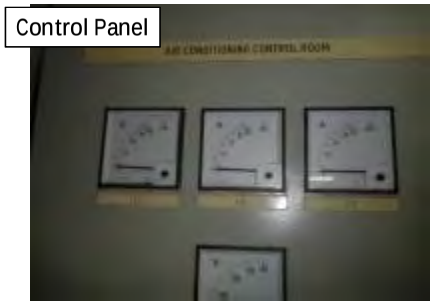
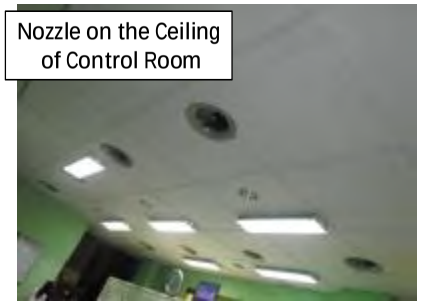
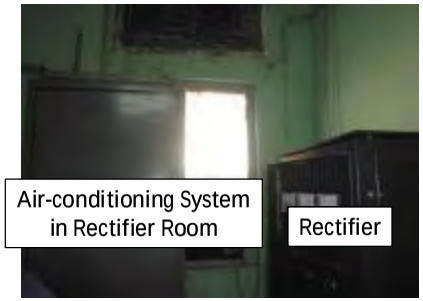
(Remark)

Air-conditioning system in control room (2 units) Manufactured in

Air-conditioning system in rectifier room (1 unit) Manufactured in

(Site Photo) Check List of Site Investigation

【date】
23-25, Feb

Photo	(Air-conditioning System) Overall	(Air-conditioning System) Detail	(Air-conditioning System) Detail	Remarks
AC 1				Air-conditioner (2 units) ・Manufactured in 1985 (31 year-old) ・Dust accumulation ・Both are broken.
AC 2				Air-conditioning control panel ・Manufactured in 1985 (31 year-old) ・Dust accumulation on wires, terminals and control cables. ・Both are broken. ・All electrical components in the cubicle do not work properly because of aging degradation.
AC 3				Ventilation duct and nozzles in control room ・Manufactured in 1985 (31 year-old) ・Dust accumulation in the ventilation duct ・Remote operation is not available from control panel.
AC 4				Air-conditioner in rectifier room (1unit) ・Manufactured in 1985 (31 year-old) ・Broken machine ・No air-conditioning equipment in rectifier room

(12.Water Level Gauge) Check List of Site Investigation

【date】
23-25, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (WLVG)	Remarks
Water Level Gauge (Water Level Gauge Unit) (Civil Equipment)	Water Level Gauge (WLVG)	Water Level Gauge (Main Body)		Detector	Visual Inspection	Float type			
						Pressure type	×	1～2	No data transmission from gauge
						Ultrasonic wave type			
						Breakwater pipe	○		
		Control Equipment (CON)		Overall	Visual Inspection	Data Transmission Line			
						Power Unit			
						Convertor, Inverter and Board			
						Rylay and Timer			
						Water Level Indicator			
						Grounding wire			
		Data Transmissio n Equipment (CDT) (VHF)		Data Transmission Equipment (CDT)	Visual Inspection	Power Unit and NFB			
						Control Unit, Detective Unit and Data Transmission Unit			
						Grounding wire			
		Frozenness and dew condensation prevention equipment		Overall	Visual Inspection	Heater Circuit			
	Control cable and wiring (Control Panel)			Wiring	Visual Inspection	Installation state of internal wire			
				Control Cable		Terminal and cable	×	1～2	・Dust accumulation on control cables

(Remark) Civil Equipment

Water Level Gauge in Dam intake (1unit) Manufactured in 1985 *This is maintained by ministry of aggriculture and irrigation.

Water Level Gauge in P/S (1 unit) Manufactured in 1985 *This is maintained by ministry of electric power.

(Site Photo) Check List of Site Investigation

【date】
23-25, Feb

Photo	(Water Level Gauge) Overall	(Water Level Gauge) Detail	(Water Level Gauge) Detail	Remarks
WLVG 1				Water level gauge at dam intake ・Manufactured in 1985 (31 year-old) ・No data transmission from water level gauge ・Dust accumulation on control cables ・This is maintained by ministry of aggriculture and irrigation .・Bulkwark is made by stainless steel.
WLVG 2				Water level gauge for tailrace ・Manufactured in 1985 (31 year-old) ・No data transmission from water level gauge ・Dust accumulation on control cables ・This is maintained by ministry of electric power .・Bulkwark pipe is made by stainless steel.

(13.Communication Equipment) Check List of Site Investigation

【date】 17-24, Feb

○: Acceptable ×:Not Acceptable ※:Remarks

Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspection		Inspection Point	Inspection Result	Photo (TC)	Remarks
Communication Equipment (TC) (Communication Equipment)	Communication Equipment (TC)	Data Transmission Equipment (CDT) (VHF)		Overall	Visual Inspection	Power Unit and NFB	×	1～3	・Communication equipment in control room is manufactured in 1963 and broken. ・Communication equipment in power room is manufactured in 1964 and broken. ・All devices are aging degradation and do not work properly. ・There are corrosion, deformation and rust. ・Corrosion and rust are on both cables and grounding wire.
						Control Unit, Detective Unit and Data Transmission Unit	×		
						Indicator, indicating lamp, and selector switch	×		
						Grounding wire	×		
		Control Equipment (TC-CON)		Overall	Visual Inspection	Data Transmission Line	×	1～3	・One unit is in control room and has been not in operation since 2007 and maintained by ministry of electric power. ・All devices are aging degradation and do not work properly. ・There are corrosion, deformation and rust.
						Power Unit	×		
						Convertor, Inverter and Board	×		
						Rylay and Timer	×		
						Indicator, indicating lamp, and selector switch	×		
						Grounding wire	×		
		Utility Pole and Steel Tower (TC-TW)		Overall	Visual Inspection	Steel tower for communication system			
						Utility pole for communication system	×	4	・There are corrosion, deformation and rust.
						lightning rod and grounding wire	×		・Melted lighting rod on utility pole
		Frozenness and dew condensation prevention equipment		Overall	Visual Inspection	Heater Circuit			
	Communication, Control Cable and Wiring			Wiring	Visual Inspection	Installation state of internal wire	×	1～4	・Dust accumulation
				Control Cable		Terminal and cable	×		

(Remark) Communication System

Telephone System in Control Room (1 unit) Manufactured in unknown by foreign manufacturer *This is maintained by ministry of electric power

CARRIER TELEHONE TERMINAL EQUIPMENT in Control Room (1unit) Manufactured in 1963 by HITACHI

CARRIER TELEHONE TERMINAL EQUIPMENT in Power Room (2 units) Manufactured in 1964 by HITACHI

Communication Antenna in Dam Intake Observing Station Manufactured in unknown by unknown

*Communication equipment is planned to set up by ministry of electric power for all hydropower plant in Myanmar and new equipment is held in Sedawgyi P/S. However, the specification of new equipment is unknown.

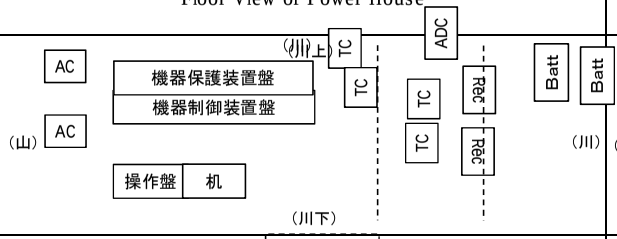
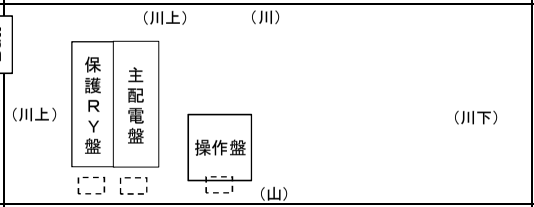
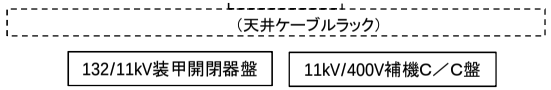
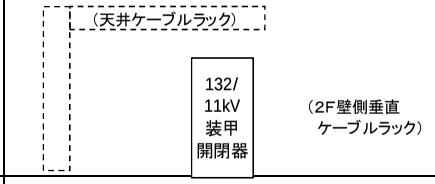
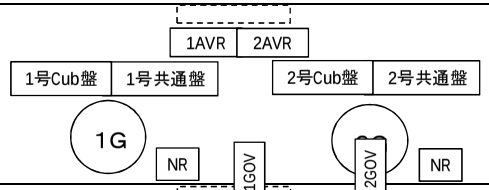
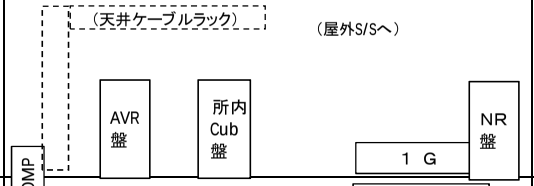
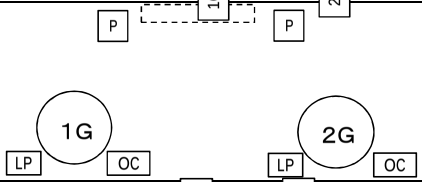
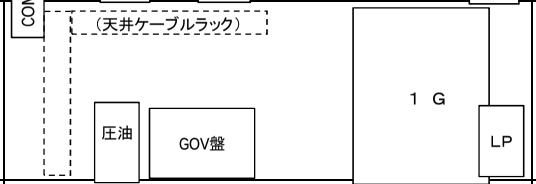
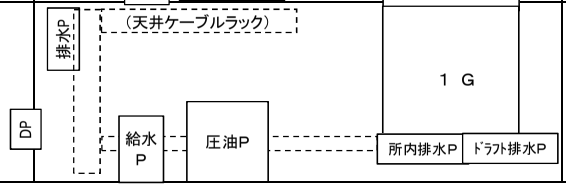
(Site Photo) Check List of Site Investigation

【date】
17-24, Feb

Photo	(Communication Equipment) Overall	(Communication Equipment) Detail	(Communication Equipment) Detail	Remarks
TC 1				Telephone System ・Not been used since 2007 ・Manufactured by foreign company ・Maintained by ministry of electric power ・Dust accumulation
TC 2				Telephone System in Control Room (1 unit) ・Manufactured in 1963 by HITACHI ・It does not work as communication tool ・Dust accumulation
TC 3				Telephone System in Power Room (2 units) ・Manufactured in 1964 by HITACHI ・It does not work as communication tool ・Dust accumulation
TC 4				Antenna for transmission of dam water level ・It does not work as communication tool ・The result of visual inspection is not accepted.

(14.Control Cable Route map) Check List of Site Investigation

【date】
17-26, Feb

Power House	Control Cable Route Floor View of Power House	Control Cable Route Cross Section of Power House	Number of cables	Length of cables	Photo No,	Remarks
1 F Control Room			Control Room and others about 350	14, 500	1 F	Distribution Panel and Relay Panel: 200 cables, 7,500m Opeartion Panel: 30 cables, 500m TC Panel (4 panels): 40cables, 2,800m AC/DC Control Panel: 40cables, 1,800m Ventilation System: 30 cables, 1,400m Air-conditioning System: 10cables, 500m
B 1 F 132/11kV Switch Gear			B1F about 170	16, 000	B1F	132/11kV Switchgear Cubicle 20 cables, 1,000m Outdoor S/S Control Cable 60 cables, 9,000m 11kV/400V Auxiliary Equipment Control Center: 90cables, 6,000m
B 2 F Generator Room			B2F about 250	14, 000	B2F	AVR Panel: 50 cables, 2,000m Station Service Cubicle: 60cables, 2,500m Turbine/Generator Gauge Panel 140 cbles, 8,500m
B 3 F Turbin Pit			B3F about 30	1, 500	B3F	Governor Regulator/Actuator Panel: 30 cables, 1,500m
B 4 F Draft Room			B4F N/A	0	B4F	Total number of removed cables: 350 + 170 + 250 + 30 = 800 cables Total length of removed cables: 14,500 + 16,000 + 14,000 + 1,500 =46,000m ⇒ Suppose the error rate is 1.2 =55200m ≒ 56, 000m

(Remark)

・Since all control cables are heavily degaraded such as corrosion, deformation and rust, the replacement is recommended.

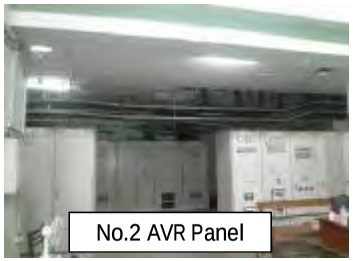
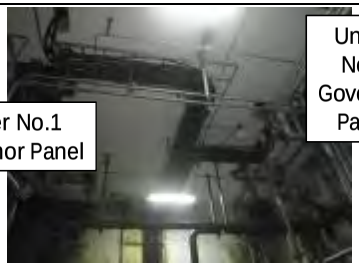
・Control cables are manufactured in 1985

(Total amount of estimated cables to remove)

1. The number of removed cables: about 800 cables
2. Total length of removed cables: about 56,000 m

(Site Photo) Check List of Site Investigation

【date】
17-26, Feb

Photo	(Control Cable) Overall	(Control Cable) Detail	(Control Cable) Detail	Remarks
1 F				
B1F				
B2F (Generator Room)				
B3F (Turbin Pit)				
B4F (Draft Room)				

ANNEX 7

REHABILITATION OF RELEVANT SUBSTATION AND TRANSMISSION LINE FACILITIES INSIDE POWER PLANTS

(1) Check List (Baluchaung No.1 Hydropower Plant)

(2) Check List (Sedawgyi Hydropower Plant)

Check List of Site Inspection for Transformers,132 kV Switchyard, Indoor Switchgear and Auxiliaries

Name of Power Station: Baluchaung No.1　　Date: 3rd Feb. to 5th Feb.

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
Transformer	132/11 kV Main Transformer			Rating	Confirmation of the rating of main transformer by name plate	○	B-1	
				Operating condition	Voltage, current, loads, frequency, power factor, cooling water temperature	○		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	○	B-2	
				Vibration	Confirmation of abnormal noise and vibration.	○	B-3	
				Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	○	B-4	
				Meter and relays	Visual inspection of operating conditions	○		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-5, B-6, B-7	Rust development has been occurred at roof of manin tank
		OLTC		Operating condition	Confirmation of normal operation and tap position	N/A		
				Vibration	Confirmation of abnormal noise and vibration.	N/A		
				Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	N/A		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	N/A		
		Bushing		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	○	B-8	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-9	Rust development has been occurred at the 11 kV bushing box.
		Oil Cooler		Oil leak	Visual inspection for oil leak of welded spot, gasket, etc.	○	B-10	
				Vibration	Confirmation of abnormal noise and vibration.	○	B-11	
				Radiator	Rust development, painting, peeling, deterioration, etc.	○	B-12	
				Cooling fan	Visual inspection of operating conditions	N/A		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	○	B-13	

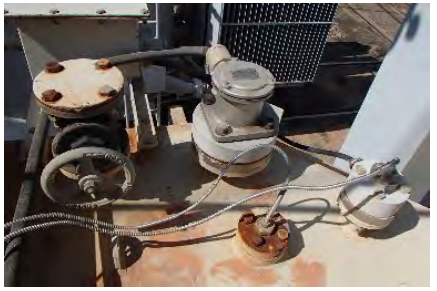
Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
Transformer	11 kV Tie Transformer			Rating	Confirmation of the rating of tie transformer by name plate	○	B-14	
				Operating condition	Voltage, current, loads, frequency, power facto, etc.	○		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	○	B-15	
				Vibration	Confirmation of abnormal noise and vibration.	○	B-16	
				Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	X		There is no oil temrature meter.
				Meter and relays	Visual inspection of operating conditions	○	B-17	Omly winding temperature meter
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-18	there is some deterioration at roof and duct of main tank.
		Cable duct		Appearance check	Rust development, painting, peeling, deterioration, etc.	○	B-19	
	11/0.4 kV Station			Rating	Confirmation of the rating of station service transformer by name plate	○	B-20	
				Operating condition	Voltage, current, loads, frequency, power facto, etc.	○		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	N/A		Dry Type
				Vibration	Confirmation of abnormal noise and vibration.	○		
				Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	○	B-21	
				Meter and relays	Visual inspection of operating conditions	○	B-21	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	○	B-22	
		Insulators		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	N/A		Dry Type
				Appearance check	Rust development, painting, peeling, deterioration, etc.	○	B-23	
132 kV Switchyard	Circuit Breaker			Rating	Confirmation of the rating of 132 kV CB by name plate	○	B-24	
				Operating condition	Confirmation of trouble report for operation	X		Auxiliary relay was broken.
				Condition	Confirmation of abnormal noise and odor.	X		Gas volume of phase C CB is lower than others

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
		Insulator		Appearance check	Pollution, deterioration, etc.	○	B-25	
		Tank		Appearance check	Rust development, painting, peeling, deterioration, etc.	○	B-26	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	B-27	
		Terminal area		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	B-28	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	X	B-29	
		Foundation		Appearance check	Deterioration, etc.	○	B-30	
	Disconnector			Rating	Confirmation of the rating of 132 kV DS by name plate	○	B-31	
		Insulator		Appearance check	Pollution, deterioration, etc.	○	B-32	
		Blade		Appearance check	Rust development, painting, deterioration, etc.	○	B-33	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	X	B-34	
		Contact parts		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	B-35	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	X	B-36	
		Foundation		Appearance check	Deterioration, etc.	○	B-37	
	Current Transformer			Rating	Confirmation of the rating of 132 kV CT by name plate	N/A		
		Insulator		Appearance check	Pollution, deterioration, etc.	N/A		
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	N/A		
		Tank and terminal area		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	N/A		
		Foundation		Appearance check	Deterioration, etc.	N/A		
	Capacitor Voltage Transformer			Rating	Confirmation of the rating of 132 kV CVT by name plate	○	B-38	
		Insulator		Appearance check	Pollution, deterioration, etc.	○	B-39	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	B-40	
		Tank and terminal area		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	○	B-41	
		Foundation		Appearance check	Deterioration, etc.	○	B-42	
	Surge Arrester			Rating	Confirmation of the rating of 132 kV SA by name plate	X		
		Insulator		Appearance check	Pollution, deterioration, etc.	○	B-43	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	B-44	

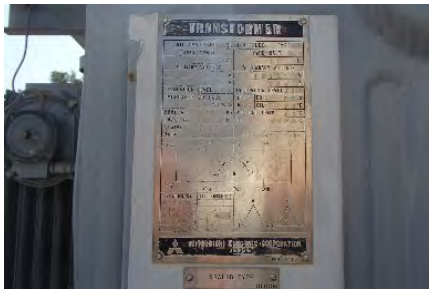
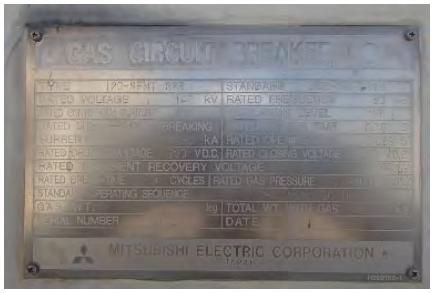
Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
		Foundation		Appearance check	Deterioration, etc.	X	B-45	
	11 kV cable and bus	11 kV cable		Appearance check	insufficient insulation, erosion, pollution, deterioration, etc.	X	B-46	Decrease of inlulation level
		11 kV busbar		Appearance check	Rust development, painting, deterioration, etc.	X	B-47	overload, loose connection, lack of capacity
		Cable head		Appearance check	Tarnish by overhear, deterioration, etc.	○	B-48	
	Gantry Structure	Steel structure		Appearance check	Rust development, painting, deterioration, etc.	○	B-49	
		Busbar conductor and clamps		Appearance check	Size, pollution, deterioration, etc.	X	B-50	loose connection
		Insulaters and fittings		Appearance check	Pollution, deterioration, etc.	X	B-51	Pollution
		Foundation		Appearance check	Deterioration, etc.	○	B-52	
Indoor Switchgear	11kV Generator Switchgear			Rating	Confirmation of the rating of 11 kV generator switchgear by name plate	○	B-53	
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-54	
		11 kV busbar	Busbar	Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	B-55	
			Insulators and support	Appearance check	Trace by corona discharge and tracking, deterioration, etc.	X	B-56	
			Voltage Transformer	Appearance check	Abraision, pollution, deterioration, etc.	○	B-57	
		11 kV switchgear	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X	B-58	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	○	B-59	
			Current transformer	Appearance check	Abraision, pollution, deterioration, etc.	○	B-60	
	Low voltage switchgear			Rating	Confirmation of the rating of LV switchgear by name plate	X		
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-61	
		400 V busbar	Busbar	Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	B-62	
			Insulators and support	Appearance check	Trace by corona discharge and tracking, deterioration, etc.	○	B-63	
		Transformer Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X	B-64	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	○	B-65	
		400V Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X	B-66	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	○	B-67	

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
Auxiliaries	AC Panel			Rating	Confirmation of the rating of DC Panel by name plate	○	B-68	
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-69	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	B-70	
	DC Panel			Rating	Confirmation of the rating of DC Panel by name plate	○	B-71	
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-72	
		DC Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X	B-73	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	B-74	
	DC Battery and Charger			Rating	Confirmation of the rating of DC battery and charger by name plate	○	B-75	
		DC battery		Appearance check	Electric erosion, leakage deterioration, etc.	X	B-76	
		DC battery charger	Cubicle	Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-77	
			Rectifier	Appearance check	Abraision, pollution, deterioration, etc.	X	B-78	
	Emergency DG set			Rating	Confirmation of the rating of EDG by name plate	○	B-79	
		Motor		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	X	B-80	
		Generator		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-81	
		Tank		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	X	B-82	
Control Room	Transmission line protection panel	Control Panel		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-83	
		Protection Panel		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	B-84	
記事								

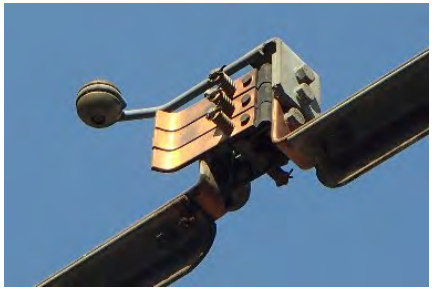
[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-1 132/11kV Main Tr. Name plate		B-2 132/11kV Main Tr. Oil leak check		B-3 132/11kV Main Tr. Vibration and noise check	
B-4 132/11kV Main Tr. Temperature meter		B-5 132/11kV Main Tr. Appearance check		B-6 132/11kV Main Tr. Appearance check	
B-7 132/11kV Main Tr. Appearance check		B-8 132/11kV Main Tr. Bushing oil leak check		B-9 132/11kV Main Tr. Appearance check	
B-10 132/11kV Main Tr. Radiator oil leak check		B-11 132/11kV Main Tr. Radiator noise check		B-12 132/11kV Main Tr. Appearance check	

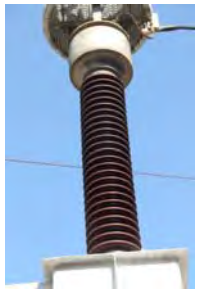
[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-13 132/11kV Main Tr. Appearance check		B-14 11/11kV Tie Transformer Name plate		B-15 11/11kV Tie Transformer Oil leak check	
B-16 11/11kV Tie Transformer Vibration and noise check		B-17 11/11kV Tie Transformer Temperature meter		B-18 11/11kV Tie Transformer Appearance check	
B-19 11/11kV Tie Transformer Cable duct check		B-20 11/0.4 kV Station Tr. Name plate		B-21 11/0.4 kV Station Tr. Temperature meter	
B-22 11/0.4 kV Station Tr. Appearance check		B-24 11/0.4 kV Station Tr. Insulators check		B-24 132 kV circuit breaker Name plate	

[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-25 132 kV circuit breaker Insulator check		B-26 132 kV circuit breaker Tank check		B-27 132 kV circuit breaker Ironware check	
B-28 132 kV circuit breaker Terminal parts check		B-29 132 kV circuit breaker Control box check		B-30 132 kV circuit breaker Foundation check	
B-31 132 kV Disconnectors Name plate		B-32 132 kV Disconnectors Insulator check		B-33 132 kV Disconnectors Blade check	
B-34 132 kV Disconnectors Ironware check		B-35 132 kV Disconnectors Contract parts check		B-36 132 kV Disconnectors Control box check	

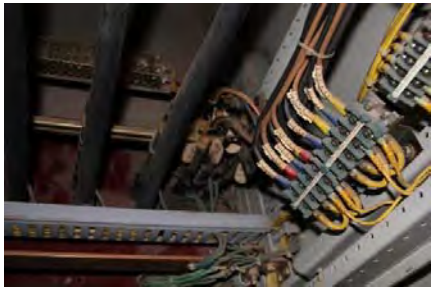
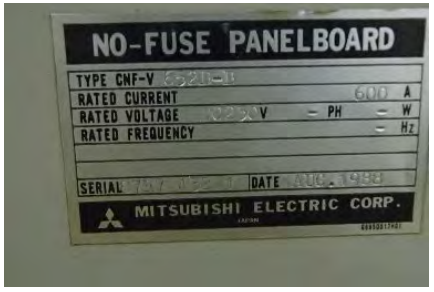
[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-37 132 kV disconnectors Foundation check		B-38 132 kV CVT Name plate		B-39 132 kV CVT Insulator check	
B-40 132 kV CVT Ironware check		B-41 132 kV CVT Tank check		B-42 132 kV CVT Foundation check	
B-43 132 kV surge arrester Insulator check		B-44 132 kV surge arrester Ironware check		B-45 132 kV surge arrester Foundation check	
B-46 11 kV cable Appearance check		B-47 11 kV busbar Appearance check		B-48 11 kV cable head Appearance check	

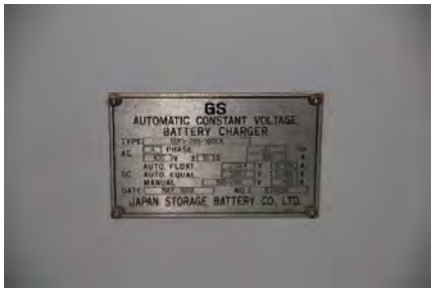
[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-49 Gantry structure. Appearance check		B-50 Cable clamps Appearance check		B-51 Insulator strings Appearance check	
B-52 Gantry structure Foundation check		B-53 11 kV circuit breakers Name plate		B-54 11 kV cubicle Appearance check	
B-55 11 kV busbar Appearance check		B-56 11 kV insulators Appearance check		B-57 11 kV VT Appearance check	
B-58 11 kV cable and terminals Appearance check		B-59 11 kV circuit breakers Appearance check		B-60 11 kV CT Appearance check	

[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-61 LV switchgear Appearance check		B-62 LV busbar Appearance check		B-63 LV insulators Appearance check	
B-64 LV cable and terminals Appearance check		B-65 LV ACB Appearance check		B-66 LV cables Appearance check	
B-67 LV MCCB Appearance check		B-68 AC panels Name plate		B-69 AC panels Appearance check	
B-70 AC panels MCCB Appearance check		B-71 DC panels Name plate		B-72 DC panels Appearance check	

[Site Photography] Power Station : Baluchaung No.1 Date : 3rd Feb. to 5th Feb.

B-73 DC panels MCCB Appearance check		B-74 DC panels Appearance check		B-75 DC battery charger Name plate	
B-76 DC batteries Appearance check		B-77 DC battery charger Appearance check		B-78 DC battery charger Appearance check	
B-79 Emergency DG set Name plate		B-80 Emergency DG motor Appearance check		B-81 EDG Generator Appearance check	
B-82 EDG oil tank Appearance check		B-83 TL control panel Appearance check		B-84 TL protection panel Appearance check	

Check List of Site Inspection for Transformers,132 kV Switchyard, Indoor Switchgear and Auxiliaries

Name of Power Station: Sedawgyi　　Date: 9th Feb. to 11th Feb.

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
Transformer	132/11 kV Main Transformer			Rating	Confirmation of the rating of main transformer by name plate	○	S-1	
				Operating condition	Voltage, current, loads, frequency, power factor, cooling water temperature	○		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	X	S-2.S-3,S-4,S-	
				Vibration	Confirmation of abnormal noise and vibration.	○	S-6	
				Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	○	S-7	
				Meter and relays	Visual inspection of operating conditions	X	S-8	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-9.S-10,S-11,S-12	
		OLTC		Operating condition	Confirmation of normal operation and tap position	N/A		
				Vibration	Confirmation of abnormal noise and vibration.	N/A		
				Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	N/A		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	N/A		
		Bushing		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	X	S-13	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-14	
		Oil Cooler		Oil leak	Visual inspection for oil leak of welded spot, gasket, etc.	X	S-15	
				Vibration	Confirmation of abnormal noise and vibration.	○	SS-6	
				Radiator	Rust development, painting, peeling, deterioration, etc.	X	S-16	
				Cooling fan	Visual inspection of operating conditions	N/A		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-17	

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
Transformer	11 kV Tie Transformer			Rating	Confirmation of the rating of tie transformer by name plate	○	S-18	
				Operating condition	Voltage, current, loads, frequency, power facto, etc.	○		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	X	S-19,S-20,S-21	
				Vibration	Confirmation of abnormal noise and vibration.	○		
				Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	X		There is no oil temrature meter.
				Meter and relays	Visual inspection of operating conditions	X		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-22	there is some deterioration at roof and duct of main tank.
		Insulators		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	X	S-23	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-24	
	11/0.4 kV Station			Rating	Confirmation of the rating of station service transformer by name plate	○	S-25	
				Operating condition	Voltage, current, loads, frequency, power facto, etc.	○		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	X	S-27	
				Vibration	Confirmation of abnormal noise and vibration.	○		
				Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	X	S-28	There is no oil temrature meter.
				Meter and relays	Visual inspection of operating conditions	X	S-28	There is no oil temrature meter.
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-29, S-30	
		Insulators		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	X	S-31	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-32	
132 kV Switchyard	Circuit Breaker			Rating	Confirmation of the rating of 132 kV CB by name plate	○	S-33, S-34	
				Operating condition	Confirmation of trouble report for operation	X		Automatic motor charging operation is broken

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
				Condition	Confirmation of abnormal noise and odor.	○		
		Insulator		Appearance check	Pollution, deterioration, etc.	○	S-35	
		Tank		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-36	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	S-37	
		Terminal area		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	S-38	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	X	S-39	
		Foundation		Appearance check	Deterioration, etc.	X	S-40	
	Disconnector			Rating	Confirmation of the rating of 132 kV DS by name plate	○	S-41, S-42	
		Insulator		Appearance check	Pollution, deterioration, etc.	○	S-43	
		Blade		Appearance check	Rust development, painting, deterioration, etc.	X	S-44	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	S-45	
		Contact parts		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	S-46	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	○	S-47	
		Foundation		Appearance check	Deterioration, etc.	○	S-48	
	Current Transformer			Rating	Confirmation of the rating of 132 kV CT by name plate	○	S-49	
		Insulator		Appearance check	Pollution, deterioration, etc.	○	S-50	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	S-51	
		Tank and terminal area		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	X	S-52	
		Foundation		Appearance check	Deterioration, etc.	○	S-53	
	Capacitor Voltage Transformer			Rating	Confirmation of the rating of 132 kV CVT by name plate	○	S-54	Not operating
		Insulator		Appearance check	Pollution, deterioration, etc.	○	S-55	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	S-56	
		Tank and terminal area		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	X	S-57	Oil leak
		Foundation		Appearance check	Deterioration, etc.	○	S-58	
	Surge Arrester			Rating	Confirmation of the rating of 132 kV SA by name plate	○	S-59	
		Insulator		Appearance check	Pollution, deterioration, etc.	○	S-60	

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	○	S-61	
		Foundation		Appearance check	Deterioration, etc.	○	S-62	
	11 kV cable and bus	11 kV cable		Appearance check	insufficient insulation, erosion, pollution, deterioration, etc.	X	S-63	Decrease of inlulation level
		11 kV busbar		Appearance check	Rust development, painting, deterioration, etc.	X	S-64	insutator was repaired due to flash over
		Cable head		Appearance check	Tarnish by overhear, deterioration, etc.	○	S-64	
	Gantry Structure	Steel structure		Appearance check	Rust development, painting, deterioration, etc.	○	S-65	
		Busbar conductor and clamps		Appearance check	Size, pollution, deterioration, etc.	○	S-66	
		Insulaters and fittings		Appearance check	Pollution, deterioration, etc.	○	S-67	
		Foundation		Appearance check	Deterioration, etc.	○	S-68	
Indoor Switchgear	11kV Generator Switchgear			Rating	Confirmation of the rating of 11 kV generator switchgear by name plate	○		
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-69, S-70	
		11 kV busbar	Busbar	Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X		
			Insulators and support	Appearance check	Trace by corona discharge and tracking, deterioration, etc.	○		
			Voltage Transformer	Appearance check	Abraision, pollution, deterioration, etc.	○	S-71	
		Unit 1 Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-74	
		Unit 2 Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-74	Not installed
		Station Transfomer 1	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-72	
		Station Transfomer 2	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-73	Not installed
		11/11 kV Tie Transformer in	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-75	
		11/11 kV Tie Transformer	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○	S-70	

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
Auxiliaries			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-75	
		Irrication Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	○		
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	○	S-76	
			Current transformer	Appearance check	Abraision, pollution, deterioration, etc.	○		
		Residential Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X		
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-77	
			Current transformer	Appearance check	Abraision, pollution, deterioration, etc.	X		not operating
	Low voltage switchgear			Rating	Confirmation of the rating of LV switchgear by name plate	X		
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-78	
		400 V busbar	Busbar	Appearance check	Tarnish by overheat, rust development, deterioration, etc.	X	S-79	
			Insulators and support	Appearance check	Trace by corona discharge and tracking, deterioration, etc.	X		
		LV Switchgear	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X	S-79	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-80	
	DC Panel			Rating	Confirmation of the rating of DC Panel by name plate	X		
				Condition	Confirmation of abnormal noise and odor.	○		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-81	
		DC Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	X	S-82	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	X	S-83	
	DC Battery and Charger			Rating	Confirmation of the rating of DC battery and charger by name plate	X		cannnot confirmed
				Condition	Confirmation of abnormal noise and odor.	X		
		DC battery		Appearance check	Electric erosion, leakage deterioration, etc.	○	S-84	Replaced on 2009 and 2012
		DC battery charger	Cubicle	Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-85	
			Rectifier	Appearance check	Abraision, pollution, deterioration, etc.	X	S-86	
	Emergency DG set			Rating	Confirmation of the rating of EDG by name plate	○	S-87	Automatic operation system is not equipped

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
		Motor		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	X	S-88	
		Generator		Appearance check	Rust development, painting, peeling, deterioration, etc.	○	S-89	
		Tank		Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	X	S-90	
Control Room	Transmission line protection panel	Control Panel		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-91	
		Protection Panel		Appearance check	Rust development, painting, peeling, deterioration, etc.	X	S-92	
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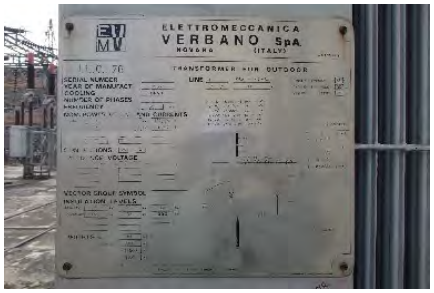
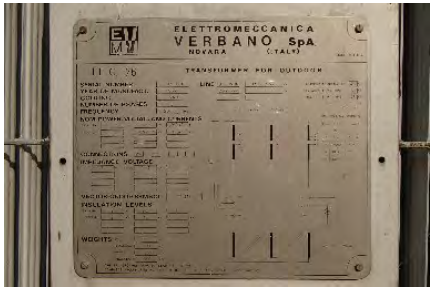
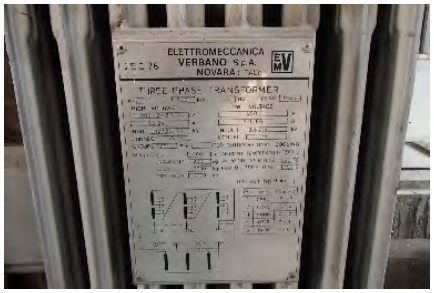
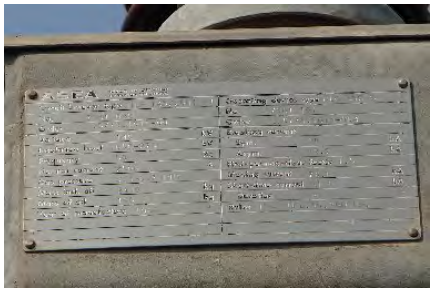
[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-1 132/11kV Main Tr. Name Plate		S-2 132/11kV Main Tr. Oil leak check		S-3 132/11kV Main Tr. Oil leak check	
S-4 132/11kV Main Tr. Oil leak check		S-5 132/11kV Main Tr. Oil leak check		S-6 132/11kV Main Tr. Vibration and noise check	
S-7 132/11kV Main Tr. Control box		S-8 132/11kV Main Tr. Temperature meter		S-9 132/11kV Main Tr. Appearance check	
S-10 132/11kV Main Tr. Appearance check		S-11 132/11kV Main Tr. Appearance check		S-12 132/11kV Main Tr. Appearance check	

[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-13 132/11kV Main Tr. 132 kV Bushing		S-14 132/11kV Main Tr. Neutral bushing		S-15 132/11kV Main Tr. Oil leak at radiator	
S-16 132/11kV Main Tr. Rust of radiator		S-17 132/11kV Main Tr. Appearance check		S-18 11/11 kV Tie Transformer Name plate	
S-19 11/11 kV Tie Transformer Oil leak check		S-20 11/11 kV Tie Transformer Oil leak check		S-21 11/11 kV Tie Transformer Oil leak check	
S-22 11/11 kV Tie Transformer Appearance check		S-24 11/11 kV Tie Transformer Insulator		S-24 11/11 kV Tie Transformer Appearance check	

[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-25 11/0.4 kV Station Tr. Name Plate		S-26 11/0.4 kV Station Tr. Oil leak check		S-27 11/0.4 kV Station Tr. Oil leak check	
S-28 11/0.4 kV Station Tr. Temperature meter		S-29 11/0.4 kV Station Tr. Appearance check		S-30 11/0.4 kV Station Tr. Appearance check	
S-31 11/0.4 kV Station Tr. Cable connection		S-32 11/0.4 kV Station Tr. Insulators check		S-33 132 kV Circuit breakers Name plate 1	
S-34 132 kV Circuit breakers Name plate 2		S-35 132 kV Circuit breakers Insulator check		S-36 132 kV Circuit breakers Tank check	

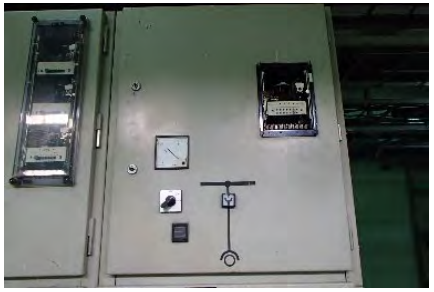
[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-37 132 kV Circuit breakers Ironware check		S-38 132 kV Circuit breakers Terminal area check		S-39 132 kV Circuit breakers Spring motor check	
S-40 132 kV Circuit breakers Foundation check		S-41 132 kV Disconnectors Name plate 1		S-42 132 kV Disconnectors Name plate 2	
S-43 132 kV Disconnectors Insulator check		S-44 132 kV Disconnectors Blade check		S-45 132 kV Disconnectors Ironware check	
S-46 132 kV Disconnectors Contract parts check		S-47 132 kV Disconnectors Control box check		S-48 132 kV Disconnectors Foundation check	

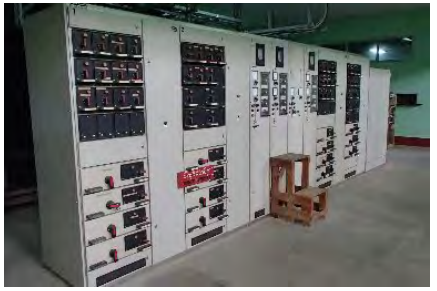
[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-49 132 kV CT Name Plate		S-50 132 kV CT Insulator check		S-51 132 kV CT Ironware check	
S-52 132 kV CT Terminal area check		S-53 132 kV CT Foundation check		S-54 132 kV CVT Name plate	
S-55 132 kV CVT Insulator check		S-56 132 kV CVT Ironware chek		S-57 132 kV CVT Tank check	
S-58 132 kV CVT Foundation check		S-59 132 kV surge arrester Name plate		S-60 132 kV surge arrester Insulator check	

[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-61 132 kV surge arrester. Surge counter		S-62 132 kV surge arrester foundation		S-63 11 kV cable Appearance check	
S-64 11 kV bubar/ cable head Appearance check		S-65 Gantry structure Appearance check		S-66 132 kV busbar Appearance check	
S-67 Insulator string Appearance check		S-68 Gantry structure Foundation chek		S-69 11 kV swtichgear Appearance check	
S-70 11 kV swtichgear Appearance check		S-71 11 kV swtichgear Appearance check VT		S-72 11 kV swtichgear Appearance check	

[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-73 11 kV swtichgear Appearance check		S-74 11 kV swtichgear Appearance check		S-75 11 kV swtichgear Appearance check	
S-76 11 kV swtichgear Appearance check		S-77 11 kV swtichgear Appearance check		S-78 LV switchgear Appearance check	
S-79 LV switchgear Cable and terminals		S-80 LV switchgear MCCB Appearance		S-81 DC panelr Appearance check	
S-82 DC panel Cable and terminal		S-83 LV switchgear MCCB Appearance check		S-84 DC batteries Appearance check	

[Site Photography] Power Station : Sedawgyi Date : 9th Feb. to 11th Feb.

S-85 DC battery charger Appearance check		S-86 DC battery charger Appearance check		S-87 Emergency DG set Name plate	
S-88 EDG motor Appearance check		S-89 EG generator Appearance check		S-90 EDG tank Appearance check	
S-91 132 kV T/L control panel Appearance check		S-92 TL protection panel Appearance check			

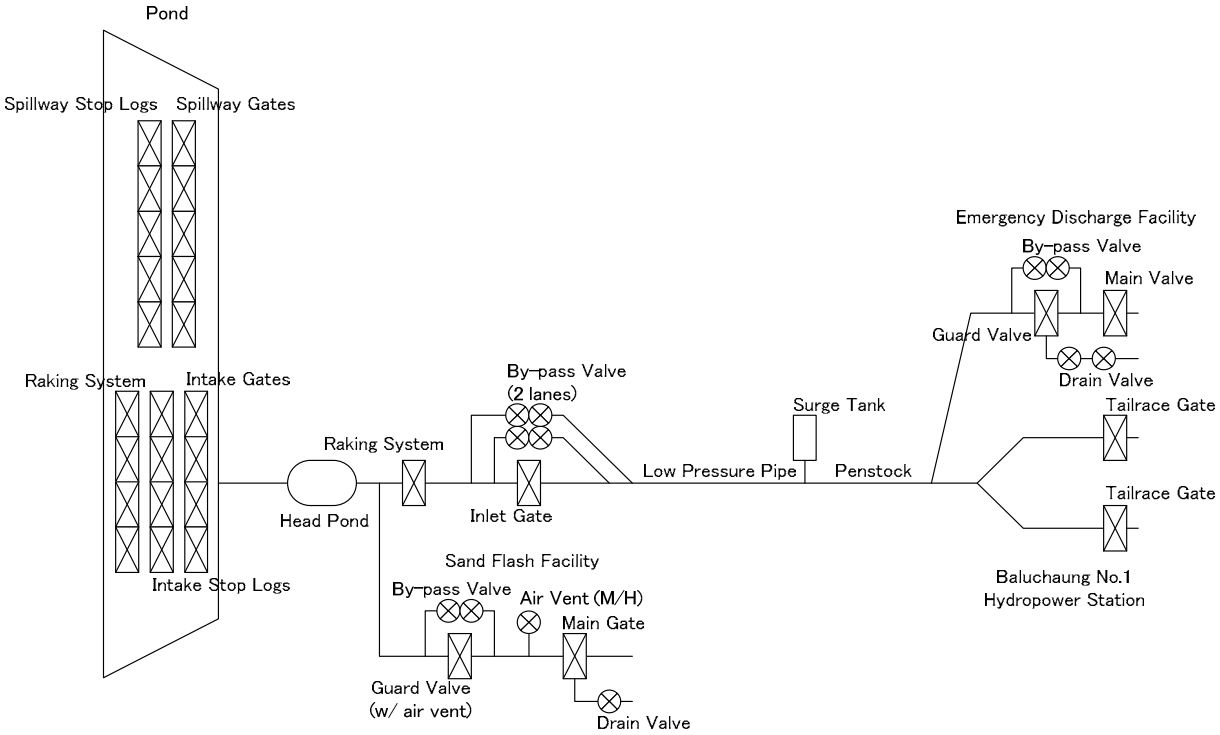
ANNEX 8

REHABILITATION OF GATES AND PENSTOCK

(1) Check List (Baluchaung No.1 Hydropower Plant)

(2) Check List (Sedawgyi Hydropower Plant)

Check Sheet of Baluchaung No.1 Hydropower Plant



Station	Place	Facility		Qty	Note
Baluchaung No.1	Dam	Spillway	Stop Log	5sets	with monorail hoist
			Gate	5sets	
		Intake	Raking sysytem	4sets	Trash car type
			Stop Log	4sets	with monorail hoist
			Gate	4sets	
	Head Pond	Inlet	Raking sysytem	1set	
			Gate	1set	
			By-pass Valve	2sets	Main & Sub each
		Sand Flash	Guard Valve	1set	with air vent
			Main Gate	1set	
			By-pass Valve	1set	Main & Sub
			Air Vent	1set	Man Hole
			Drain Valve	1set	for Main Gate
	Low Pressure Pipe			1set	
	Penstock			1anes	with Y branch
	Power Station	Tailrace Gate	Gate	2sets	with monorail hoist
		Emergency Discharge	Guard Valve	1set	
			Main Gate	1set	
			By-pass Valve	1set	Main & Sub
			Drain Valve	1set	for Guard Valve

Baluchaung No.1 Hydropower Plant

Documents

Object	Items	☑	Detail	Photo
Documents	Calculation Sheet	☐	Provision of calculation sheets	
	Drawing	☐	Provision of drawings	
Maintenance Record	Maintenance Record	☐	Provision of maintenance record that shows current failure	
	Modification Record	☐	Provision of modification record	
Hearing	Operation	☐	Confirm the frequency and criteria for gate operation	
	Failure	☑	Confirm the current failure	☑
	Inspection	☑	Confirm the frequency and measure for the inspection and maintenance	
		☐		☐

Baluchaung No.1 Hydropower Plant

Intake Dam Spillway Gates

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Frame	Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Component	Visual Inspection	☑	Plate	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Wire Rope	Visual Inspection	☑	Damage, deformation or greasing condition	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Installation	Installation	Visual Inspection	☑	General arrangement	☑
		Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Dimensions of open mouth	☑
	Wiring, Piping	Confirm the route	☑	Check the route of wiring and piping	☑
	Outside	Visual Inspection	☑	General arrangement, space for crane and access	☑
Control	Control Panel	Visual Inspection	☑	Damage, deformation or corrosion (outside)	☑
		Visual Inspection	☑	Damage, deformation or corrosion (inside)	☑
		Visual Inspection	☑	Plate, items	☑
	Meters	Visual Inspection	☑	Damage, deformation and legibility	☑
	Lumps	Visual Inspection	☑	Conditions of the light bulbs	☑

Baluchaung No.1 Hydropower Plant

Intake Dam Spillway Stoplog

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Frame	Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Wire Rope	Visual Inspection	☑	Damage, deformation or greasing condition	☑

Baluchaung No.1 Hydropower Plant

Intake Dam Intake Gate

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Component	Visual Inspection	☑	Plate	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Wire Rope	Visual Inspection	☑	Damage, deformation or greasing condition	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Installation	Installation	Visual Inspection	☑	General arrangement	☑
		Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Dimensions of open mouth	☑
	Wiring, Piping	Confirm the route	☑	Check the route of wiring and piping	☑
	Outside	Visual Inspection	☑	General arrangement, space for crane and access	☑
Control	Control Panel	Visual Inspection	☑	Damage, deformation or corrosion (outside)	☑
		Visual Inspection	☑	Damage, deformation or corrosion (inside)	☑
		Visual Inspection	☑	Plate, items	☑
	Meters	Visual Inspection	☑	Damage, deformation and legibility	☑
	Lumps	Visual Inspection	☑	Conditions of the light bulbs	☑
Raking System	Screen	Visual Inspection	☑	Damage, deformation or corrosion	☑
		Visual Inspection	☑	Deterioration of the paint	☑
	Raking System	Visual Inspection	☑	Damage, deformation or corrosion	☑
		Visual Inspection	☑	Operation	☑
		Visual Inspection	☑	Oil leakage	☐

Baluchaung No.1 Hydropower Plant

Intake Dam Intake Stoplog

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Frame	Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑

Baluchaung No.1 Hydropower Plant

Head Pond Inlet Gate

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Frame	Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☐
		Measure the thickness	☑	Measure the thickness of the skinplate	
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Component	Visual Inspection	☑	Plate	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Spindle	Visual Inspection	☑	Damage, deformation or greasing condition	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Installation	Installation	Visual Inspection	☑	General arrangement	☑
		Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Dimensions of open mouth	☑
	Wiring, Piping	Confirm the route	☑	Check the route of wiring and piping	☑
	Outside	Visual Inspection	☑	General arrangement, space for crane and access	☑
Control	Control Panel	Visual Inspection	☑	Damage, deformation or corrosion (outside)	☑
		Visual Inspection	☑	Damage, deformation or corrosion (inside)	☑
		Visual Inspection	☑	Plate, items	☑
	Meters	Visual Inspection	☑	Damage, deformation and legibility	☑
	Lumps	Visual Inspection	☑	Conditions of the light bulbs	☑
Raking System	Screen	Visual Inspection	☑	Damage, deformation or corrosion	☑
		Visual Inspection	☑	Deterioration of the paint	☑
	Raking System	Visual Inspection	☐	Damage, deformation or corrosion	☐
		Visual Inspection	☐	Operation	☐
		Visual Inspection	☑	Oil leakage	☐

Baluchaung No.1 Hydropower Plant

Head Pond Bypass Valve

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Spindle	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Installation	Installation	Visual Inspection	☑	General arrangement	☑
		Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Dimensions of open mouth	☑
	Operation Room	Visual Inspection	☑	General arrangement, hooks on ceiling	☑
	Outside	Visual Inspection	☑	General arrangement, space for crane and access	☑

Baluchaung No.1 Hydropower Plant

Head Pond Sand Flash Gate

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Spindle	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Installation	Installation	Visual Inspection	☑	General arrangement	☑
		Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Dimensions of open mouth	☑
	Operation Room	Visual Inspection	☑	General arrangement, hooks on ceiling	☑
	Outside	Visual Inspection	☑	General arrangement, space for crane and access	☑
Control	Control Panel	Visual Inspection	☑	Damage, deformation or corrosion (outside)	☑
		Visual Inspection	☑	Damage, deformation or corrosion (inside)	☑
		Visual Inspection	☑	Plate, items	☑
	Meters	Visual Inspection	☑	Damage, deformation and legibility	☑
	Lumps	Visual Inspection	☐	Conditions of the light bulbs	☑

Baluchaung No.1 Hydropower Plant

Low Pressure Pipe Line

Facility	Item	Measure	☑	Details	Photo
Steel Pipe	General	Visual Inspection	☐	Damage, deformation or water leakage	☐
	Surface	Visual Inspection	☐	Deterioration of the paint	☐
	Steel Pipe	Measure the thickness	☑	Measure the thickness of the steel pipe	
Support	Support	Visual Inspection	☐	Damage or deformation	☐
Access	Access	Visual Inspection	☐	General arrangement, space for crane and access	☐

Baluchaung No.1 Hydropower Plant

Penstocks

Facility	Item	Measure	☑	Details	Photo
Steel Pipe	General	Visual Inspection	☑	Damage, deformation or water leakage	☐
	Surface	Visual Inspection	☑	Deterioration of the paint	☐
	Steel Pipe	Measure the thickness	☑	Measure the thickness of the steel pipe	
Support	Support	Visual Inspection	☑	Damage or deformation	☐
Access	Access	Visual Inspection	☑	General arrangement, space for crane and access	☐

Baluchaung No.1 Hydropower Plant

Power Station Emergency Discharge Valve

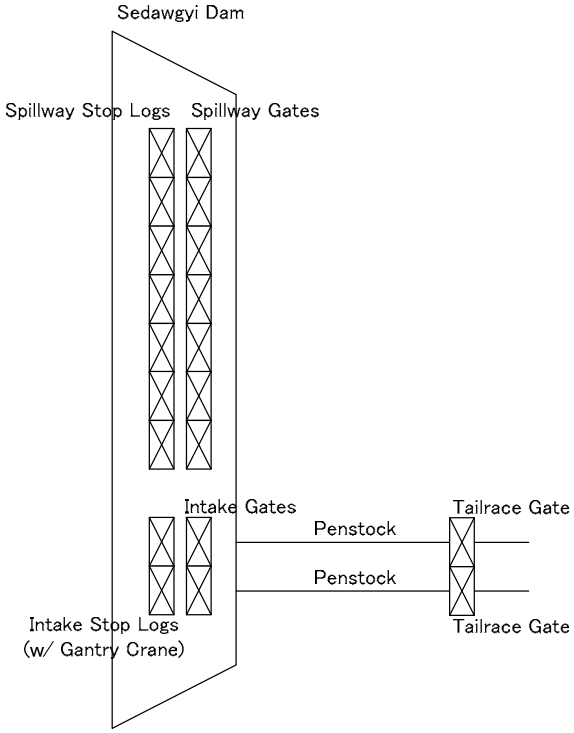
Facility	Item	Measure	☑	Details	Photo
Valve	General	Visual Inspection	☑	Cleanness	☑
	Valve	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Viblation or noise	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Oil Pressure Unit	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Oil Pressure Pipe	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Installation	Installation	Visual Inspection	☑	General arrangement	☑
		Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Dimensions of open mouth	☑
	Operation Room	Visual Inspection	☑	General arrangement, hooks on ceiling	☑
	Outside	Visual Inspection	☑	General arrangement, space for crane and access	☑
Control	Control Panel	Visual Inspection	☑	Damage, deformation or corrosion (outside)	☑
		Visual Inspection	☑	Damage, deformation or corrosion (inside)	☑
		Visual Inspection	☑	Plate, items	☑
	Meters	Visual Inspection	☑	Damage, deformation and legibility	☑
	Lumps	Visual Inspection	☑	Conditions of the light bulbs	☑

Baluchaung No.1 Hydropower Plant

Baluchaung No.2 Headrace Channel Gate (Upstream and Downstream)

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Frame	Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
Hoist	General	Visual Inspection	☑	Damage, deformation or corrosion	☑

Check List of Sedawgyi Hydropower Plant



Station	Place	Facility		Qty	Note
Sedawgyi	Dam	Spillway	Stop Log	1set	
			Gate	7sets	
		Intake	Stop Log	2sets	with gantry crane
			Gate	2sets	
	Penstock			2lanes	
	Power Station	Draft Tube Gate	Gate	2sets	with gantry crane

Sedawgyi Hydropower Plant

Documents

Object	Items	☑	Detail	Photo
Documents	Calculation Sheet	☐	Provision of calculation sheets	
	Drawing	☐	Provision of drawings	
Maintenance Record	Maintenance Record	☐	Provision of maintenance record that shows current failure	
	Modification Record	☐	Provision of modification record	
Hearing	Operation	☐	Confirm the frequency and criteria for gate operation	
	Failure	☑	Confirm the current failure	☑
	Inspection	☑	Confirm the frequency and measure for the inspection and maintenance	
		☐		☐

Sedawgyi Hydropower Plant

Draft Tube Gate

Facility	Item	Measure	☑	Details	Photo
Gate, Frame	General	Visual Inspection	☑	Cleanness	☑
	Frame	Visual Inspection	☑	Major dimensions	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☑
	Gate leaf	Visual Inspection	☑	Deterioration of the paint	☑
		Visual Inspection	☑	Damage, deformation or corrosion	☐
		Measure the thickness	☑	Measure the thickness of the skinplate	
Hoist Gantry Crane	General	Visual Inspection	☑	Viblation or noise	☑
	Component	Visual Inspection	☑	Plate	☑
	Arrangement	Visual Inspection	☑	General arrangement	☑
	Structure	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Power Output	Visual Inspection	☑	Damage, deformation or corrosion	☑
	Spindle	Visual Inspection	☑	Damage, deformation or greasing condition	☑
	Position Indicator	Visual Inspection	☑	Damage, deformation, legibility and gap between actual gate position	☑
Control	Control Panel	Visual Inspection	☑	Damage, deformation or corrosion (outside)	☑
		Visual Inspection	☑	Damage, deformation or corrosion (inside)	☑
		Visual Inspection	☑	Plate, items	☑
	Meters	Visual Inspection	☑	Damage, deformation and legibility	☑
	Lumps	Visual Inspection	☑	Conditions of the light bulbs	☑

Sedawgyi Hydropower Plant

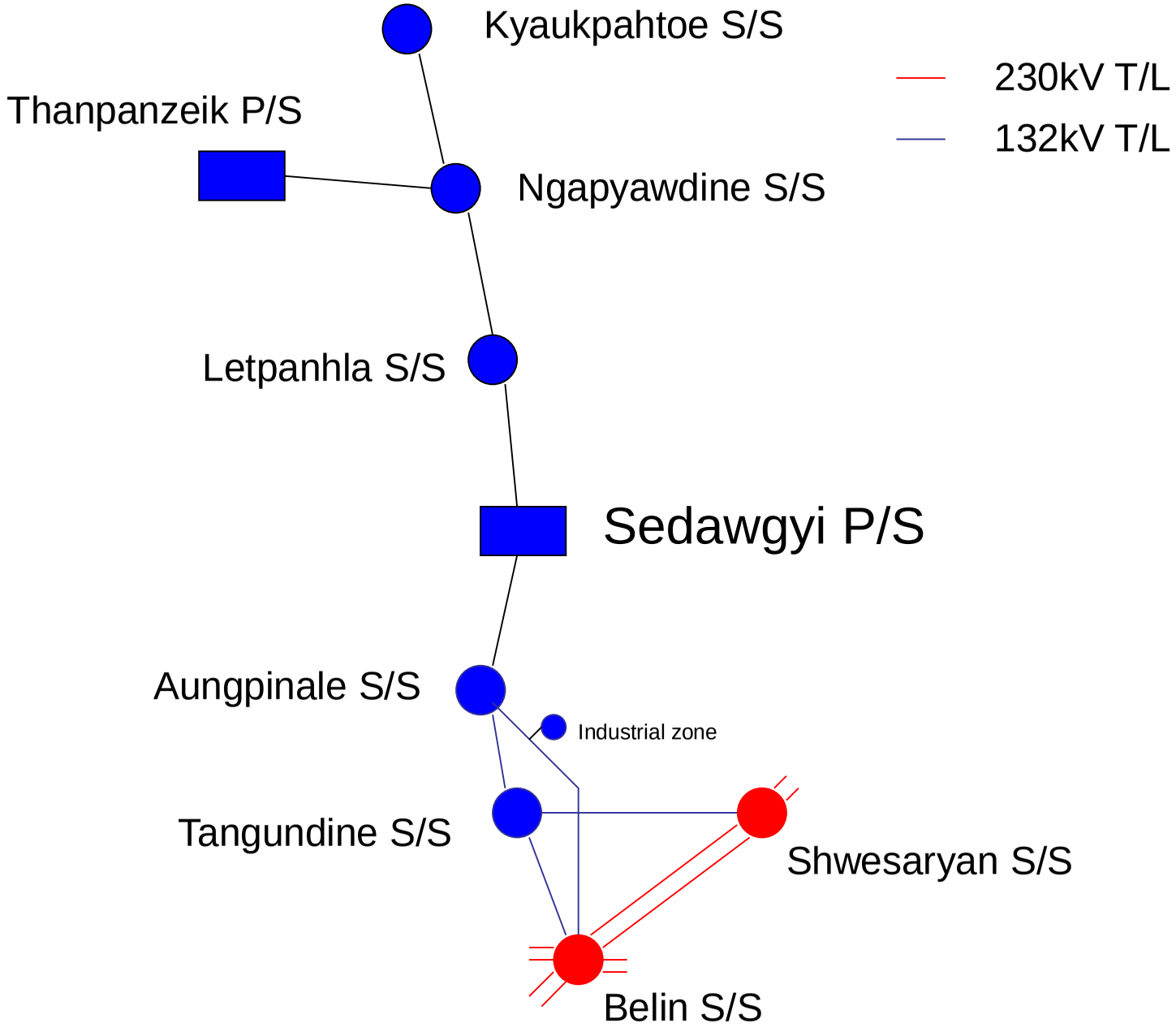
Penstock

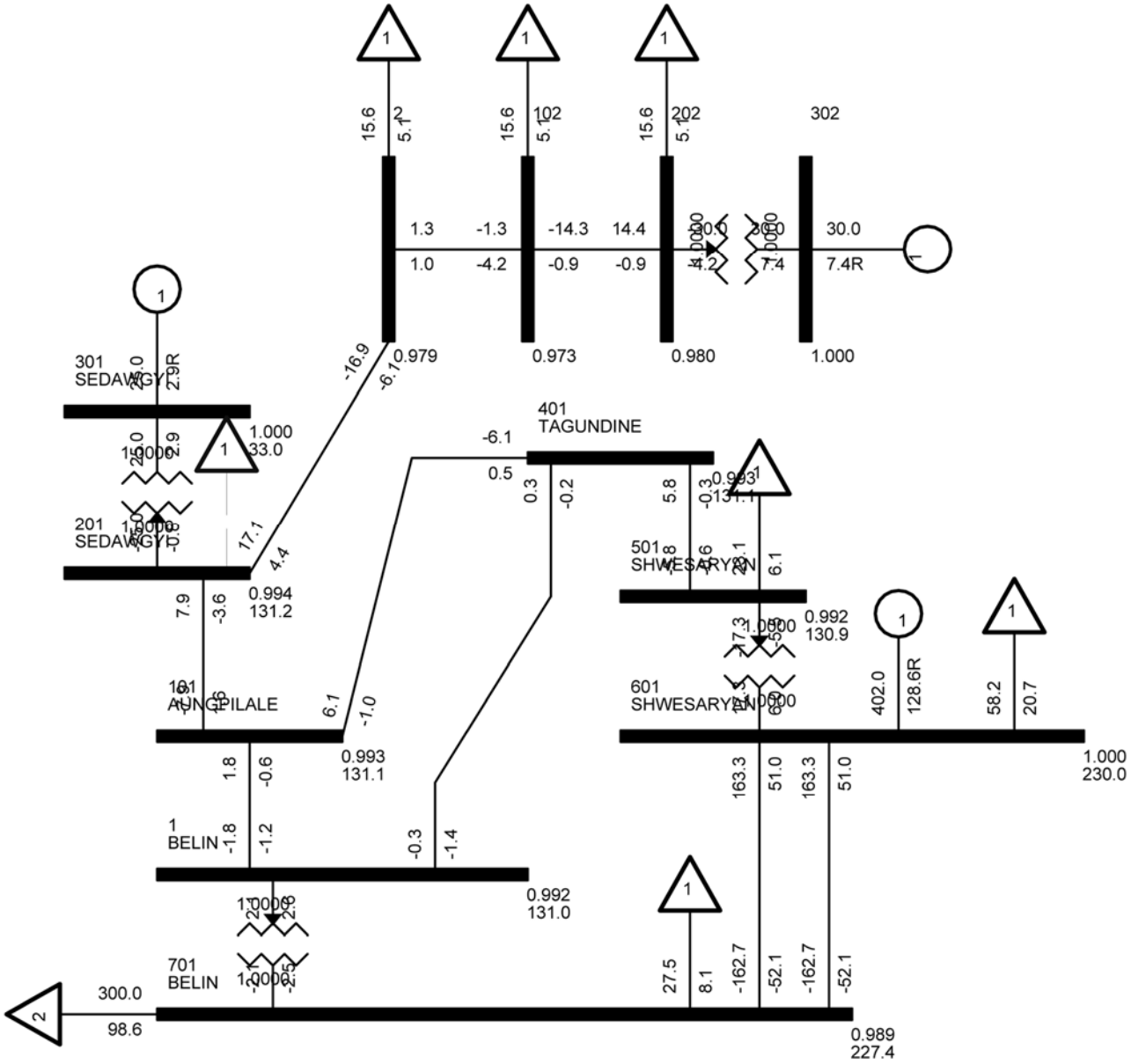
Facility	Item	Measure	☑	Details	Photo
Steel Pipe	General	Visual Inspection	☐	Damage or deformation	☐

ANNEX 11

POWER SYSTEM ANALYSIS FOR REQUIRED EXPANSION OF TRANSMISSION LINE

Power system surrounding Sedawgyi P/S

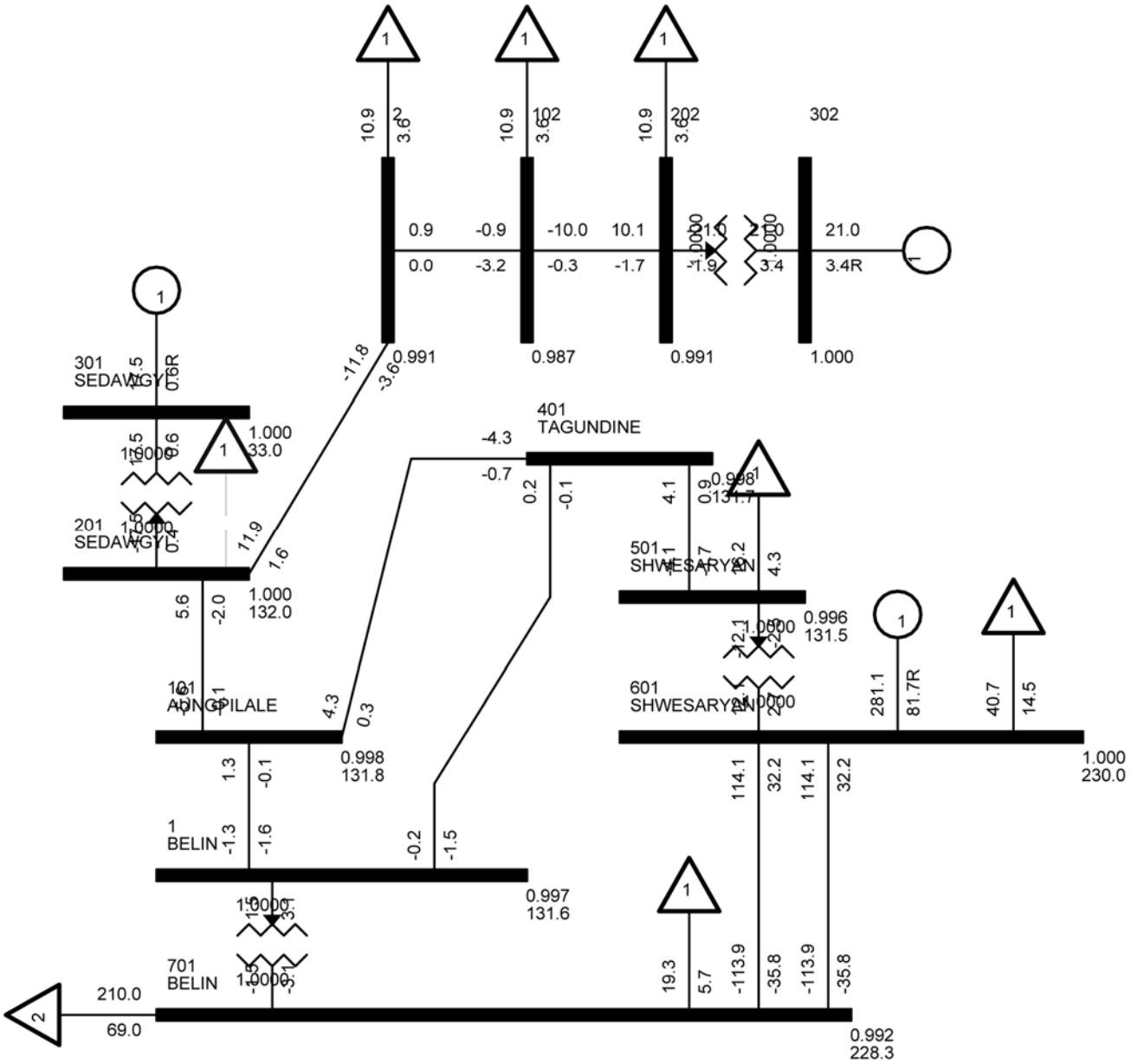




Power System surrounding Sedawgyi P/S
As of 2020
Peak Time

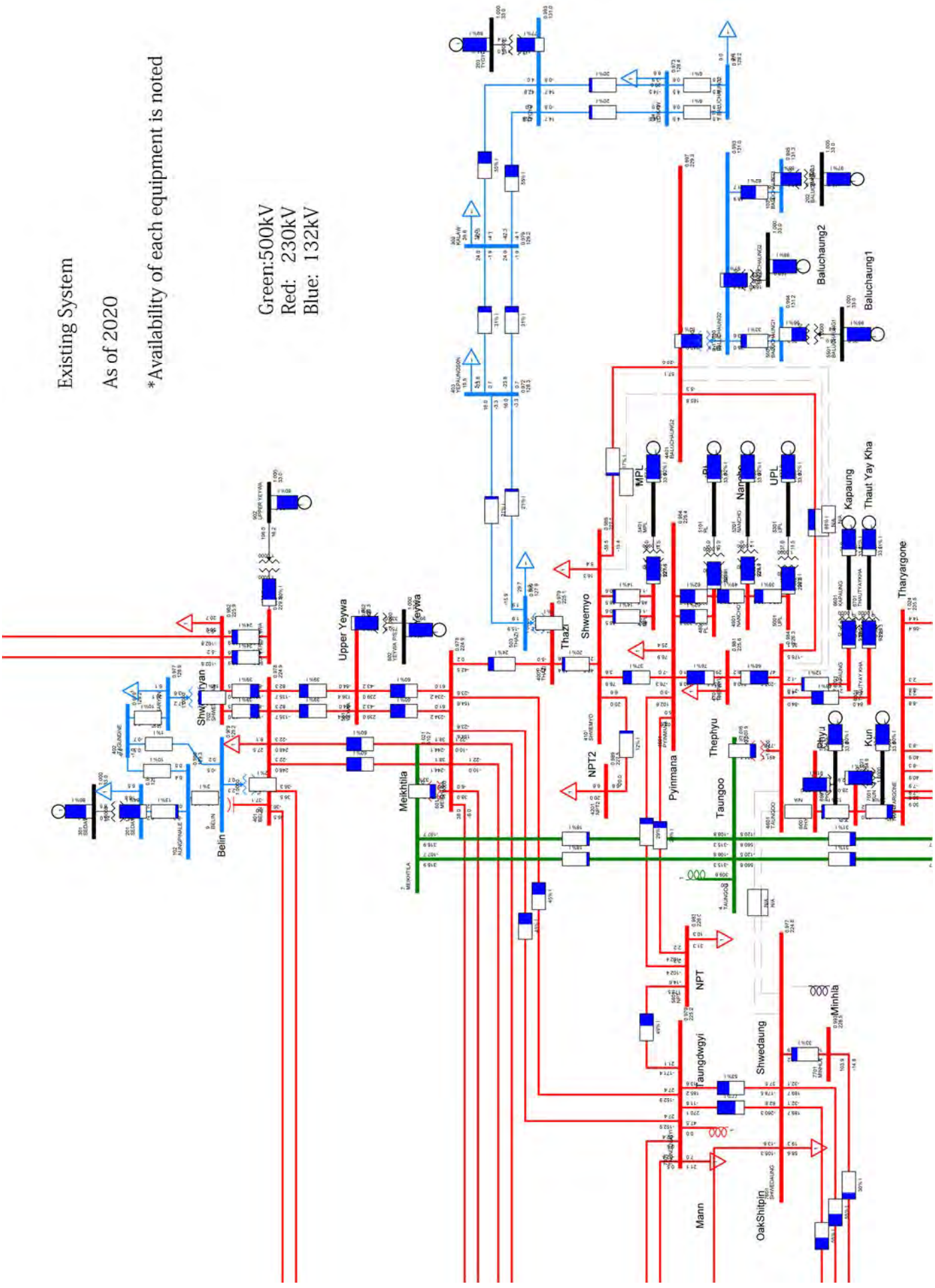
* Voltage compensation equipment is no necessary because of bus voltage within standard value (±5%)

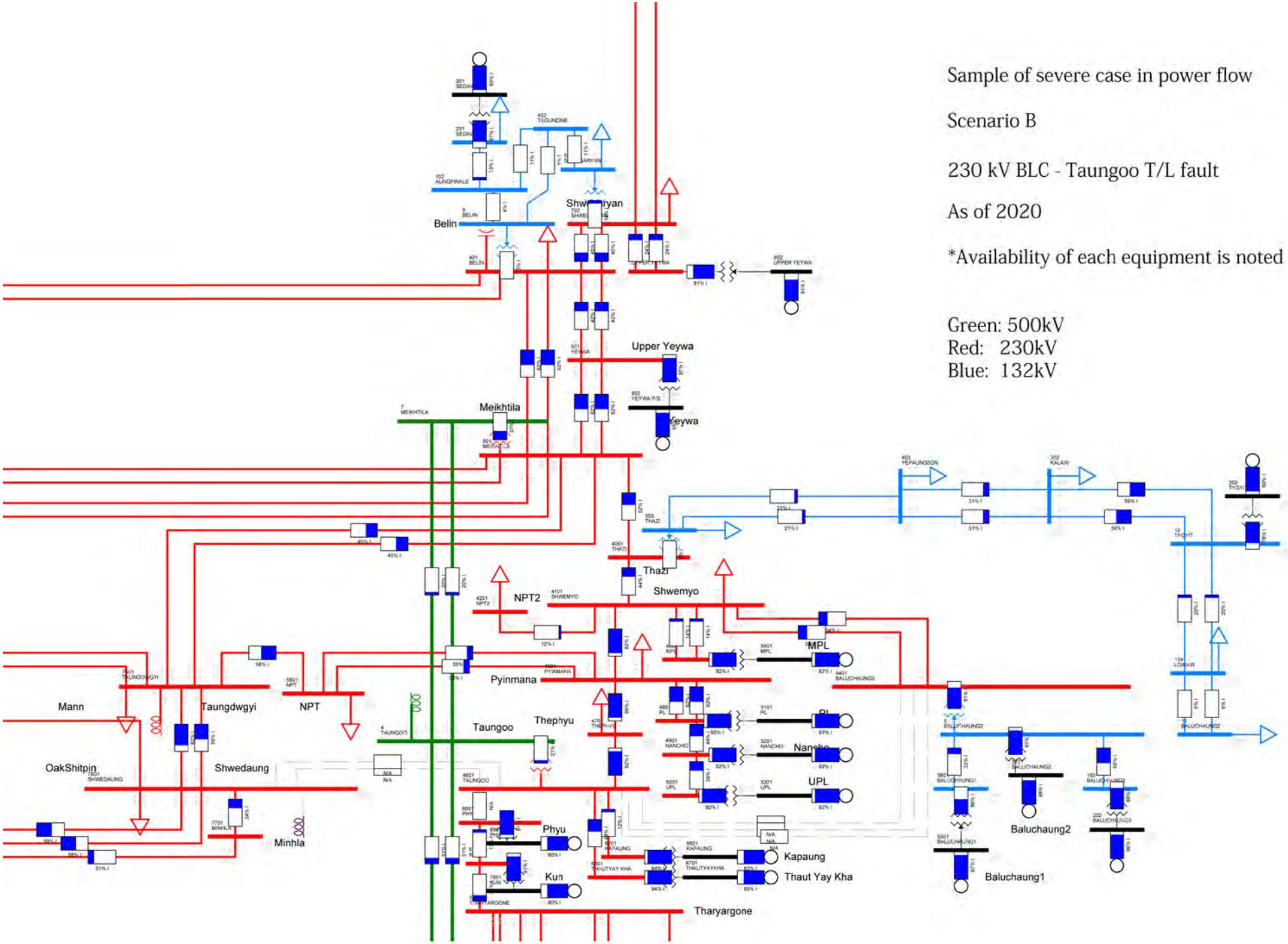
** Short circuit current at Sedawgyi P/S is 2.3kA, even if 230kV Shwesaryan P/S Short circuit current increased to 30kA (Max. Short circuit current of 230kV substation refer to Master plan), Short circuit current at Sedawgyi P/S would be 2.5kA.



Power System surrounding Sedawgyi P/S
As of 2020
Off Peak Time

* Voltage compensation equipment is no necessary because of bus voltage within standard value (±5%)


Existing System
As of 2020
*Availability of each equipment is noted
Green:500kV
Red: 230kV
Blue: 132kV
Baluchaung2
Baluchaung1
MPL
Nancho
UPL
Kapaung
Thaut Yay Kha
Tharyargone
Upper Yeywa
Yeywa
Shwemyo
Thazi
NPT2
Pyinmana
Thephyu
Taungoo
Meiktila
Belin
NPT
Faungdwgyi
Shwedaung
Minhla
Mann
OakShitpin


Sample of severe case in power flow
Scenario B
230 kV BLC - Taungoo T/L fault
As of 2020
*Availability of each equipment is noted
Green: 500kV
Red: 230kV
Blue: 132kV
Belin
Upper Yeywa
Yeywa
Meikhtila
Thazi
Shwemyo
NPT2
MPL
Pyinmana
Mann
Taungdwgyi
NPT
Taungoo
Thephyu
OakShitpin
Shwedaung
Minhla
Phyu
Kun
Kapaung
Thaut Yay Kha
Tharyargone
Nanchoe
UPL
Baluchaung2
Baluchaung1

Thermal capacity of transmission line

Conductor Type	MCM	Ampere	132kV	230kV	500kV
Ibis	397.5	407A	79MW	-	-
Duck	605	530A	121MW	179MW	-
Drake	795	622A	142MW	211MW	458MW

*PF:0.85

**Maximum thermal temperature :75℃

Annex 11-2 Power System Expansion Scenario around Baluchaung No.1

(1) Baluchaung No.2 P/S – Taungoo S/S T/L (Scenario A)

One more 230kV T/L candidate is between Baluchaung No.2 P/S and Taungoo S/S. The scenario is called Scenario A (Fig.11.2-1).

In this scenario, the existing 230kV T/L (795MCM (Drake) single bundle, single circuit, 154.5km) is scrapped and new 230kV T/L (795MCM (Drake) double bundle, double circuit, 159km) for new 500kV Taungoo S/S is built. The new T/L route is almost same as the existing T/L route, so land acquisition issue is few. And the generation power of Baluchang P/S is directly transmitted to Yangon area via Taungoo S/S, so the power system loss is decreased.

But along the 230kV T/L route for Taungoo S/S, the issue of land mine exists. In the interview with PTP (Department of Power Transmission Project) in MEPE, the existing T/L for Taungoo S/S has the tower fences in which land mines are buried for defense the towers from the destroyers. In order to scrap and built the T/L for Taungoo S/S, it is necessary to survey and eliminate the land mines by support of Ministry of Defense. But peace agreement should be done before that, so just now it is very difficult to proceed Scenario A.

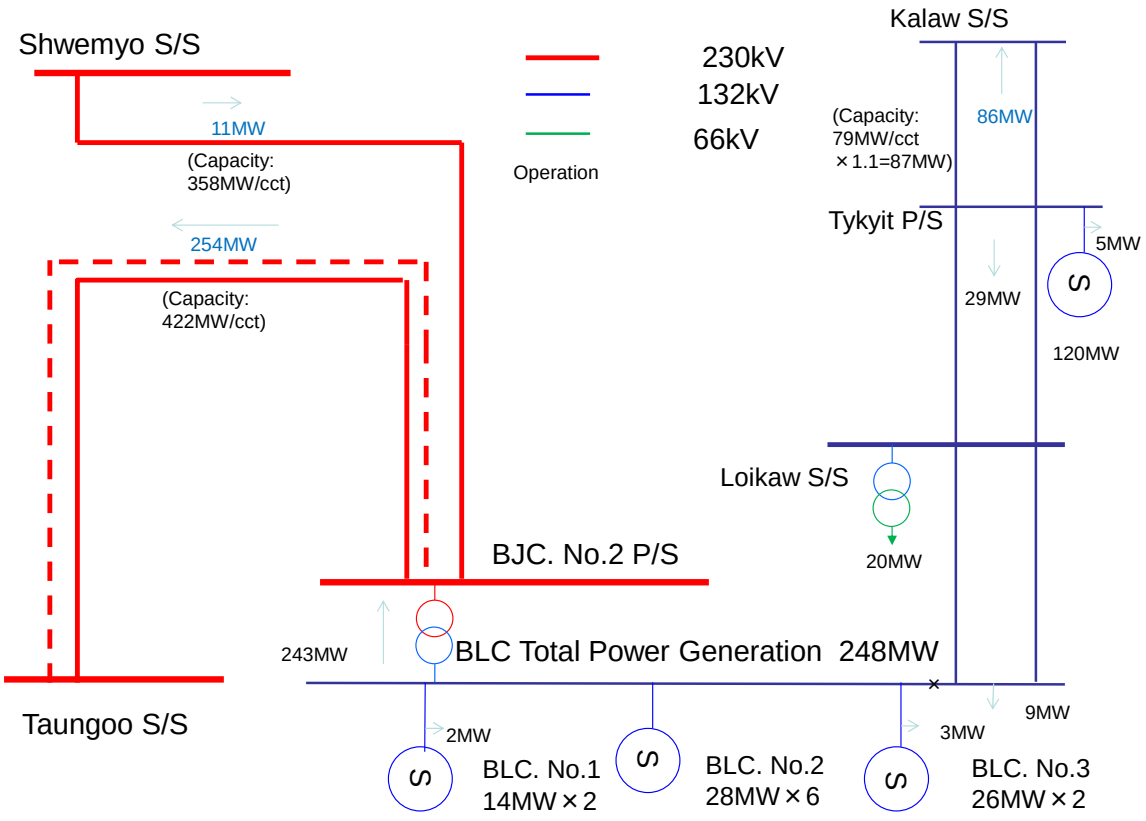


Fig. 11.2-1 Scenario A for Power System surrounding Baluchaung

(2) Baluchaung No.2 – Shwemyo S/S T/L (Scenario B)

One more 230kV T/L candidate is between Baluchaung No.2 P/S and Shwemyo S/S. The scenario is called Scenario B (Fig.11.2-2).

In this scenario, the expansion 230kV T/L (605MCM (Duck) double bundle, single circuit, 193.1km) for Shwemyo S/S is built near the existing 230kV T/L (605MCM (Duck) double bundle, single circuit, 193.1km), which will start the operation soon in 2016. This scenario can avoid the issue of land mine such as Scenario A, but the length of the T/L is 34km longer than Scenario A and the generation power of Baluchaung P/S in transmitted to Yangon area via Shwemyo S/S, so the power system loss is more than Scenario A. Moreover, in the interview with MEPE, the existing T/L for Shwemyo S/S is the newest T/L, it is very difficult to propose another T/L for Shwemyo S/S just now.

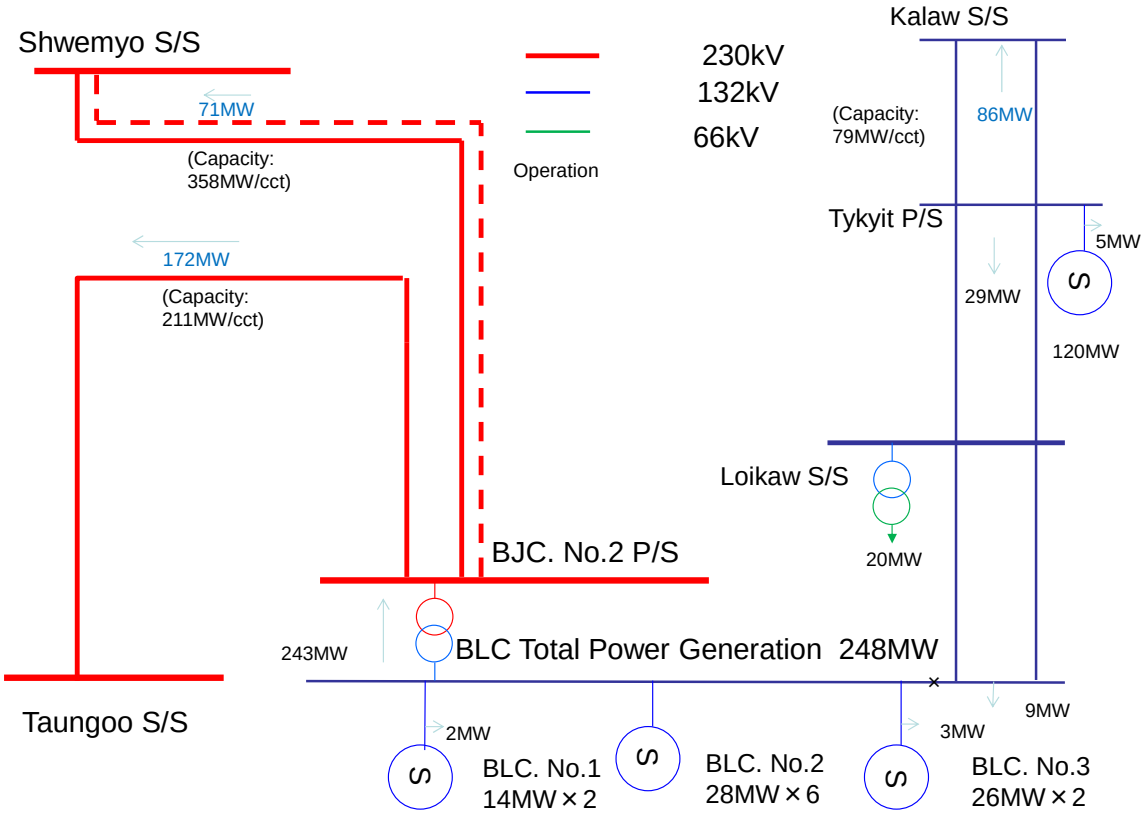


Fig.11.2-2 Scenario B for Power System surrounding Baluchaung

(3) Loikaw S/S upgrade (Scenario C)

As upper mentioned, in case of one more 230kV T/L expansion scenario for Taungoo S/S or for Shwemyo S/S, each of them are under the difficult situation for implementation, alternative scenario is desired for transmitting the generation power of Baluchaung P/S.

Alternative scenario is based on the another approach, where the generation power of Baluchaung P/S (Baluchaung 1-3 P/S) is reduced by supplying the power as much as possible to the nearest consumer load. The scenario is called Scenario C (Fig.11.2-3).

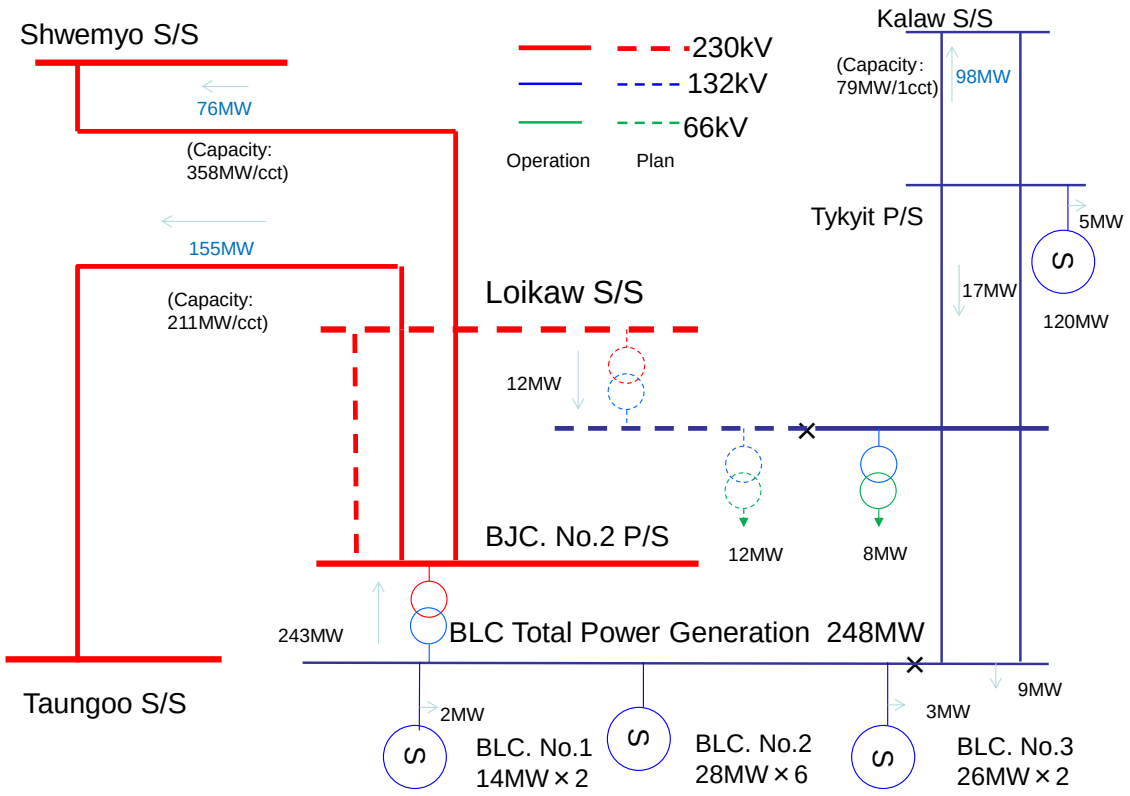


Fig. 11.2-3 Scenario C for Power System surrounding Baluchaung

In this Scenario, the existing 132kV Loikaw S/S, which is the nearest substation to Baluchaung P/S, is upgraded to 230kV substation, the existing 230kV T/L for Taungoo S/S and for Shwemyo are connected to upgraded 230kV Loikaw S/S, and one more 230kV T/L around 20km length between Baluchaung No.2 P/S and Loikow P/S, is built.

The effect of Scenario C is shown in Fig.11.2-4 and Fig.11.2-5. When the 230kV T/L between Loikaw S/S and Shwemyo S/S is tripped by fault, the power flow 231MW of 230kV T/L between Taungoo S/S and Loikaw S/S is under transmission capacity 232MW because the generation power 243MW of Baluchaung P/S is submitted by the load of Loikaw S/S 12MW (Effect 1).
On the other hand, when one 132kV T/L between Tykyit P/S and Kalaw S/S is tripped by fault, the power flow 98MW of the other 132kV T/L between Tykyit P/S and Kalaw S/S is over the transmission capacity 87MW at the time point of the fault. But by switching the part of Loikaw S/S load 12MW to Tykyit P/S system side, the power flow 86MW is under the transmission capacity 87MW (Effect 2).

In conclusion, the generation power of Baluchaung P/S and Tykyit P/S can be transmitted in the case of any T/L fault by Scenario C.

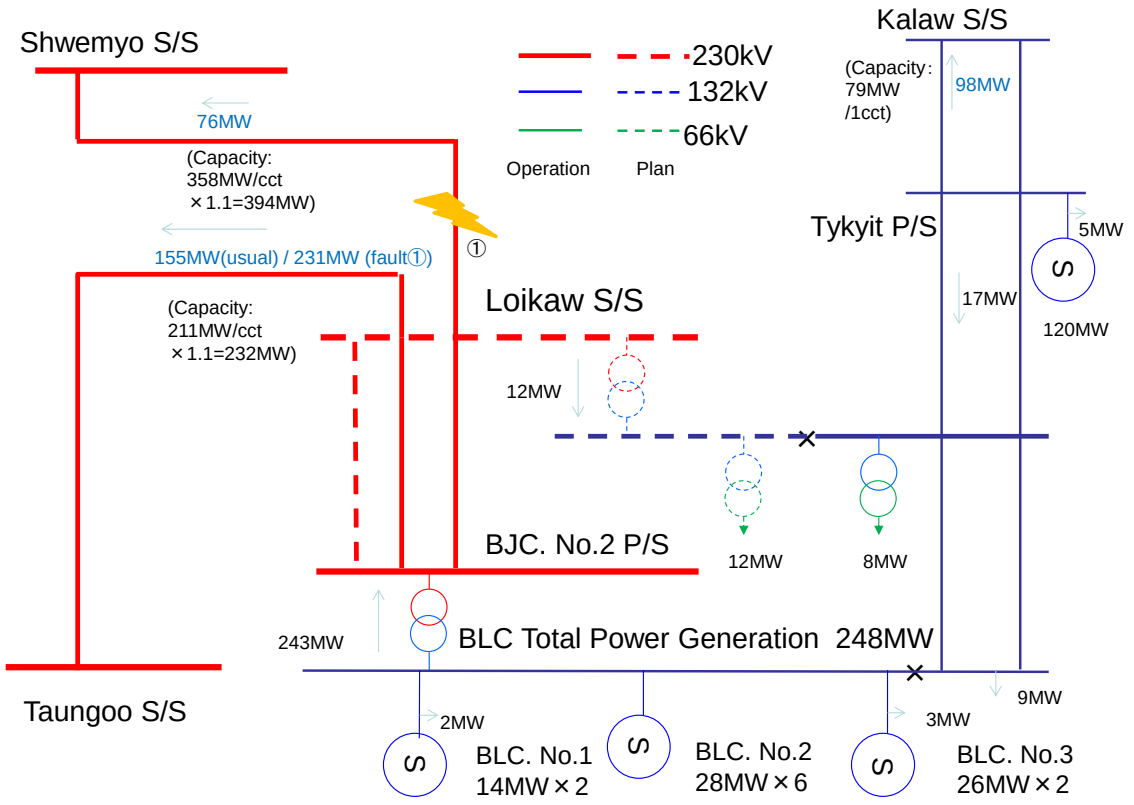


Fig. 11.2-4 Effect 1 on Scenario C

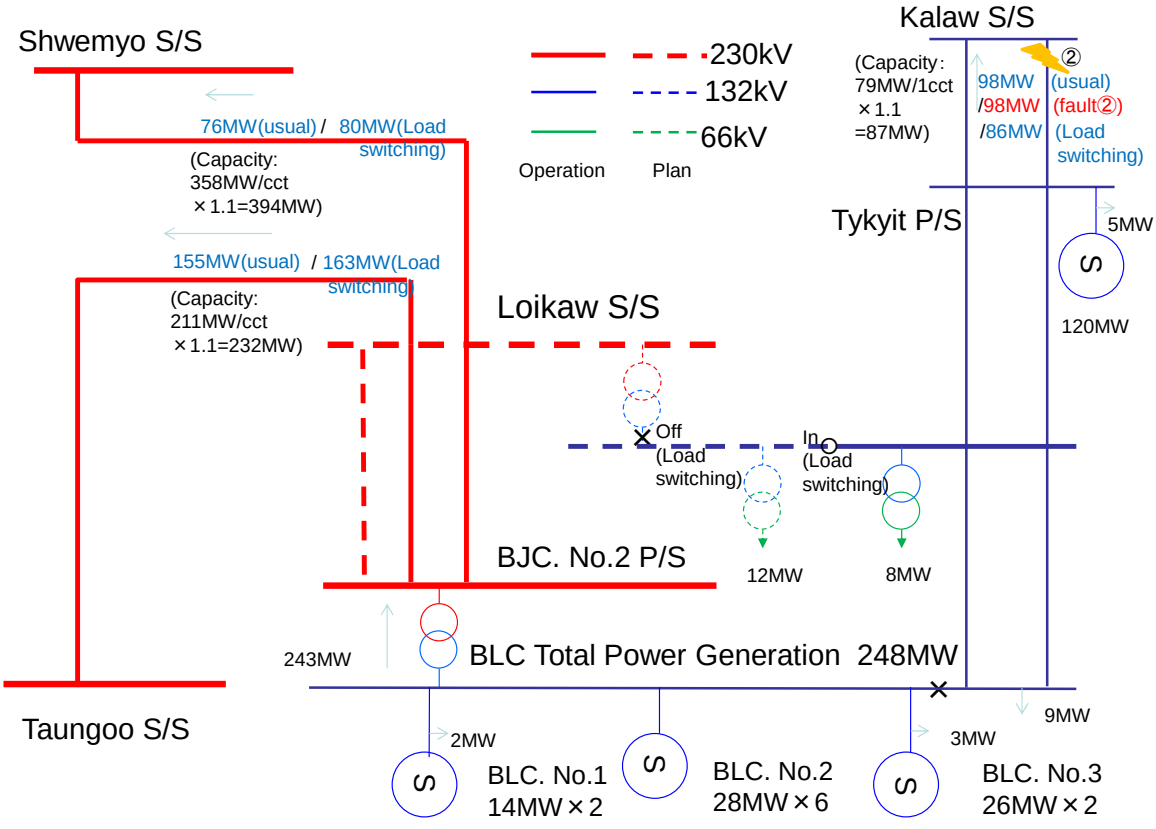


Fig. 11.2-5 Effect 2 on Scenario C

Optional two Scenarios of scenario C is settled on the view point of economy. In order to supplying the part of generation power to the consumer load of Loikaw S/S, the 132kV T/L between Baluchaung No.1 P/S and Loikaw S/S is built in Scenario C' (Fig.11.2-6) and the 33kV distribution line between Baluchaung No.2 /S and Loikaw S/S is built in Scenario C" (Fig.11.2-7).

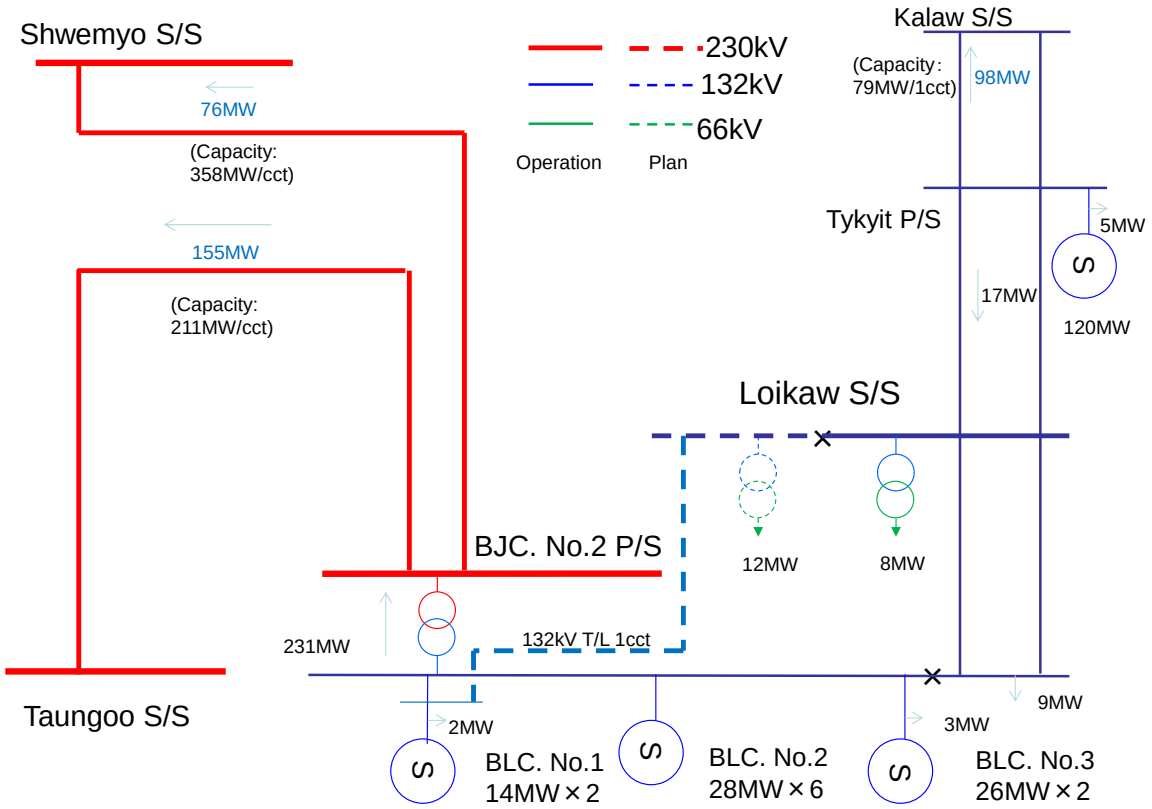


Fig. 11.2-6 Scenario C'
(Loikaw's partial load is transmitted from Baluchaung No.1 by 132kV T/L)

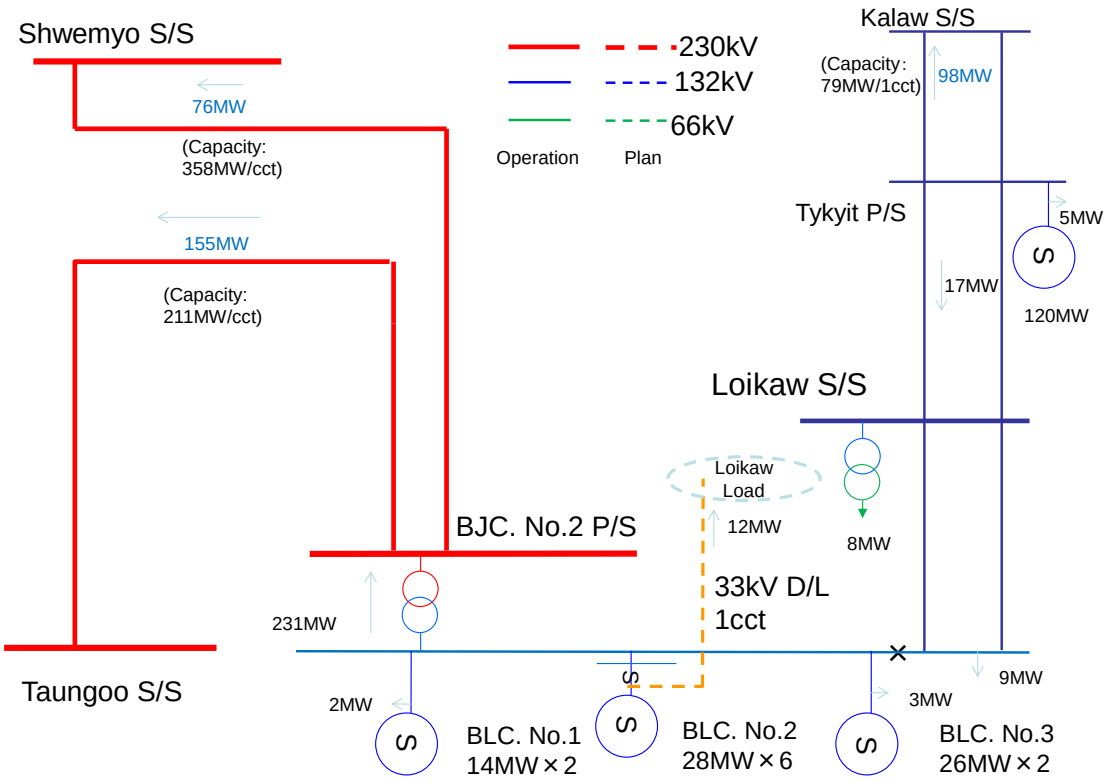


Fig. 11.2-7 Scenario C"
(Loikaw's partial load is transmitted from Baluchaung No.2 by 33kV D/L)

Generally, the off peak time is more strict than the peak time for the power system because the consumer load is reduced and transmitted power tends to be increased, so the power flow at the off peak time is checked. In the off peak time at night in dry season of May, the generation power of Baluchaung P/S is full power and the load in rural area is around 70% of the peak time load.

In Scenario C, when the 230kV T/L between Loikaw S/S and Shwemyo S/S is tripped by fault, the power flow 230.5MW of the 230kV T/L between Loikaw S/S and Taungoo S/S is under the transmission capacity 232MW (Fig.11.2-8).

On the other hand, when one 132kV T/L between Tykyit P/S and Kalaw S/S is tripped by fault, the power flow 110.2MW of the other 132kV T/L between Tykyit P/S and Kalaw S/S is over the transmission capacity 87MW. But by switching the generation power of Tykyit P/S to 230kV power system side via Loikaw S/S, there is no bottle neck T/L (Fig.11.2-9).

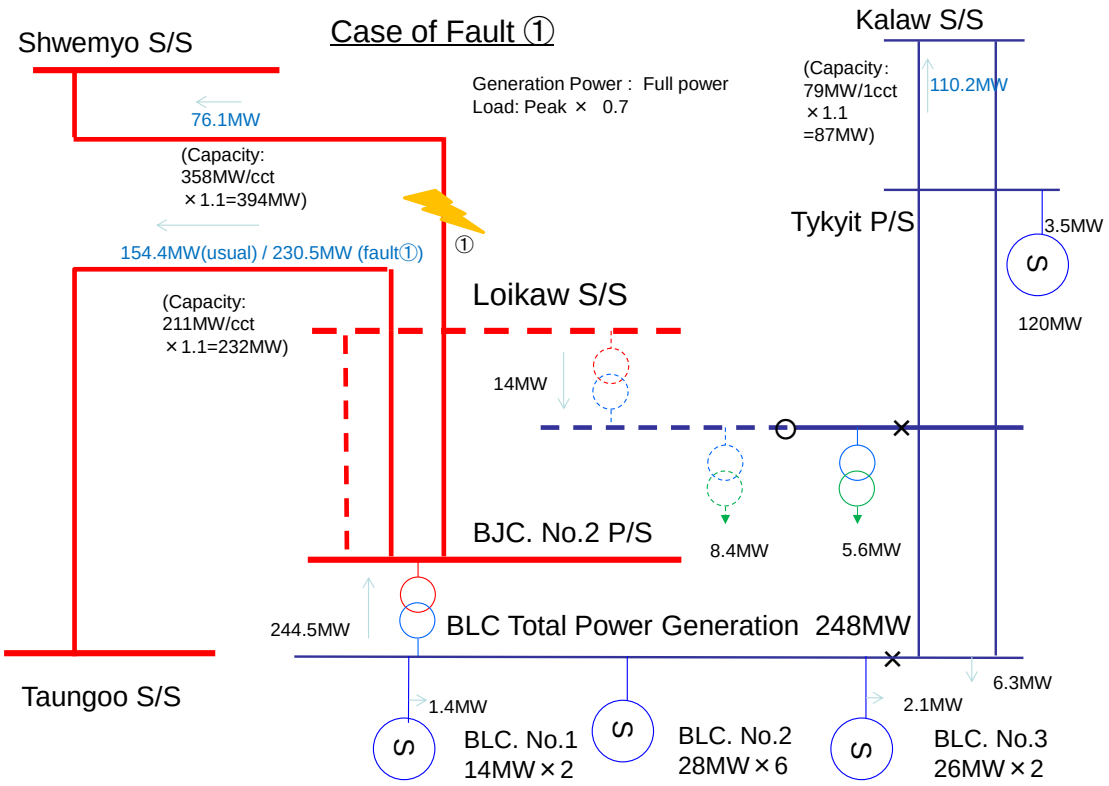


Fig. 11.2-8 Off Peak Power Flow 1 (at night in dry season of May) in Scenario C

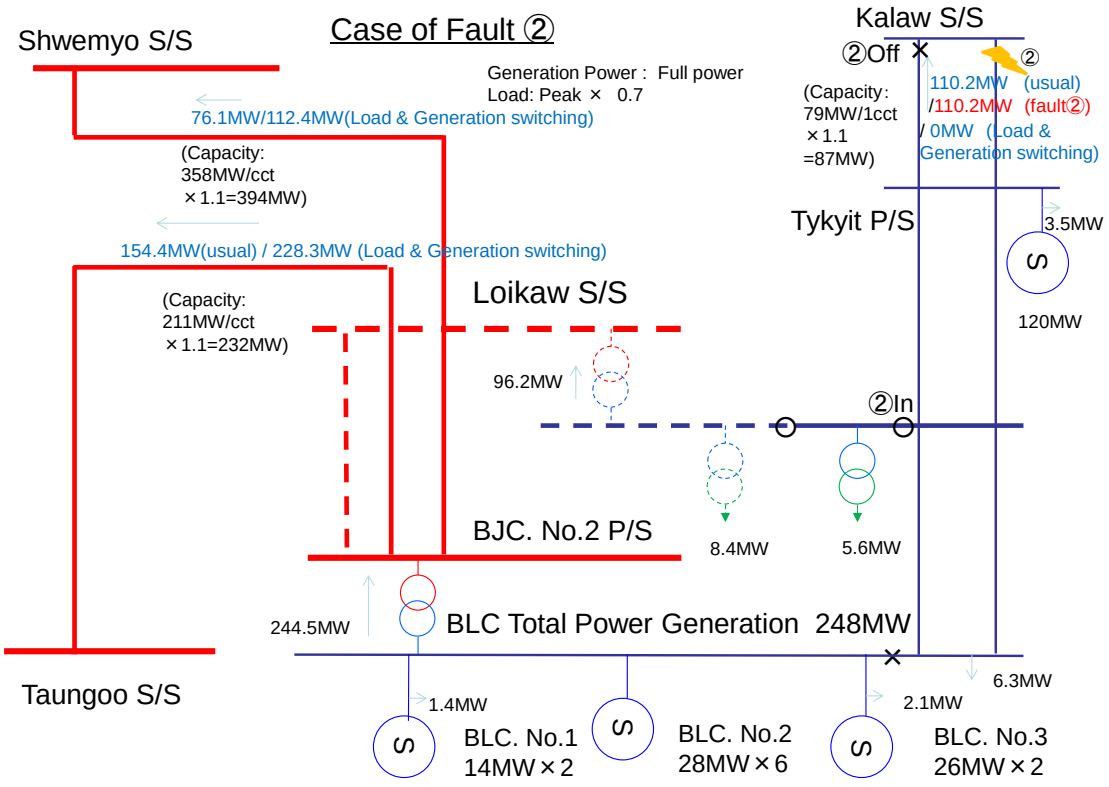


Fig. 11.2-9 Off Peak Power Flow 2 (at night in dry season of May) in Scenario C

In Scenario C', at the peak time there is no bottle neck even in the case of T/L fault, which is similar to Scenario C. But at the off peak time, when one 132kV T/L between Tykyit P/S and Kalaw S/S is tripped, the power flow 110.2MW of the other 132kV T/L between Tykyit P/S and Kalaw S/S is over the transmission capacity 87MW of the T/L.

In order to decrease the power flow, not only switching of load 8.4MW at Loikaw S/S, but generation power limitation 14.8MW at Tykyit P/S is necessary (Fig.11.2-10).

In scenario C", at the peak time and the off peak time, generation power limitation at Tykyit P/S is necessary in the case of the 132kV T/L fault between Tykyit P/S and Kalaw S/S (Fig.11.2-11 and Fig.11.2-12)

Summary of comparison among Scenario C, C' and C" is shown in Table 11.2-1 at the view point of generation power limitation.

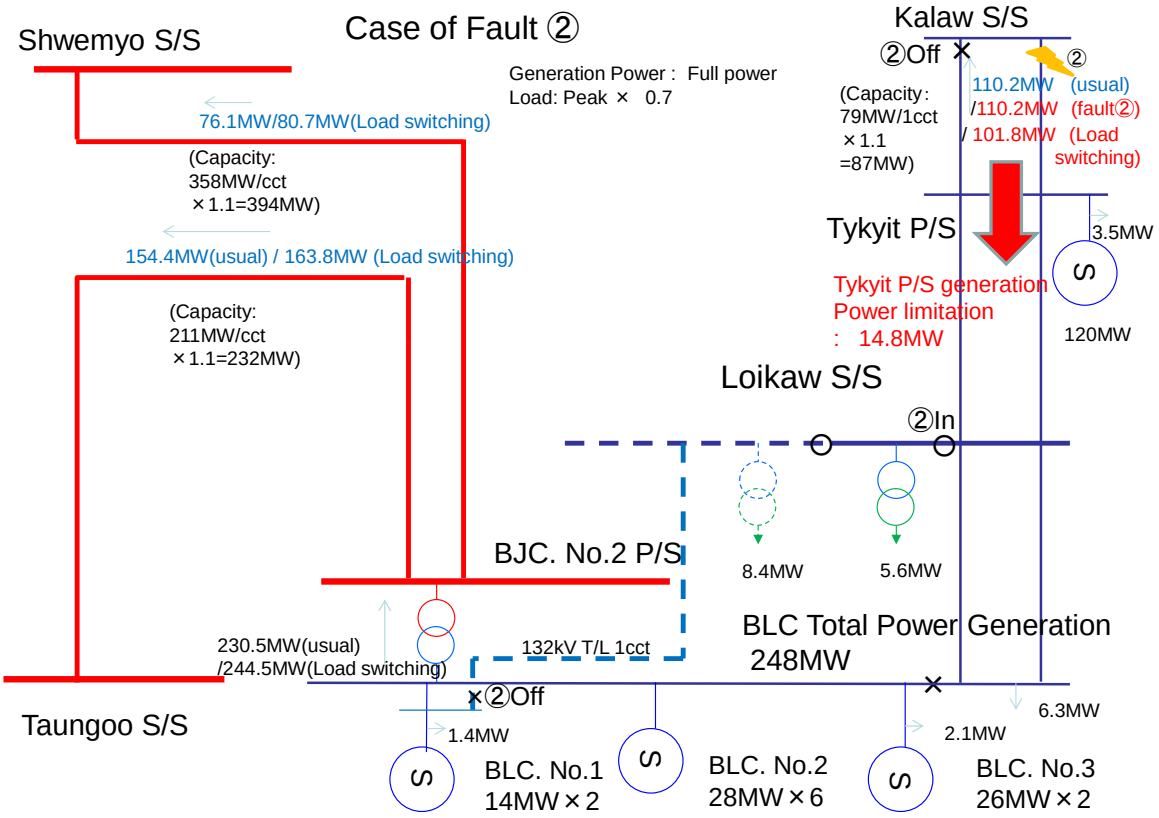


Fig. 11.2-10 System Operation Restriction in Scenario C' at Off Peak Time

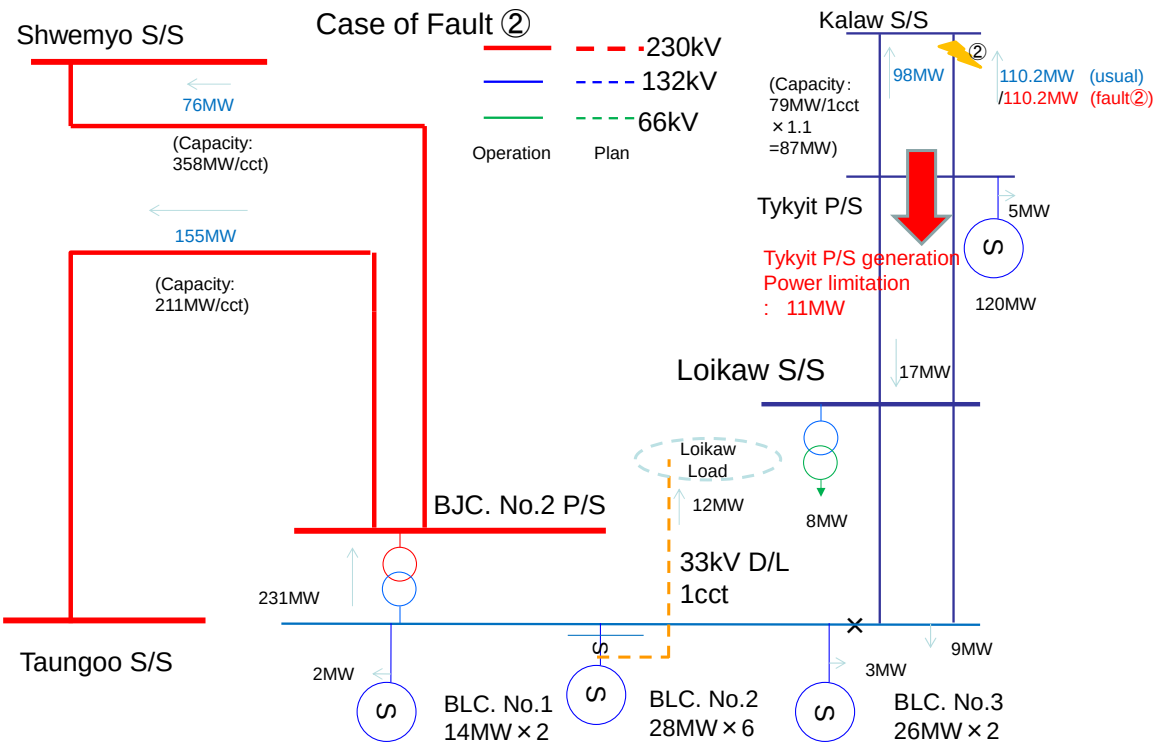


Fig. 11.2-11 System Operation Restriction in Scenario C" at Peak Time

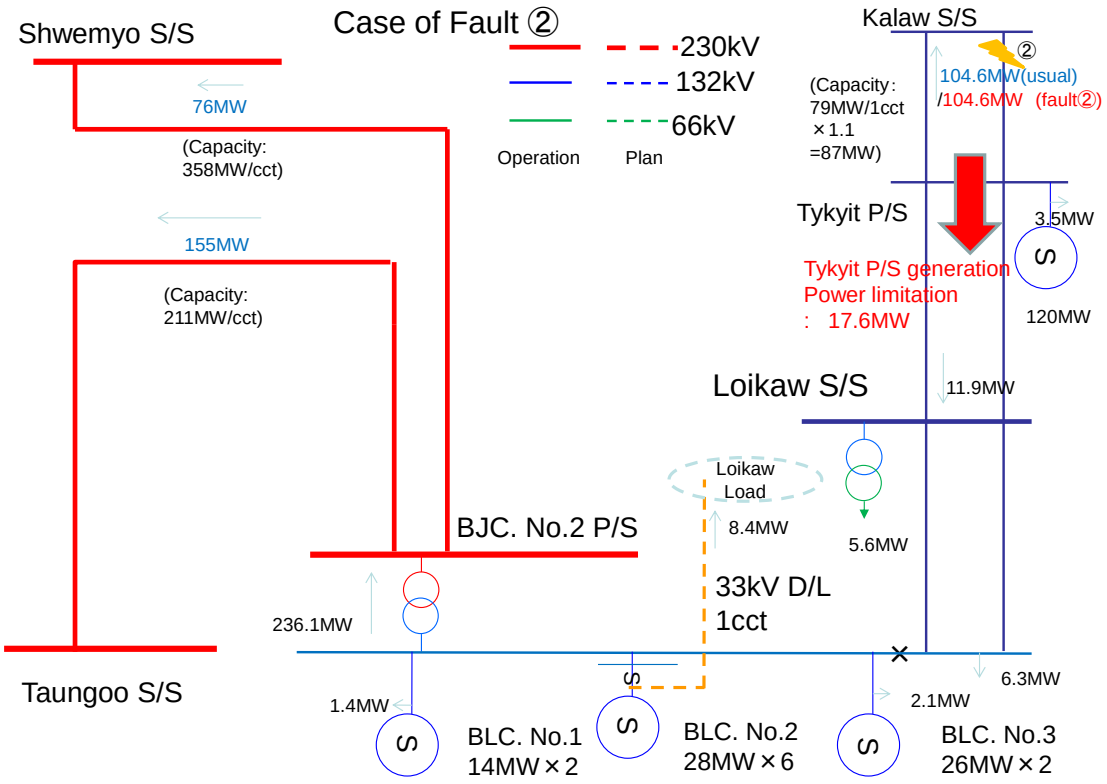


Fig. 11.2-12 System Operation Restriction in Scenario C" at Off Peak Time

Table 11.2-1 Tykyit P/S Generation Power Limitation in the case of 132kV T/L Fault

	Scenario C	Scenario C'	Scenario C"
Peak time	0 MW	0 MW	11 MW
Off Peak time	0 MW	14.8 MW	17.6 MW
Estimation	+++	++	+

(4) Evaluation

Comparison diagram of upper discussed five (5) scenarios for expansion of power system surrounding Baluchaung P/S is shown in Table 11.2-2, where qualitative estimation is carried out at the view point of power system analysis, construction feasibility, and cost.

When the issue of land mine is resolved in the future, the rehabilitation as Scenario A is desired to be carried out.

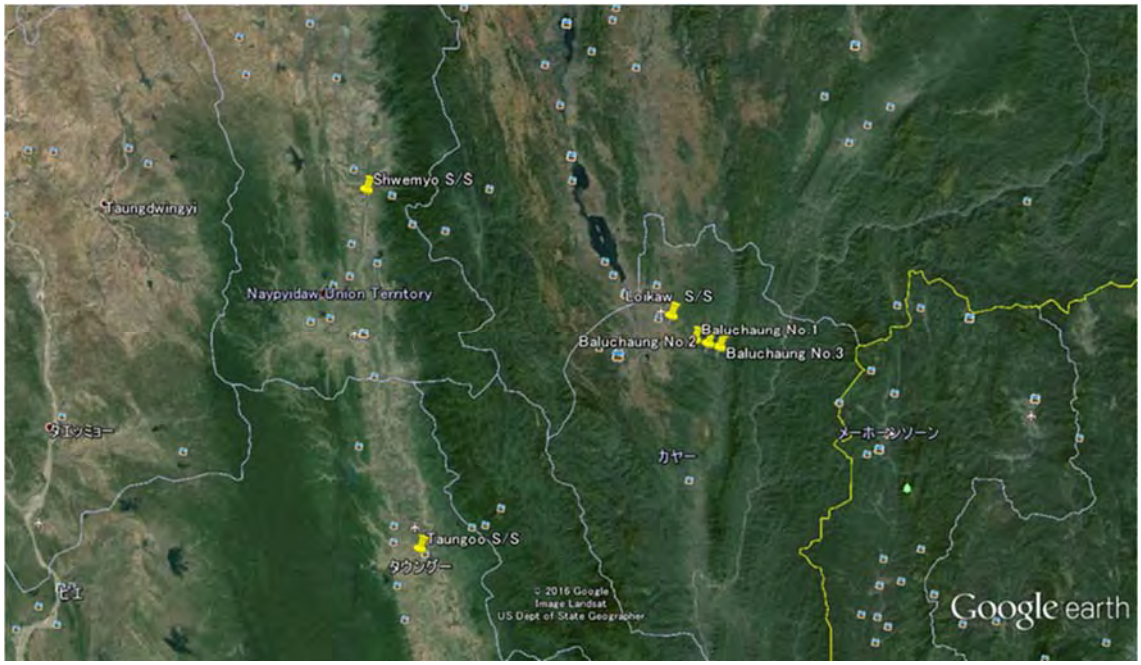
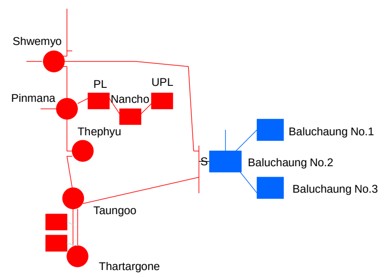
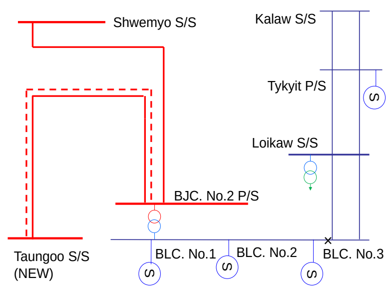
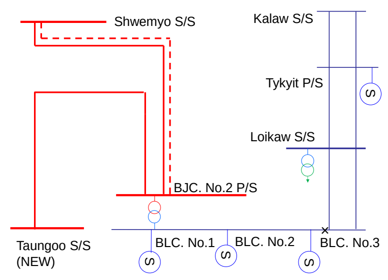
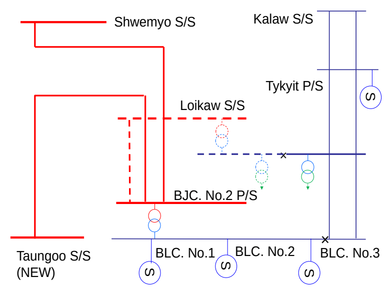
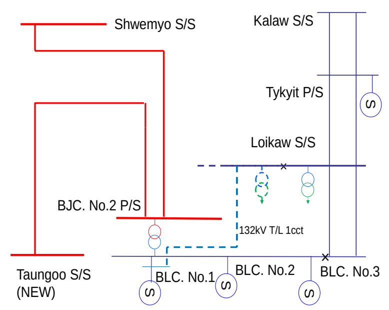
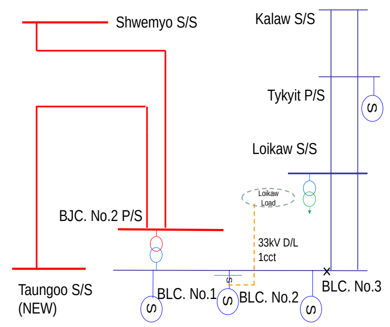


Fig. 11.2-13 Location of Relevant Substation and Power Station

Table 11.2-2 Power System Expansion Scenarios Study for Baluchaung Hydropower Station No.1

		Existing		Scenario A	Scenario B	Scenario C	Scenario C'	Scenario C"
Power System Diagram								
Transmission Line (T/L) Specification	Voltage level	230kV	230kV	230kV	230kV	230kV	132kV	33kV
	Substation ~ Substation	Baluchaung No.2 ~ Taungoo (Existing)	Baluchaung No.2 ~ Shwemyo	Baluchaung No.2 ~ Taungoo (New)	Baluchaung No.2 ~ Shwemyo	Baluchaung No.2 ~ Loikaw	Baluchaung No.1 ~ Loikaw	Baluchaung No.2 ~ Loikaw
	Length	154.5km	193.1km	159km	193.1km	around 20km	around 15km	around 20km
	Conductor type	795MCM (Drake)	605MCM (Duck)	795MCM (Drake)	605MCM (Duck)	795MCM (Drake)	397.5MCM(Ibis)	150sq
	Number of conductors/phase	Single	Double	Double	Double	Double	Single	Single
	Number of circuit	Single	Single	Single	Single	Single	Single	Single
	Remark	-	(Operation start 2016, soon)	Expansion (Scrap & Build)	Expansion	New	New	New
Substation Specification				Taungoo S/S (New) 230kV 1cct feeder equipment (Expansion) Balluchaung No.2 P/S 230kV 1cct feeder equipment(Expansion)	Shwemyo S/S 230kV 1cct feeder equipment (Expansion) Balluchaung No.2 P/S 230kV 1cct feeder equipment (Expansion)	Loikaw S/S 230kV Bus (New) (include feeder equipment) 230kV/132kV Transformer (Expansion) 132kV Bus (Expansion) 132kV/66kV Transformer (Expansion) Baluchaung No.2 P/S 230kV 1cct feeder equipment (Expansion)	Loikaw S/S 132kV Bus (Expansion) (include feeder equipment) 132kV/66kV Transformer (Expansion) Baluchaung No.1 P/S 132kV 1cct feeder equipment (Expansion)	Baluchaung No.2 P/S 33kV 1cct feeder equipment (Expansion)
Power System Analysis	Load Flow			+++	+++	+++	++ (System operation restriction)	+(System operation restriction)
	Power Loss			++++	+++	++	++	++
	Transient Stability			+++	+++	+++	+++	+++
Transmission Line (T/L) Route Feasibility				+ (Land mine issue)	++	+++	+++	+++
Substation Feeder Facility (S/S F.F.) Feasibility				+++	+++	+++	+	++
Cost	Construction of T/L (USD)			++	++	++++	+++++	+++++
	Construction of S/S F.F. (USD)			++	++	++	+++	+++
	Total around constructio cost (USD) (Subject to change)			36 million USD	45 million USD	15 million USD	6 miilion USD	1 million USD

ANNEX 11-3 Power Flow Analysis and Power Stability Analysis Results

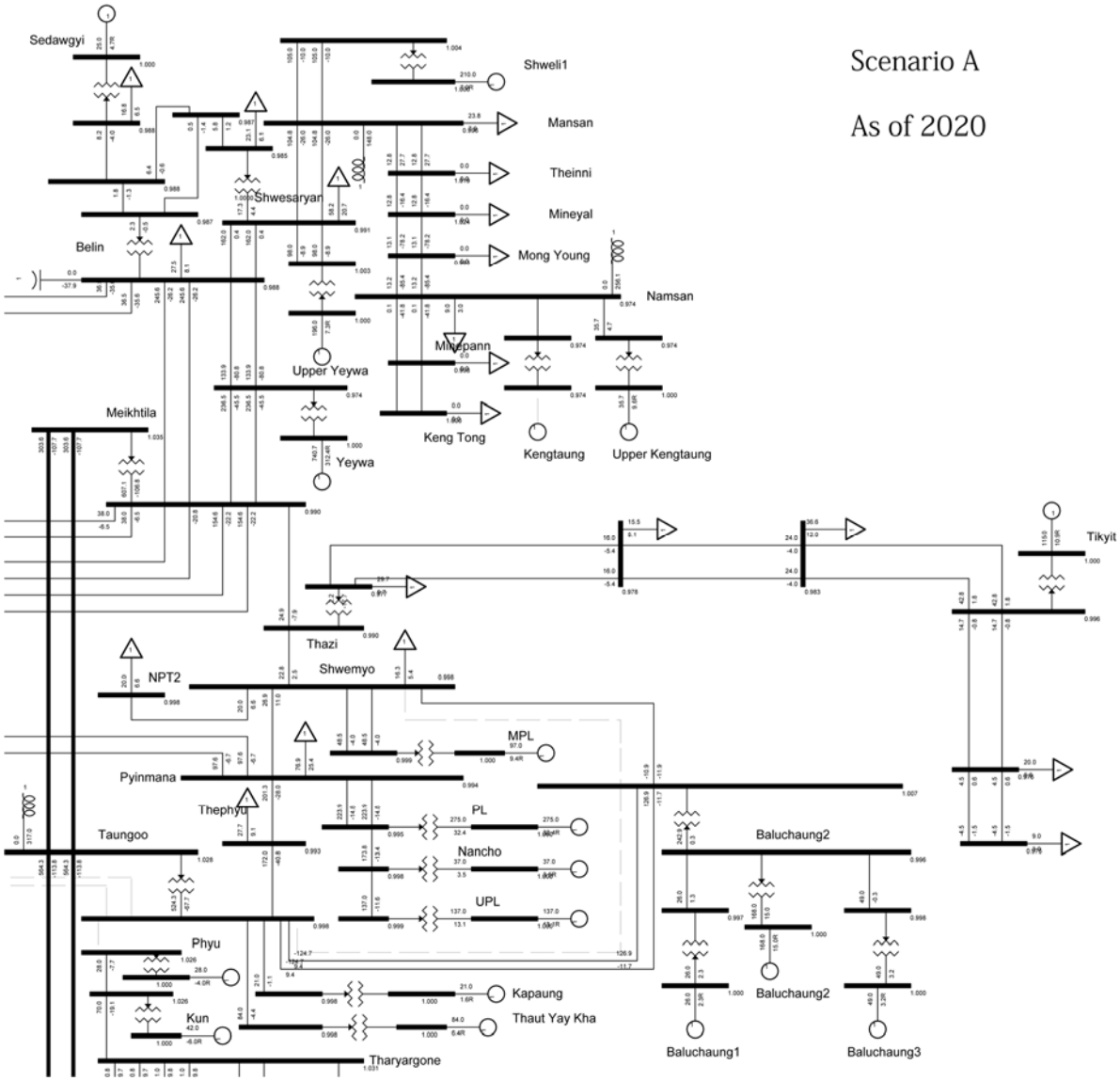


Fig.11.3-1 Power Flow in Scenario A as of 2020

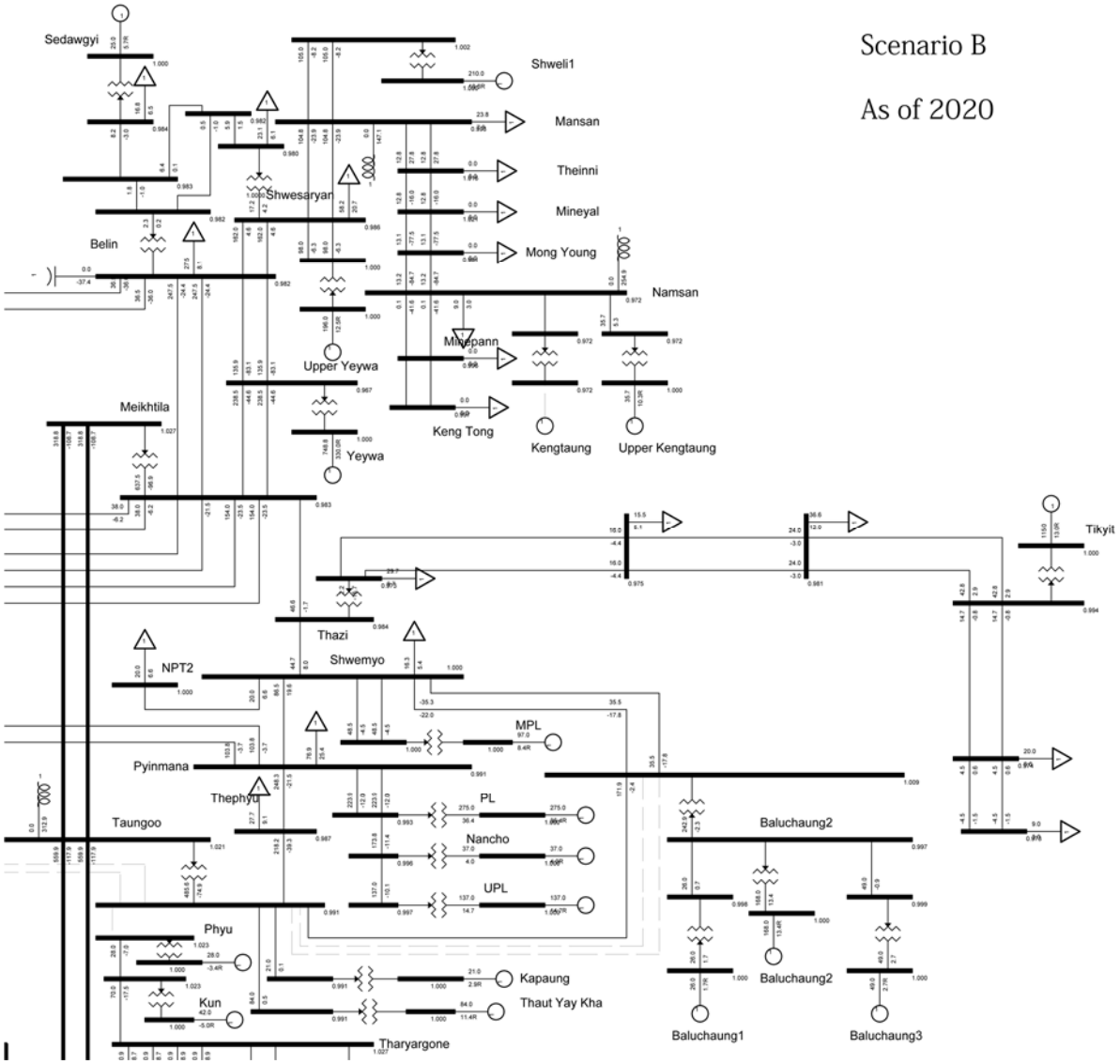


Fig.11.3-2 Power Flow in Scenario B as of 2020

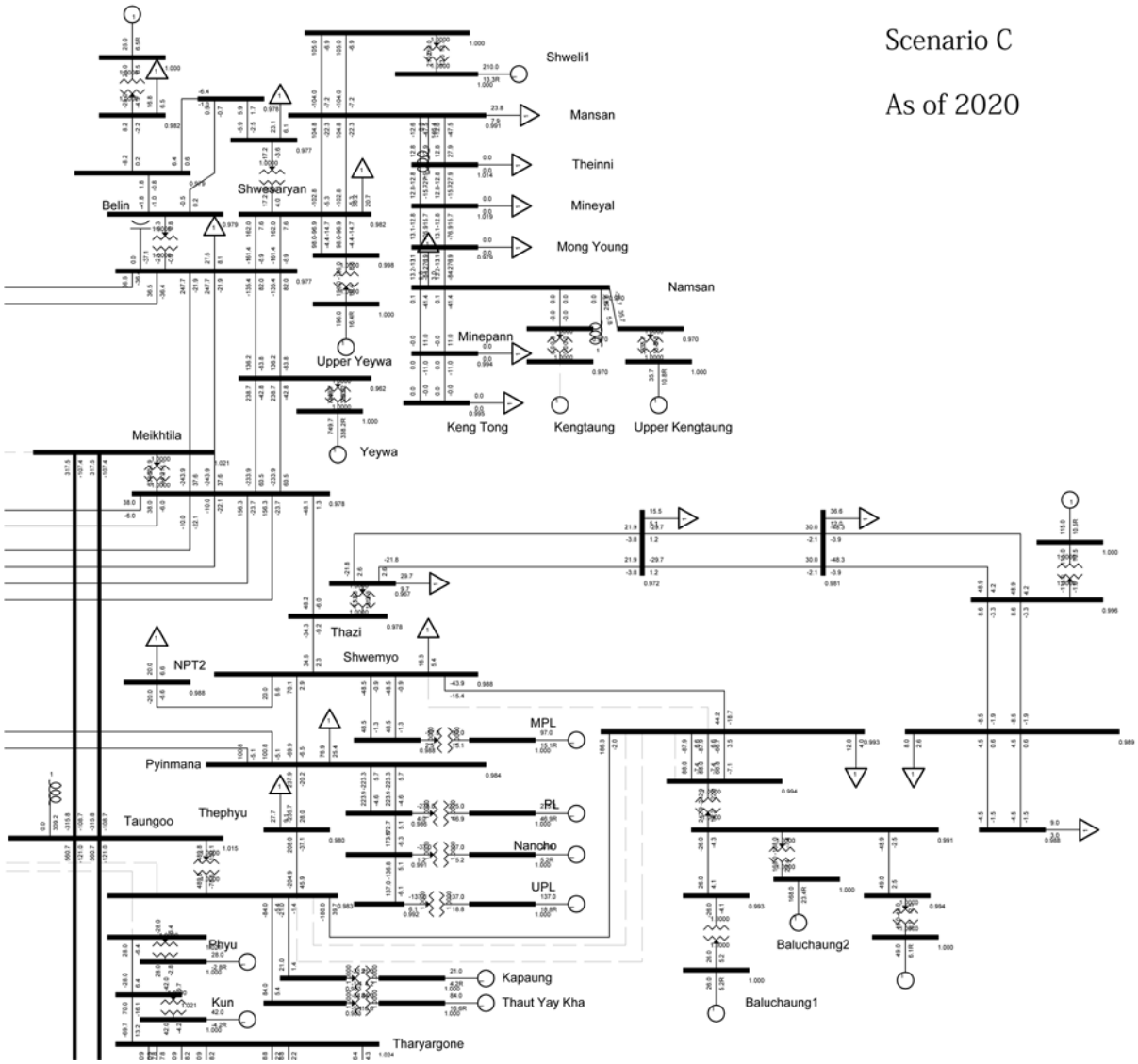


Fig.11.3-3 Power Flow in Scenario C as of 2020

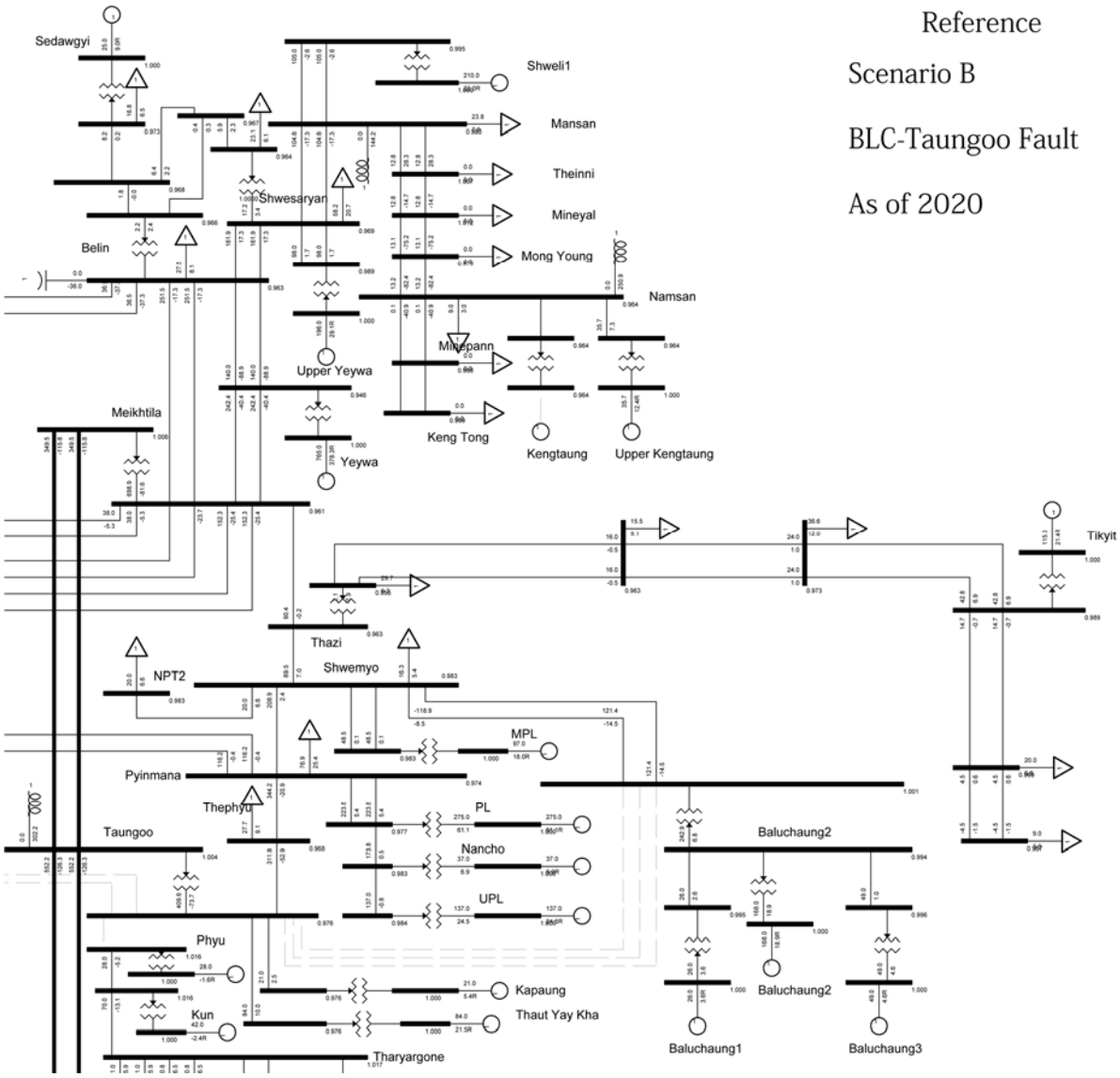


Fig.11.3-4 Power Flow in Scenario B: Baluchaung - Tangoo Fault as of 2020

For reference, power flow of Scenario B in the case of the 230kV T/L fault between Baluchaung No.2 P/S and Taungoo S/S is shown in Fig.11.3-4, where the generation power of Baluchaung P/S is transmitted to Yangon area via Shwemyo S/S and the power flow situation is very strict in total power system, but there is no bottleneck T/L.

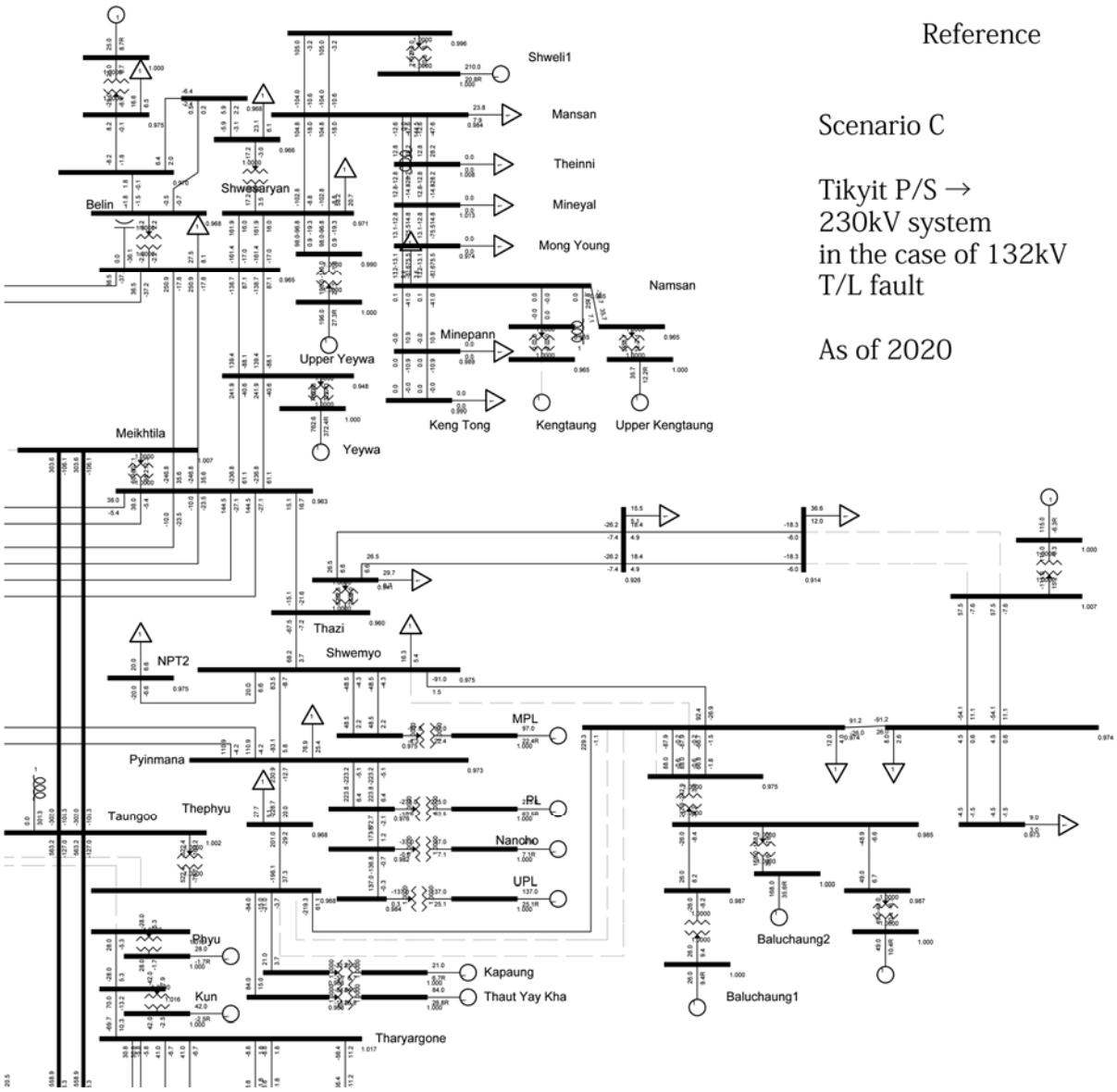


Fig.11.3-5 Power Flow in Scenario C: 132kV T/L Fault as of 2020

For more reference, power flow of Scenario C in case of one 132kV T/L fault between Tykyit P/S and Kalaw S/S is shown in Fig.11.3-5, where the generation power of Tykyit P/S is transmitted to 230kV system via Loikaw S/S and there is no issue in the view point of power flow.

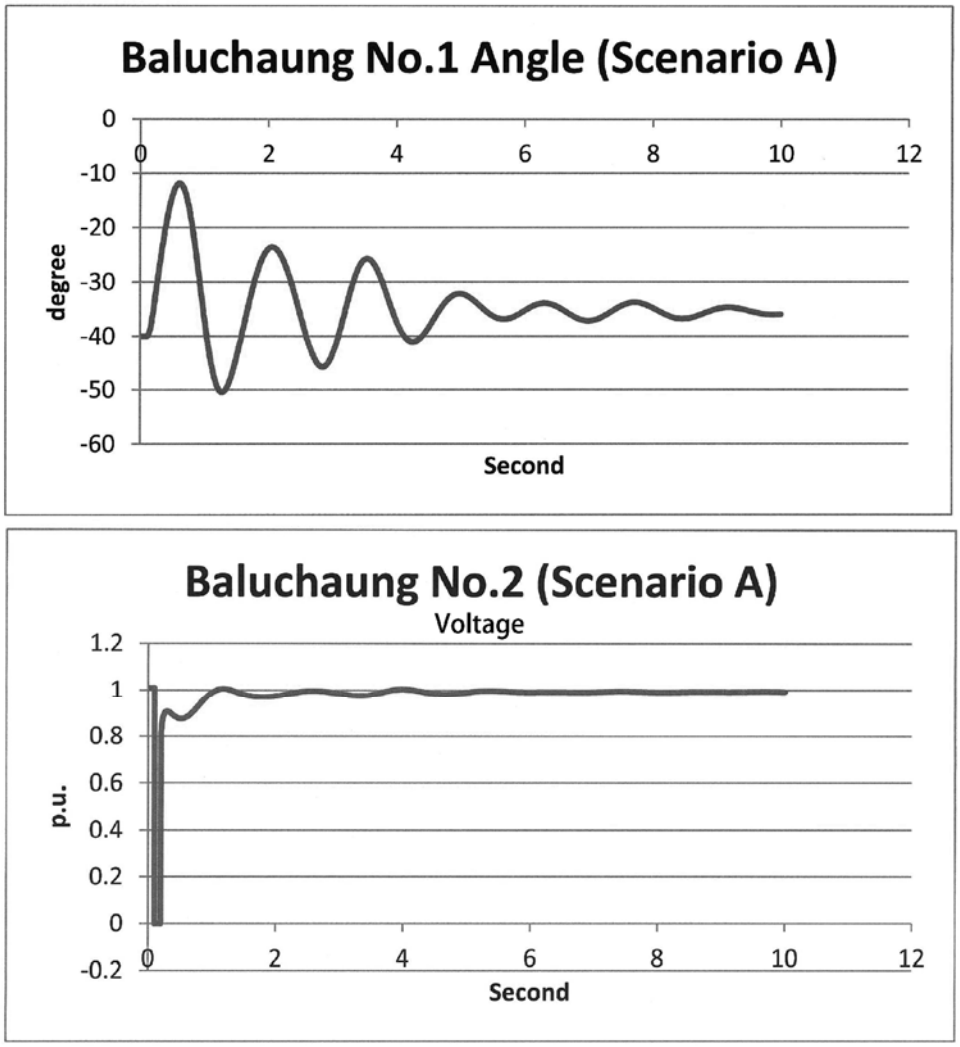


Fig.11.3-6 Power System Stability in Scenario A as of 2020

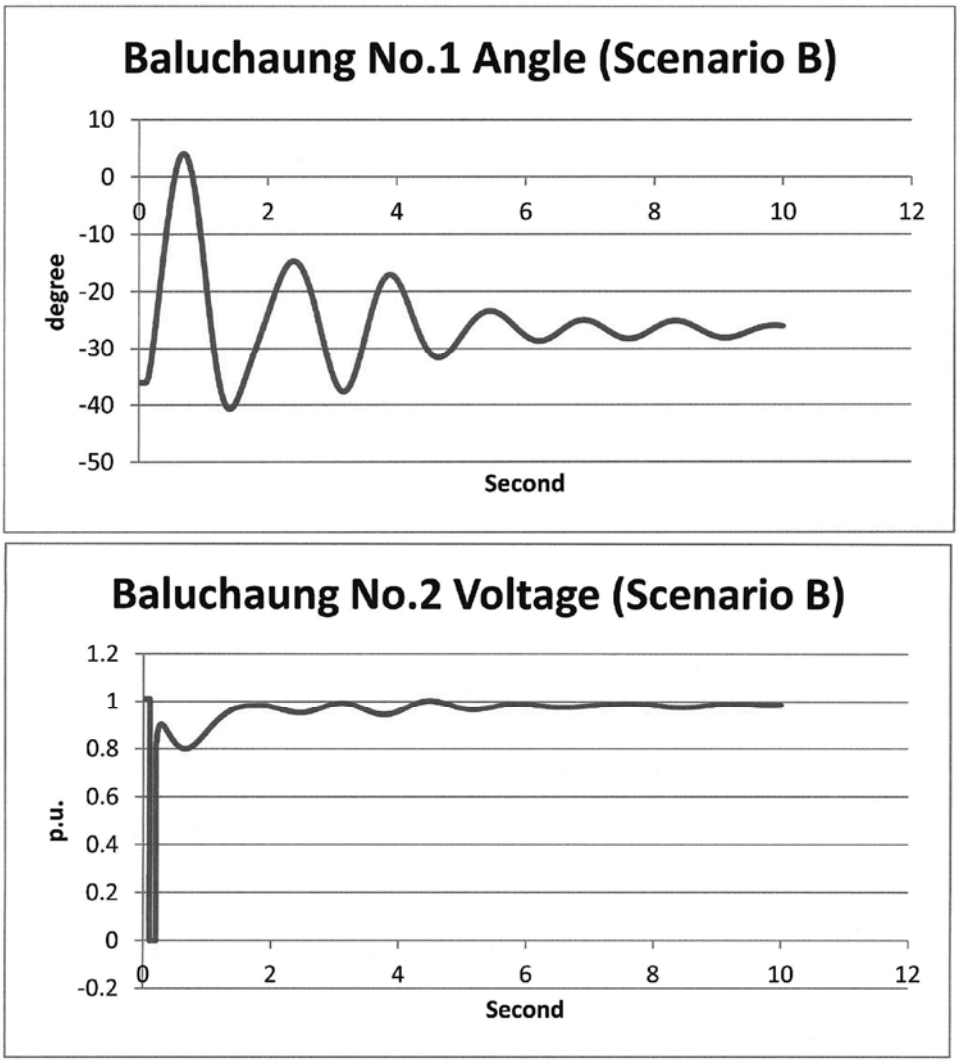


Fig.11.3-7 Power System Stability in Scenario B as of 2020

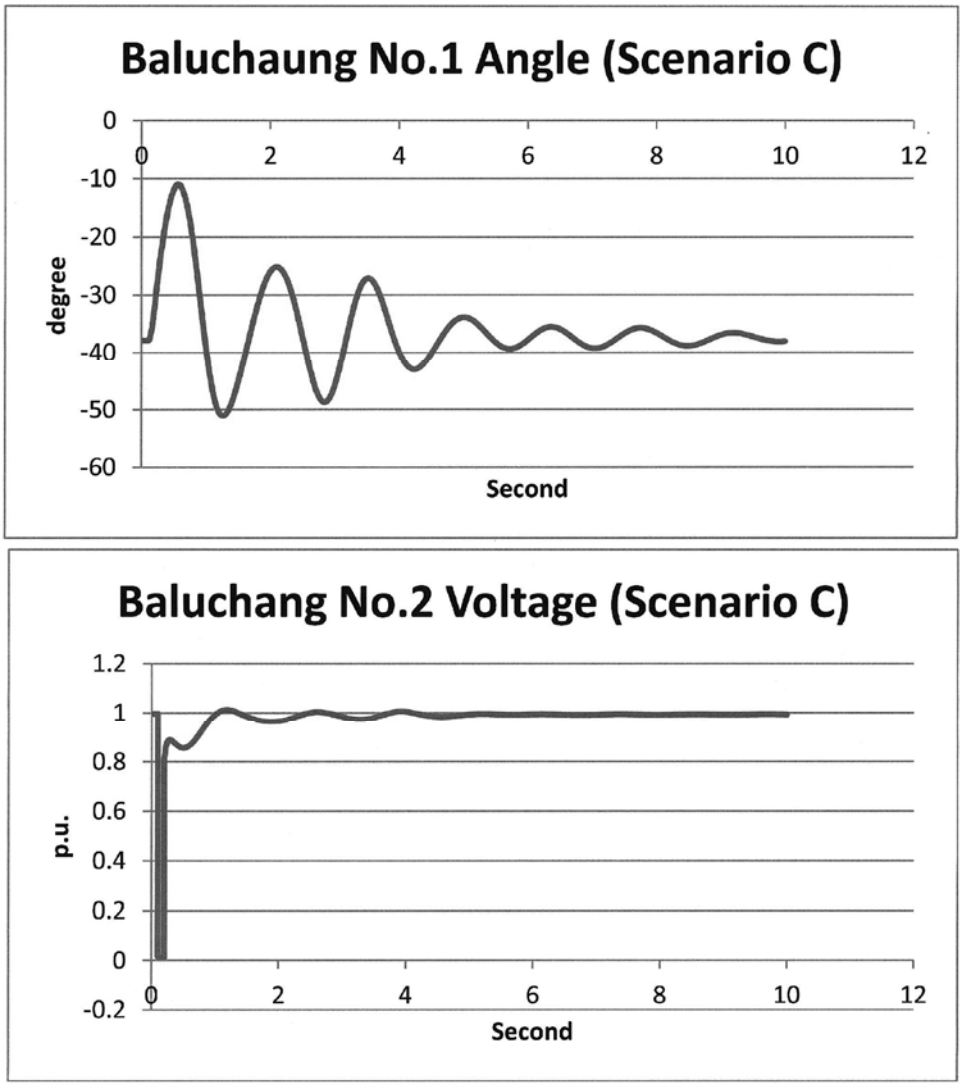


Fig.11.3-8 Power System Stability in Scenario C as of 2020

Transmission loss analysis result

For expansion scenarios of the power system surrounding Baluchanug P/S, total transmission loss in Myanmar power system is calculated. The result is shown in Table 11.3-1, where the transmission loss of Scenario A is the fewest in three scenarios.

Table 11.3-1 Transmission Line Loss

		Existing	Scenario A	Scenario B	Scenario C
Total transmission loss	(MW)	144.4	134.7	142.6	143.5
	(%)	(100)	93.3	98.8	99.4

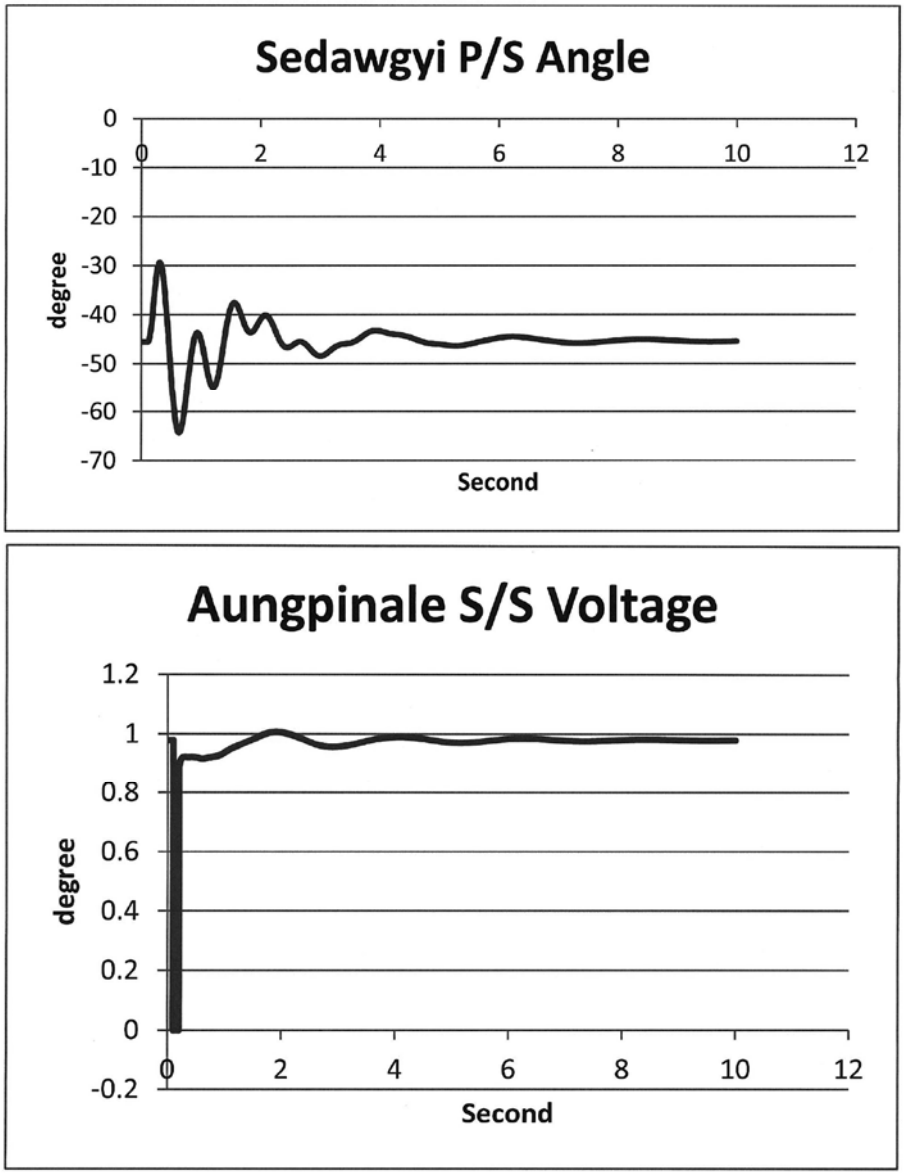


Fig.11.3-9 Power System Stability in Sedawsgyi as of 2020

ANNEX 16

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

16.1 Environmental Management Plan (EMP)

16.2 Related Documents prepared by JICA Survey Team and submitted to EPGE to obtain the ECC from MONREC

Annex 16.1 Environmental Management Plan (EMP)

Followings are EMPs, which were requested to prepare and submit to ECD, MONREC through EPGE.

A16.1-1 Environmental Management Plan (EMP) for Rehabilitation Project of Baluchaung No.1 HPP

Environmental Management Plan (EMP) for Rehabilitation Project of Baluchaung No.1 Hydropower Plant

Electric Power Generation Enterprise (EPGE)
Ministry of Electricity and Energy (MOEE)

October, 2016

Executive Summary

1. Outline of the Project Plan
2. Laws, Rules and Regulations related to Environmental and Social Considerations
3. Results of Preparation for Environmental Management Plan
4. Possible Major Negative Impacts and Mitigation Measures
5. Preparation of Environmental Management Plan (EMP)
6. Preparation of Environmental Monitoring Plan (EMoP)
7. Results of Stakeholder meetings

Environmental Management Plan (EMP) for Rehabilitation Project of Baluchaung No.1 Hydropower Plant

Executive Summary

- In the scheme of the National Electricity Master Plan, it is suggested that rehabilitation of hydropower plants is recommended from a standpoint of preventive measures against failures. It is because deterioration of major equipment and parts of existing Baluchaung No.1 hydropower plants (Baluchaung No.1 HPP) is progressing. Rehabilitation of existing hydropower plants is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel and so on.

- The project aims to conduct rehabilitation of existing Baluchaung No.1 HPP through replacement, repair or addition of facilities/equipment/devices without expansion of site / facilities and increase in power generation capacity with Electric Power Generation Enterprise (EPGE) as the proponent.

- As for the implementation schedule, the Project will start with preparation work such as selection of consultant, detailed design study and tender from March of 2017. Then, construction work will start at the end of 2018 at earliest and continued for about 2 years.

- The Project site is located in the Baluchaung River which is a tributary of the Nam Pawn River of the Thanlwin River system and was commenced in operation in August 1992 by Japan's ODA as one of cascade-type power generation scheme utilizing precipitous geography.

- After screening the proposed Project by MONREC (ECD), the Project is required to prepare an Environmental Management Plan (EMP).

- Outline of the EMP prepared are as follows:

    1. Possible impacts were identified and the extent of the impacts were evaluated one by one with rating against 38 environmental items (Social Environment 17, Natural environment 10, and Environmental pollution 11) as indicators expressing environmental and social conditions for the Project.

    2. Results of identification and evaluation of expected environmental and social impacts indicate that (a) there is no affected item with rating of (A-), which means significant negative (adverse) impact and (b) other affected items are classified into rating (B-), which means not significant but some negative impact, or rating (D), which means no or negligible negative impact

    3. An EMP was prepared with tabular form for major items having negative impacts and for implementation stages with describing possible negative impacts, necessary mitigation measures, implementing organization, responsible and supervising organizations as follows:

        (1) Planning stage – No item.

        (2) Construction stage
            1) Social Environment -Existing social infrastructures and services (Traffic condition), Public health and Sanitation, Working condition, Hazards/risk, Accidents
            2) Natural Environment – Global warming
            3) Environmental pollution – Air pollution, Water pollution, Soil contamination, Solid waste, Noise and vibration

        (3) Operation stage – No item

(4) Whole stages

1) Social Environment - Land use and utilization of local resources, Social institutions such as social infrastructure and local decision-making institutions, a split of communities, The poor, refugees, indigenous of ethnic minority people, Gender, Children's right, Misdistribution of benefit and damage, Local conflict of interests

4. An Environmental Monitoring Plan (EMoP) was also prepared in tabular form for same items as the EMP and ECC and other necessary approval with describing method of monitoring/parameter to be monitored, monitoring place/point, frequency, implementation organization as well as responsible and/or supervising organization.

5. Stakeholder meetings were held two times (July 2nd and September 17th) for information disclosure and public participation. In the first meeting outline of the project plan and method for required study of environmental and social considerations were presented and discussed. In the second meeting results of the study were presented and discussed.

Executive Summary (Myanmar Version)

စီမံကိန်းလုပ်ငန်းအကျဉ်း □ အမ်ိ□းသားေရးဆိုင်ရာ လွှ်ပ်စွာတ်အားရရှိေရး စီမံခ်က်အရ ေရအားလွှ်ပ်စ်အရင်းအျမစ်ွဲအား အရည်အေသြး ေလ့လာတိုင်းတာရာတြင် စက်ိရိယာမ်ား၏ အဓိကအစိတ်အပိုင်းမ်ားသည် အရည်အေသြးက်ဆင်းလာခဲ့ပါသည်။ လက်ိရိလည်ပတ်ေနေသာ ဘိလူးေခ်ာင်းအမွတ်(၁)ေရအား လွှ်ပ်စွက်၏အဓိက စက်ွစ□ည်း အစိတ်အပိုင်း မ်ားအားအစားထိုးလဲလွှည်ရန် လိုအပ်လာပါသည်။ အစားထိုးလဲလွှည်ျခင်းလုပ်ငန်း ေဆာင်ရွက်ရန် ေလ့လာမ□မ်ား ျပ□လုပ်ရာတြင် □ိုင်ငံ၏ စီပြားေရးဖွံ□ဖ□ိုးတိုးတက်မ□အား အေထာက်အကူျပ□မ□၊ လူမ□သာဝ ပတ်ဝန်းက်ငဲ့ ထိခိုက်မ□ မရှိေစေရး၊ တိုးခ်ဲ□မ□ျပ□လုပ်ငေဆာင်ရွက်နိုင်ေရးတို□အားထည့်သြင်းစဉ်းစားခဲ့ပါသည်။

□ လွှ်ပ်စွာ်ိတ်အားထုတ်လုပ်ေရးလုပ်ငန်း□ွင့်ပူးေပါင်းကာ အရြယ်အစားတိုးခ်ဲ□မ□ျပ□လုပ်ငွ□ွင့် စက်ွစ□ည်းမ်ား အစားထိုးလဲလွယ်ျခင်း၊ ျပန်လည်ျပ□ျပင်ျခင်းတို□ျဖင့်စီမံကိန်းအားေဆာင်ရွက်ထည့်သြင်းစဉ်းစားခဲ့ပါသည်။

□ လုပ်ငန်းအေကာင်အထည်ေဖာ်ေဆာင်ရွက်မည့်အစီအစဉ်အရ စီမံကိန်းေဆာင်ရွက်ရာတြင် စီမံကိန်းအ□ကဲေပး ေရြးခ်ယ်ျခင်း၊ စီမံကိန်းပံုစံေရးစြဲခ်မွတ်ျခင်း၊ စီမံကိန်းအတြက်တင်ခြေခ□ျခင်း၊ စီမံကိန်းလုပ်ငန်း အေကာင်အထည် ေဖာ်ေဆာင်ရွက်ျခင်းစသည်တို□ျဖင့် ေဆာင်ရွက်သြားမည် ျဖစ်ပါသည်။ စီမံကိန်းလုပ်ငန်း အေကာင်ထည်ေဖာ် ေဆာင်ရွက်ျခင်း လုပ်ငန်းကို ၂၀၁၈ ခု□ွစ်ေ□ွာင်းပိုင်းတြင်ေဆာင်ရွက်မည်ျဖစ်ပါသည်။ စီမံကိန်းအား(၂)□ွစ်□ကာ ေဆာင်ရွက်မည်ျဖစ်ပါသည်။ □ လွှ်ပ်စွာ်ိတ်အား ထုတ်လုပ်ေရးလုပ်ငန်း□ွင့် ပူးေပါင်းကာ အရြယ်အစားတိုးခ်ဲ□မ□ မျပ□လုပ်ငွ□ွင့် စက်ွစ□ည်းမ်ား အစားထိုး လဲလွယ်ျခင်း၊ ျပန်လည်ျပ□ျပင်ျခင်းတို□ျဖင့်စီမံကိန်းအားေဆာင်ရွက်ထည့်သြင်းစဉ်းစားခဲ့ပါသည်။ □ စီမံကိန်းသည်သြင်ျမစ်၏ ျမစ်လက်တက်ခုျဖစ်ေသာနန့်ပြန်ျမစ်ွဲျမစ်ွဲးခံလာေသာဘိလူးေခ်ာင်းေပ□ တြင် တည်ွိ သည်။ ၁၉၉၂ ခု□ွစ် ဂ်ပန□ိုင်ငံအကူအညီျဖင့်စတင်ေဆာင်ရွက်ခဲ့ေသာေရအားလွှ်ပ်စ်ီမံကိန်းျဖစ်ပါသည်။ □တြင်းခဲ့ေသာ အစီအရင်ခံစာအား သယ်ဇာတ□ွင့် သာဝပတ်ဝန်းက်ငဲ့ ထိန်းသိမ်းေရးဝန□ကီးဌာနမွ □ကည့်ရ□ စစ်ေဆး□ီး ေနာက်တြင် စီမံကိန်းသည် သာဝပတ်ဝန်းက်ငဲ့မံခန့□ခြံမ□အစီအစဉ်အား ေရးဆြဲရန်ည□န□ကားခဲ့ပါသည်။ □ သာဝ ပတ်ဝန်းက်ငဲ့ စီမံခန့□ခြံမ□ အစီအစဉ်ထ်ွင်

ေအာက္ေဖာ္ျပပါအခ်က္မ်ားအားထည့္သြင္းေရးဆြဲခဲ့ပါသည္။ ၁. ျဖစ္ေပ□□ိဳင္ေသာ သက္ေရာက္မ□မ်ားအား သတ္မွတ္ျခင္း၊ သက္ေရာက္မ□မ်ားအား တခုျခင္းစီအလိုက္ အဆင့္ခြဲျခားျခင္း ေဆာင္ရြက္ရာတြင္(၃၈)မ်ိ□း ပါဝင္ခဲ့ပါသည္။ လူမ□ေရး အမွတ္(၁၇)၊ သဘာဝပတ္ဝန္းက်င္ အေျခအေန အမွတ္(၁၀) □ွင့္ သဘာဝပတ္ဝန္းက်င္သစ္ဆုံးမ□ အမွတ္(၁၁) တို□ျဖစ္ပါသည္။ ၂. သတ္ေရာက္မ□မ်ားအား အဆင့္ခြဲျခားသတ္မွတ္ရာတြင္ (A-) သည္ ပတ္ဝန္းက်င္ ထိခိုက္မ□မရွိျခင္း (B-) သည္ ပတ္ဝန္းက်င္ ထိခိုက္မ□ အနည္းငယ္သာရွိျခင္း၊ (D) သည္ ပတ္ဝန္းထိခိုက္မ□ မရွိျခင္း စသည္တို□ျဖင့္ ခြဲျခားသတ္မွတ္ ထားပါသည္။

၃. သဘာဝပတ္ဝန္းက်င္စီမံခန္□ခြဲမ□အစီအစဥ္အားေရးဆြဲရာတြင္ လုပ္ငန္း အေကာင္အထည္ေဖာ္ေဆာင္ရြက္ျခင္း အဆင့္တြင္ ျဖစ္ေပ□လာ□ိဳင္ေသာ ထိခိုက္မ□မ်ားအတြက္ ေလွ်ာ့ခ်ေရးအစီအစဥ္၊ အေကာင္အထည္ေဖာ္ ေဆာင္ရြက္ မည့္အဖြဲ□အစည္း၊ တာဝန္ရွိေသာ အဖြဲ□အစည္း □ွင့္ □ကီး□ကပ္ေရးအဖြဲ□အစည္းတို□ကို ေအာက္ပါအတိုင္း ထည့္သြင္းေရးဆြဲပါသည္။ (၁) အစီအစဥ္ေရးဆြဲျခင္းအဆင့္ (၂) လုပ္ငန္းအေကာင္အထည္ေဖာ္ျခင္း - (၁) လူမ□သဘာဝပတ္ဝန္းက်င္- လက္ရွိလူမ□ပတ္ဝန္းက်င္အေျခအေန၊ က်မ္းမာေရး ေစာင့္ေရွာက္မ□ အေျခ အေန၊ အလုပ္အကိုင္ အခြင့္အလမ္း၊ ေဘးအ□□ရာယ္မ်ား (၂) သဘာဝပတ္ဝန္းက်င္-ကမ□ာေျမပူေ□ြးလာမ□ (၃) သဘာဝပတ္ဝန္းက်င္သစ္ဆုံးမ□- ေလထုညစ္ညမ္းမ□၊ ေရထုညစ္ညမ္းမ□၊ ေျမထုညစ္ညမ္းမ□၊ ဆူညံသံ မ်ား၊ တုန္ခါမ□မ်ား ၃. စီမံကိန္းအေကာင္အထည္ေဖာ္ေဆာင္ရြက္မ□ ၄. လုပ္ငန္းအဆင့္မ်ား (၁)လူမ□သဘာဝပတ္ဝန္းက်င္- ေျမယာအသံုးခ်မ□ □ွင့္ ေဒသတြင္းေျမယာ အသံုးျပ□ံပုမ်ား၊ ေဘးဒုက□သည္မ်ား၊ တိုင္းရင္းသားမ်ိ□း□ြယ္မ်ား၊ လိင္၊ ကေလးသူငယ္အခြင့္အေရး၊ ခြဲေဝမ□□ွင့္အသံုးခ်မ□မ်ား၊ ေဒသတြင္းျပ□နာမ်ား

၄.သဘာဝပတ္ဝန္းက်င္ ေစာင့္□ကည့္တိုင္းတာျခင္း အစီအစဥ္ကိုလည္း သဘာဝပတ္ဝန္းက်င္ စီမံခန္□ခြဲမ□ အစီအစဥ္ အတိုင္းေရးဆြဲပါမည္။ ေရးဆြဲရာတြင္ စံ□□နး်မ်ား၊ ေနရာမ်ား၊ အ□ကိမ္အေရအတြက္၊ ေဆာင္ရြက္မည့္အဖြဲ□အစည္း၊ □ကီး□ကပ္မည့္အဖြဲ□အစည္း၊ တာဝန္ခံအဖြဲ□အစည္းတို□ပါဝင္မည္ျဖစ္ပါသည္။

၅.

ေဒသခံမ်ား□ွင့္ေတြ□ဆံုေဆြးေ□ြး၍သတင္းအခ်က္အလက္မ်ားရယူျခင္းကို(၂)□ကိမ္ျပ□ လုပ္ခဲ့ပါသည္။ ပထမအ□ကိမ္ေတြ□ဆံု ေဆြးေ□ြးပြဲတြင္ စီမံကိန္းအခ်က္အလက္မ်ား၊ လူမ□ေရး□ွင့္သဘာဝပတ္ဝန္းက်င္ ေလ့လာဆန္းစစ္ျခင္း ျပ□လုပ္မည့္ ပံုစံမ်ား အားရွင္းလင္း တင္ျပခဲ့ပါသည္။ ဒုတိယအ□ကိမ္ေတြ□ဆံုေွဆြးေ□ြးပြဲတြင္ျပ□လုပ္ ေဆာင္ရြက္ခဲ့ေသာ အေ□ကာင္းအရာမ်ား ရွင္းလင္း တင္ျပခဲ့ပါသည္။

1. Outline of the Project Plan

(1) Objectives and Scope of the Project

1) Objectives

In the scheme of the National Electricity Master Plan, it is suggested that rehabilitation of hydropower plants is recommended from a standpoint of preventive measures against failures. It is because deterioration of major equipment and parts of existing Baluchaung No.1 hydropower plants (hereafter referred to as Baluchaung No.1 HPP) is progressing. Rehabilitation of existing hydropower plants is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel and so on.

As improvement of existing electric power supply conditions is expected in terms of such as increase of power generation efficiency and reduction of blackout occurrence by rehabilitation of both hydropower plants

2) Necessity of the Project

Rehabilitation of existing Baluchaung No.1 HPP through replacement, repair or addition of facilities/ equipment/devices without expansion of site / facilities and increase in power generation capacity.

Table 1 Necessity of Rehabilitation (Replacement, Repair or Addition) with Major Facilities/Equipment of Existing Hydropower Plant

1) Change in Existing Land Use	Rehabilitation work and subsequent operation of the hydropower plant will be done within the existing plant site. Thus, there will be no changes in land use of the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities such as farming and livestock, and living conditions of residents in surrounding area.
2) Change in External of Existing Facilities or Civil Structures	No changes in space, capacity and dimension from the existing hydropower plant are not expected for following facilities and structures: **(1)** No raising / expansion of existing body of dam, **(2)** No changes in amount of length, and dimension and route of flow channel due to sluicing intake water, **(3)** No change in dimension of civil facilities such as powerhouse.
3) Change in Internal of Existing Facilities, Equipment or Devices	The preliminary inspection and records of the failure of existing Baluchaung No.1 HPP found considerable deterioration of major parts and systems relevant to turbine and auxiliary equipment, generator and auxiliary equipment, plant control and protection system, substation and transmission facilities, gates and penstock, as well as civil facilities. Therefore, rehabilitation through replacement and/or repair are expected to improve such equipment.
4) Operation of Hydropower Generation	There will be no change in conditions of operation for electric power generation such as power generation capacity, pattern and schedule of operation.

3) Implementation Schedule of the Project

As for the implementation schedule, the Project will start with preparation work such as selection of consultant, detailed design study and tender as shown in Table 2. Then, construction work will start at the end of 2018 and continued for about 2 years.

Table 2 Implementation Schedule for Rehabilitation Project of Hydropower Plant

	Subject	2016				2017				2018				2019				2020				2021			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	JICA Preparatory Study	←			→																				
2	Loan Agreement				↔																				
3	Consulting Services for Rehabilitation of Hydropower Stations Project (selction of Consultant, Detailed Design Study, Tender for Constructors)					←							→												
4	Implementation of Constrcution Work for Rehabilitation												←								→				
5	Power Plant Operation after Rehabilitation																				←				

4) Expected number of workers engaged to the construction work

About 50 skilled workers are mostly employees of EPGE will be engaged in the construction work. In addition, people of surrounding area will have chances to engage in temporary and no skill work.

5) Estimated Project Cost

Estimation of the project cost is not yet completed.

6) The Project Proponent

Electric Power Generation Enterprise (EPGE), Ministry of Electricity and Energy (MOEE)

7) Location of Hydropower Plants

- Baluchaung No.1 HPP is located in the Baluchaung River which is a tributary of the Nam Pawn River of the Thanlwin River system and was commenced in operation in August 1992 by Japan's ODA as one of cascade-type power generation scheme utilizing precipitous geography. In the same river system Baluchaung No.2 Hydropower Plant (MOEP, 1960) and Baluchaung No.3 Hydropower Plant (Future Energy, 2014) are operating, which are important hydropower plant group for Myanmar and which can supply stable power throughout the year by regulating river flow by the Mobye Reservoir in the upstream.

- The electric power generated by Baluchaung No.1 HPP is transmitted to ~~the~~ substation the Baluchaung No.2 hydropower plant by 132 kV transmissions line and to Taungoo substation by 230 kV transmission line as shown in Table 2. The plant is located about 20 km far from central area of LoikawTownship, the capital of KayahState as shown in Figure 1and 2.

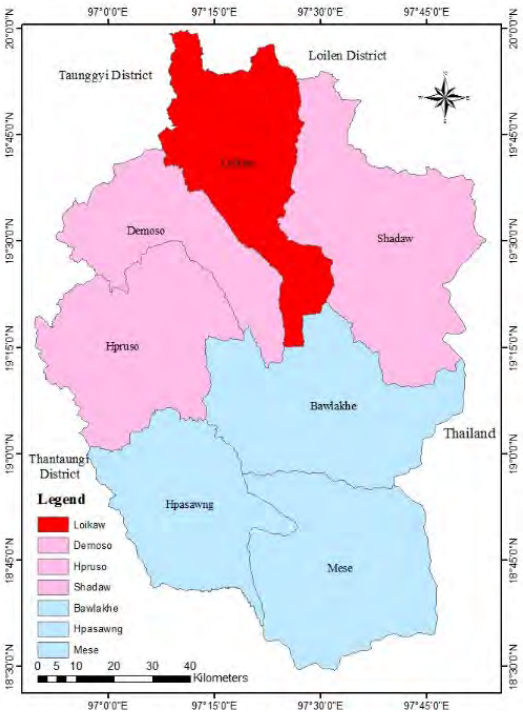


Figure 1 Location of Loikaw Township in Kayah State

Source: Land Records Department (2000)

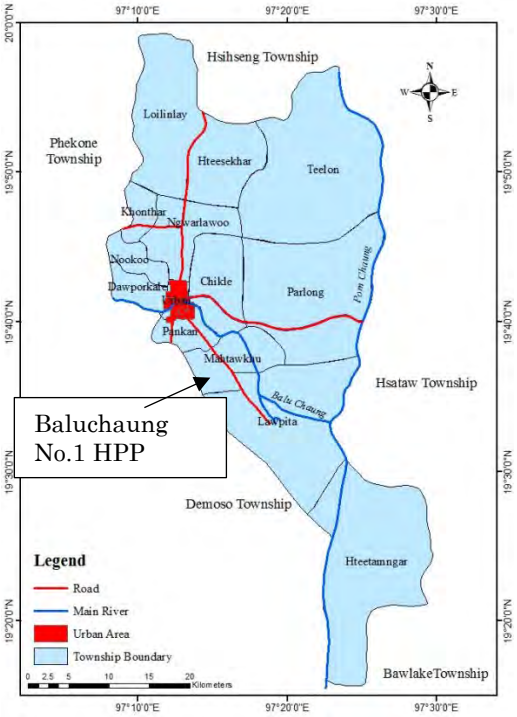


Figure 2 Location of Village Tracts in Loikaw Township

Source: Land Records Department

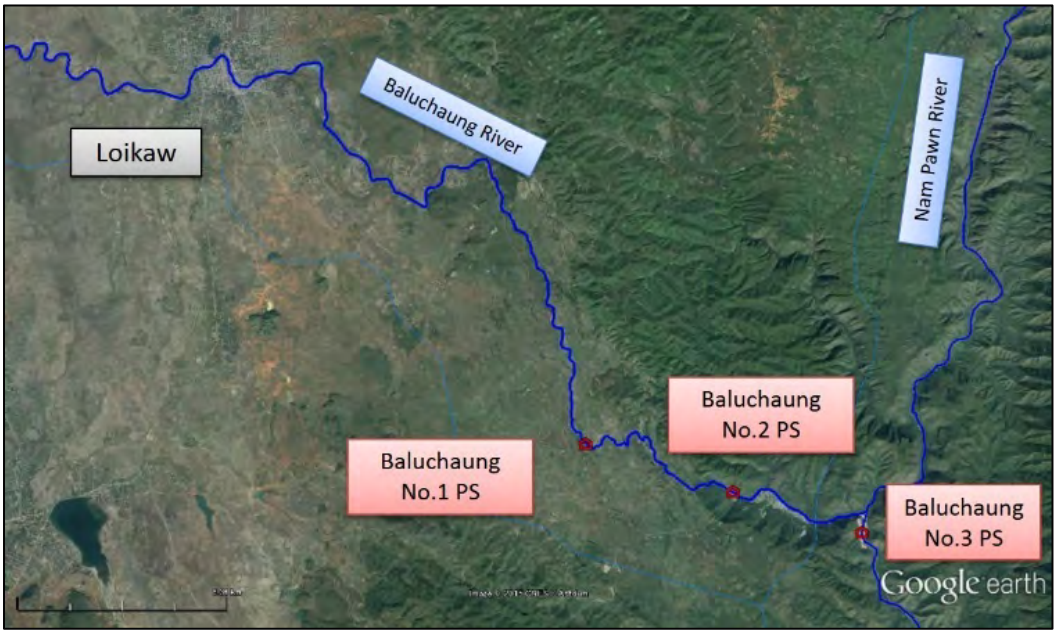


Figure 3 Location Map of Baluchaung No.1 HPP along Baluchaung River

Photo 1 Existing Baluchaung No.1 HPP

Table 3 Major Parameters of Baluchaung No.1 HPP

Item	Baluchaung No.1 Hydropower Plant
Max. power	28.0MW
Annual generated energy	200GWh (nominal) / 186GWh (2013 actual)
Annual operation hour	8,104 hours (2012 actual)
Commencement of operation	Aug-92
Power generation type	Run-of-river
Region/state	Kayah state
River	Thanlwin River system, Baluchaung River
Catchment area	7,960km^2
Max. power discharge	47.6m^3/s
Dam/weir	Concrete weir 11.0m
Effective head	69.6m
Turbine type	Francis turbine (Hitachi-Mitsubishi), 14.0MW × 2 units

2. Laws, Rules and Regulations related to Environmental and Social Considerations

(1) General

Environmental Conservation Law (2012) and Environmental Conservation Rules (2014) are recently enacted laws to determine the comprehensive environmental conservation and management in Myanmar. Following laws, rules and regulations are related to environmental and social consideration in Myanmar.

Table 4 Major Laws and Regulations relevant to Environment

Name of Laws, Rules etc.	Year
1. Constitution and Environmental Policy	
Constitution of the Republic of the Union of Myanmar	2008
Myanmar National Environmental Policy	1994
National Sustainable Development Strategy 2009	2009
2. Environmental Conservation	
Myanmar Environmental Conservation Law 2012	2012
Environmental Conservation Rules 2014	2014
Environmental Impact Assessment Procedures 2015	2015
3. Biodiversity and Natural Conservation	
Wildlife Protection Act 1936	1936
Myanmar Marine Fisheries Law 1990	1990
Fresh Water Fisheries Law 1991	1991
The Law Relating to Aquaculture	1989
Forest Law 1992	1992
Animal Health and Development Law 1993	1993
Protection of Wildlife and Conservation of Natural Area Law 1994	1994
Conservation of Water Resources and River Law 2006	2006
National Biodiversity Strategy Action Plan in Myanmar	2012
4. Development and Management of Economic Activities	
Irrigation Laws and Regulations	1982
Factory Act	1951
Mines Law	1994
Electricity Law 1984 (amended 2014)	2014
Electricity Act 1948 (amended in 1967)	1967
Petroleum Act	1934
Petroleum Rules of 1937 (amended in 1946	1946
Law on Aquaculture (1989)	1990
Freshwater Fisheries Law	1991
5. Land Acquisition and Resettlement	
The Upper Burma Land and Revenue Regulation	1889
The Land Acquisition Act 1894	1894
Transfer of Immovable Property Restriction Act	1947
Land Nationalization Act	1953
Disposal of Land Tenancies Law	1963
Transfer of Immovable Property Restriction Law	1987
Wasteland Instruction	1991
Farmland Law 2012	2012
Farmland Rules 2012	2012
Vacant, Fallow, Virgin Land Management Law 2012	2012
Vacant, Fallow, Virgin Land Management Rules 2012	2012
6. Pollution Control and Occupational Health	
Factory Act	1951
Standing Order 2_95 Occupational Health Plan 1995	1995
Standing Order 3_95 Water and Air Pollution Control Plan 1995	1995
Occupational Safety and Health Law (Draft)	2012
The Science and Technology Development Law 1994	1994
Myanmar Mines Law 1994	1994
National Environmental Quality (Emissions) Guidelines	2015

(2) Environmental Conservation Law, 2012

The principal law governing environmental management in Myanmar is the Environmental Conservation Law (ECL), which was issued in March, 2012 (The PyidaungsuHluttaw Law No.9/2012).

The law stipulates that government bodies are in charge of environmental conservation as well as their relevant roles and responsibilities. It touches on water, noise, vibration and solid waste qualities but does not provide specific standards to be met.

It also mentions that any new development project must perform a system of Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) in order to find out whether or not a project or activity to be undertaken by any government department, organization or person may cause a significant impact on the environment or not. In the context of project development, it is important to note that the law adopts the notion of 'Polluter Pays Principle' as it implies that the project proponents are responsible for covering all environmental and social costs generated by the project.

The law serves as the basis for founding of Environmental Conservation Department (ECD) under the Ministry of Natural Resources and Environmental Conservation (MONREC)*

* In May of 2016 former Ministry of Environmental Conservation and Forestry (MOECAF) was changed to the MONREC adding with function of natural resources management.

Following the Environmental Conservation Law are two legal instruments:

Environmental Conservation Rules (2014); and EIA Procedures (2015).

(3) Environmental Conservation Rules, 2014

Environmental Conservation Rules (ECR) No. 59/2014 emphasizes the importance of conservation of cultural heritage areas, natural heritage areas, cultural monuments, buildings and natural area and to set up the method to mitigate the impact of polluted waste during destruction, storage, placement and transportation of such waste.

In addition, ECR stipulates basic policy and concept of Environment Impact Assessment (EIA) application in developing Projects in Section 55 of Chapter XIas follows:

The Government department, organization or person which carry out the plan, business service or activity which are responsible to carry out the environmental impact assessment or initial environmental examination which is established before the issue of these rules;

(a) Shall submit to the Ministry, after drawing environment management plan in accord with the procedure relating to the environmental impact assessment.

(b) Shall implement and carry out the environment management plan which approved and scrutinized by the Ministry and matters stipulated by the Ministry within the time stipulated by the Ministry.

As described below, according to the EIA Procedure 2015, Prior Permission is required for economic activities including certain types of business, work-site or factory, workshops which may cause an impact on the environmental quality.

(4) Environmental Assessment (EIA) Procedure, 2015

In December 2015 Environmental Assessment (EIA) Procedure, which was long-awaited was enacted by MOECAF.

Major statements stipulated are as follows.

8) Chapter II - Establishment of the EIA Process

a) Section 3

Pursuant to Section 21 of the Law and Articles 52, 53 and 55 of the Rules, all Projects and Project expansions undertaken by any ministry, government department, organization, corporation, board, development committee and organization, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual (and/or all Projects, field sites, factories and businesses including expansions of such Projects, field sites, factories and businesses identified by the Ministry, which may cause impact on environmental quality and are required to obtain Prior Permission in accordance with Section 21 of the Law, and Article 62 of the Rules) having the potential to cause Adverse Impacts, are required to undertake Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) or to develop an Environmental Management Plan (EMP), and to obtain an Environmental Compliance Certificate (ECC) in accordance with this Procedure.

b) Section 5

In accordance with Article 68 of the Rules, small-scale Projects, field sites, factories or businesses which are not specifically identified by the Ministry, but which may impact on environmental quality and as such are required to obtain Prior Permission in accordance with Section 21 of the Law or Article 62 of the Rules, and which are also not included in Annex 1 'Categorization of Economic Activities for Assessment Purposes', shall obtain the recommendation of the Department as to whether or not such a Project has Environmental Impacts and shall comply with the terms and conditions prescribed by the Department before applying for a permit or license from the relevant ministry or governmental organization.

- EIA procedures describe types of categories of business which are necessary to carry out IEE/EIA studies before the implementation of the project. In the Annex 1 of the EIA Procedure, guidance as to whether an IEE or an EIA is required for 141 types of projects or activities.

- In the Annex 1, economic activities relating to schemes of hydropower development are shown in Table 5.

Table 5 Categorization of Hydropower Development Schemes

Type of Economic Activity	Criteria for IEE Type Economic Activities	Criteria for EIA Type Economic Activities
(a) Energy Sector Development		
Hydro Power Plants	a) Installed capacity ≥ 1 MW but < 15 MW	a) Installed capacity ≥ 15 MW
	b) Reservoir volume (full supply level) < 20,000,000 m^3	b) Reservoir volume (full supply level) ≥ 20,000,000 m^3
	c) Reservoir area (full supply level) < 400 ha	c) Reservoir area (full supply level) ≥ 400 ha
Electrical Power Transmission Lines (≥ 115 kV 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

Note: Edited from Annex I of EIA Procedure 2015, in which 141 types of economic activities are categorized with respective to types of their economic activities

c) Section 6

The ECC issued by the Ministry shall reflect any terms and conditions that are contained in any relevant Prior Permission.

d) Section 8

Any Project already in existence prior to the issuance of the Rules, or the construction of which has already commenced prior to the issuance of the Rules, and which, in either case, shall be required to undertake, within the timeframe prescribed by the Department, an environmental compliance audit, including on-site assessment, to identify past and/or present concerns related to that Project's Environmental Impacts, and to:

(a) Develop an EIA or IEE or EMP;
(b) Obtain an ECC; and
(c) Take appropriate actions to mitigate Adverse Impacts in accordance with the Law, the Rules, and other applicable laws.

9) Chapter III - Screening

a) Section 23

(a) The Project Proponent shall submit the Project Proposal to the Ministry for Screening. In accordance with this Procedure, the submission of the Project Proposal for Screening is the same as the submission of an application for Prior Permission.

(b) The Ministry will send the Project Proposal to the Department to determine the need for environmental assessment.

(c) Following the preliminary Screening and verification that the Project Proposal contains all required documents and related materials, subject to Articles 8, 9, 10, 11, 26 and 27 the Department shall make a determination in accordance with Annex 1 'Categorization of Economic Activities for Assessment Purposes', taking into account Article 25 and the additional factors listed in Article 28 in order to designate the Project as one of the following, and then submit their designation to the Ministry:

i) an EIA Type Project, or
ii) an IEE Type Project, or
iii) A Non IEE or EIA Type Project, and therefore not required to undertake any environmental assessment.

b) Section 24

The Ministry shall also make a determination whether an EMP shall be required in respect of any Project.

10) Chapter VII - Environmental Management Plan

a) Section 76

For Project types which require EMP according to the Article 55 (a) of the Rules or Article 24 of the Procedure, the Project Proponent may prepare an EMP by itself or may appoint a person or organization who/which is registered according to the Article 18.

b) Section 77

The Project Proponent shall issue a letter of endorsement in a format prescribed by the Ministry according to the Article 63. Such letter shall be submitted to the Department prepared either in the Myanmar language, or in the English language or both. The Project Proponent shall submit the EMP to the Department in both digital form and complete paper copies, together with the required service fee as prescribed by the Department, and confirming:

(a) the accuracy and completeness of the EMP;

(b) that the EMP has been prepared in strict compliance with applicable laws including this procedure; and

(c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EMP.

c) Section 78

Upon Receipt of the EMP from the Project Proponent, the Department shall review and submit to the Ministry to enable it to make a final decision on approval of the EMP.

d) Section 79

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

e) Section 80

Upon completion of its review of the EMP, the Ministry shall;

(a) approve the EMP, subject to any conditions it may prescribe, and issue an ECC; or

(b) require that the Project carry out an IEE or EIA, citing the reasons for this decision and informing the Project Proponent of its decision; and, in either case

(c) publicly disclose its decision.

f) Section 81

The Department shall deliver the final decision of the Ministry within thirty (30) working days of receipt of an EMP. If the Ministry requires an EMP to be amended, then the due date for delivery of the Ministry's decision shall be extended accordingly.

g) Section 82

Any additional costs associated with reaching a determination regarding Project types which require EMP shall be borne by the Project Proponent.

(5) Procedures of Environmental Assessment

The EIA Procedures are expected to stipulate the conditions under which EIA is required and the steps to be followed in conducting and assessing the EIA. Under the EIA Procedure, the Ministry, as the Executing Agency sets an EIA Review Committee, is to give recommendations from an environmental point of view whether to approve the EIA reports or not. Composition of the EIA Review Committee will be determined by the Minister of MOECAF but needs to include persons from the industry, academia, and civil society, as well as government officials. EIA includes an environmental management plan and a social impact assessment report. The Procedures may also

include a clause for public participation in implementing the Initial Environmental Examination (IEE), EIA, and Environmental Management Plan (EMP), yet only if deemed necessary by the Ministry.

If the proponent intends to obtain ECC for the project implementation from MONREC, a series of procedures described below (i) to (ix), which depend on the type and/or feature of the project, are required to the proponent with incorporating MONREC and other related organizations such as EIA Report Review Body, third person or organization undertaking IEE and EIA:

(i) Project proposal screening, (ii) IEE - IEE investigation and review, (iii) IEE - IEE review and approval, (iv) EMP review and approval, (v) Scoping of EIA, (vi) EIA investigation and review, (vii) EIA review and approval(viii) Appeal process.

A series of the procedures are shown in the Environmental Assessment Procedure Flowcharts.

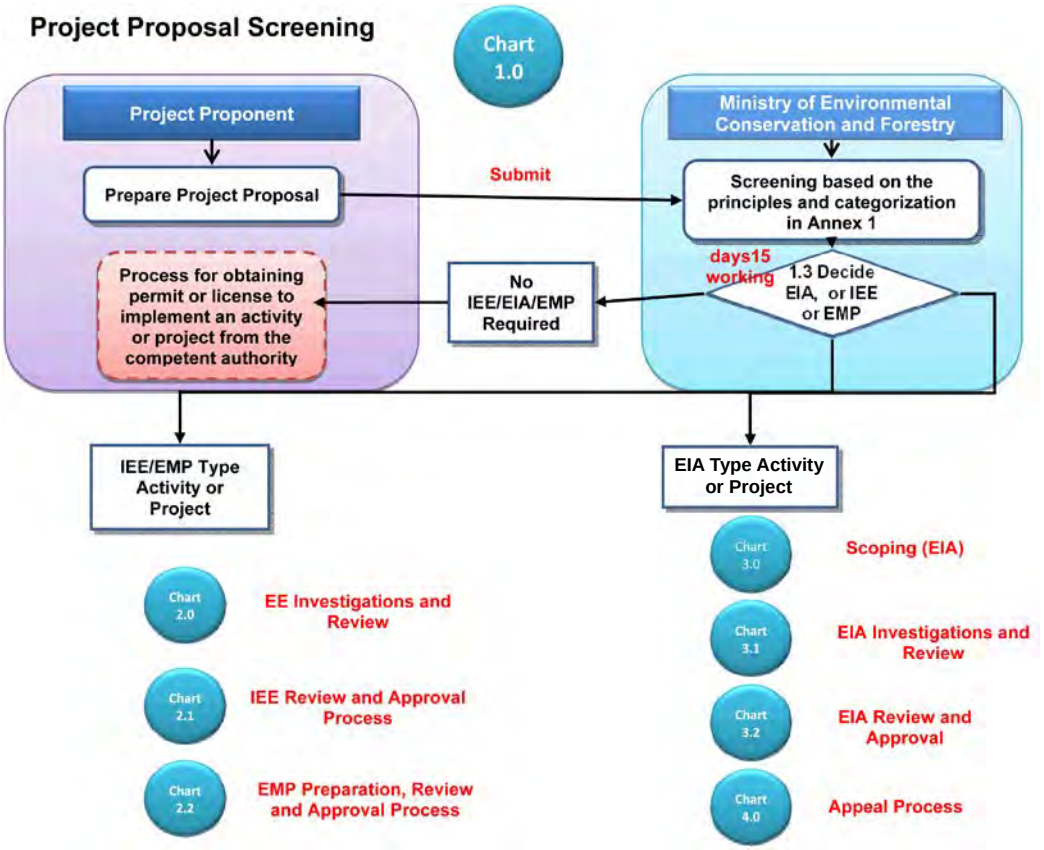


Figure 4 Project Proposal Screening

Source: EIA procedure 2015

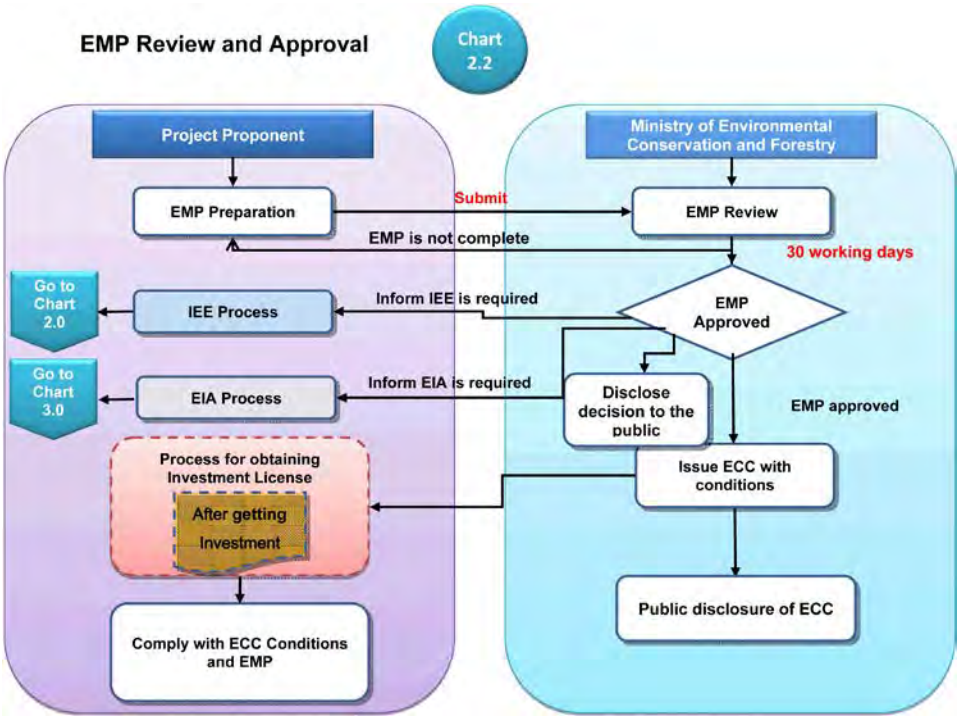


Figure 5 EMP Review and Approval

Source: EIA procedure 2015

(6) Environmental Quality Standards

National Environmental Quality (Emissions) Guidelines 2015 (hereafter referred to NEQEG) was enacted at the end of 2015.

NEQEG provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health.

The NEQEG have been primarily excerpted from the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries. The Guidelines are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of these Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

As specified in the EIA Procedure, all projects are obliged to use, comply with and refer to applicable national guidelines or standards or international standards adopted by the Ministry. The NEQEG will be applied by the Ministry in satisfying this requirement until otherwise modified or succeeded by other guidelines or standards. Following project approval, a project shall commence implementation strictly in accordance with the project EMP and any additional requirements set out in the project ECC, which will encompass conditions relating to emissions. In this regard, the Ministry will require that projects adhere to general and applicable industry guidelines as set out in Annex 1.

Projects shall engage in continuous, proactive and comprehensive self-monitoring of the project and comply with applicable guidelines and standards. For purposes of the NEQEG, projects shall be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC.

Guidelines regarding air emissions, wastewater, noise level and odor are explained and specified.

(7) Solid Waste Management

In Myanmar solid waste management is mostly under the control of local government. For example, large cities such as Yangon and Mandalay City, Township Development Committee has a principal function of solid waste management including industrial and hazardous waste as part of pollution control.

On the other hand, in national level ECD is preparing national policy of solid waste management. However, no regulation of solid waste management including hazardous waste has been established in Myanmar until now.

(8) Laws, Rules and Regulations concerning Land Use, Ownership and Acquisition

There are many significant laws which govern land issues, land administration, and land ownership in Myanmar such as Land Nationalization Act (1953), Disposal of Tenancies Law (1963), Land Acquisition Act (1894), Forest Law (1992), Farm Land Law (2012), and so on.

Among them, the Land Acquisition Act (1894) is even now the core law of land acquisition.

The Land Acquisition Act 1894 promulgated in the British Colonial Era is even now the core law for land acquisition and resettlement in Myanmar. As there are problems such as consistency of the procedures by MONREC with the procedures by Ministry of Home Affairs or by local governments, and problem of abilities in MONREC to do institutional management of the system, etc., the new effectual system is also undecided at present.

As mentioned in Table 1 and below (Table 4), construction work for rehabilitation and subsequent operation of the hydropower plant will be done within the existing plant site. Thus, there will be no changes in land use in the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities.

3. Results of Preparation for Environmental Management Plan

Procedures of Preparation of EMP is schematically shown in Figure 6.

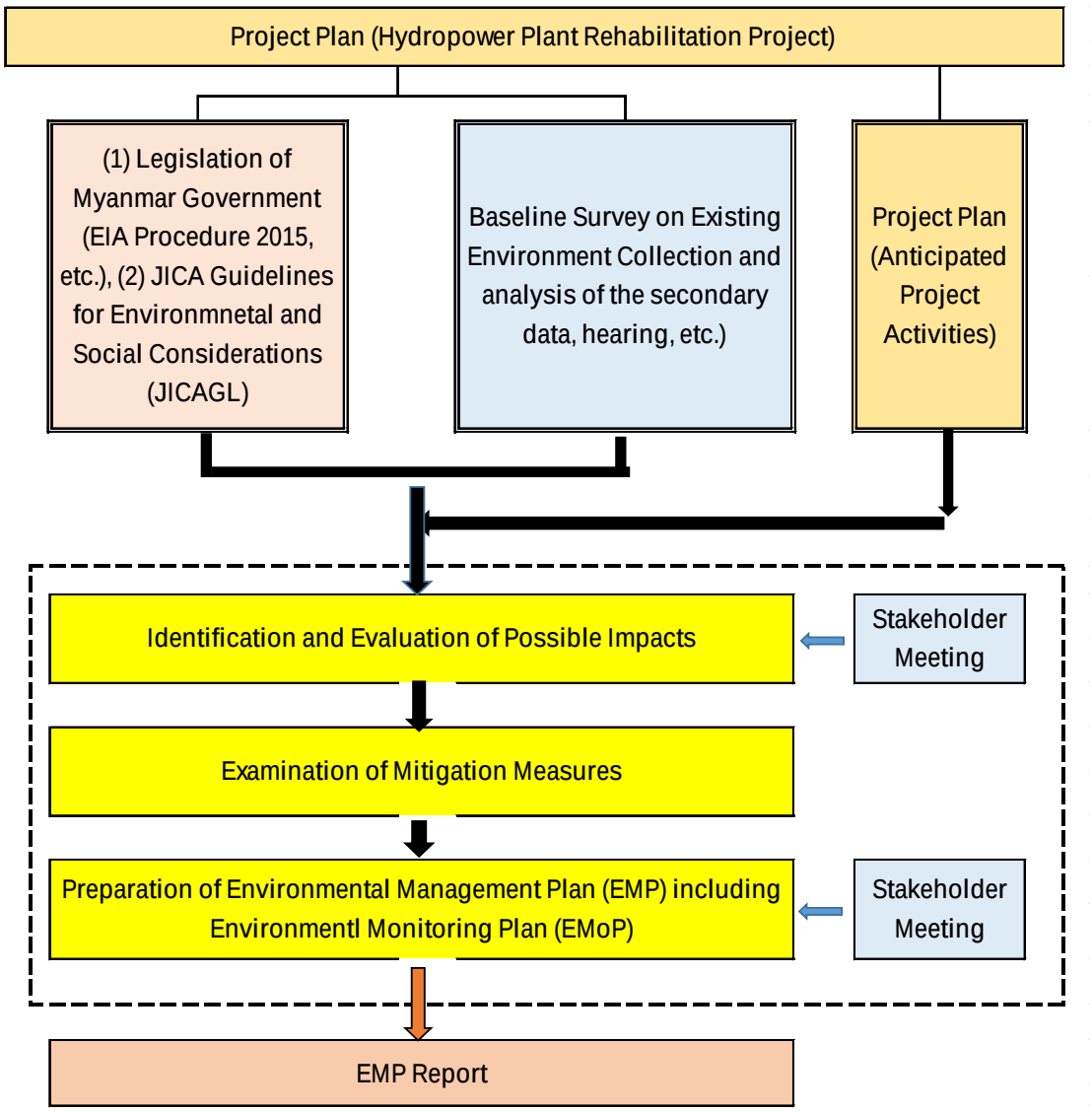


Figure 6 Schematic Flow of EMP Preparation

(1) Project Activities

Anticipated activities due to the proposed project plan for Baluchaung No.1 HPP are shown in Table 6.

Table 6 Anticipated Activities due to the Rehabilitation of Existing Hydropower Plants

Stage	Anticipated Activities
I Planning Stage (Pre-construction Stage)	Securing land/space for hydropower plant and related facilities
	Securing construction yard including storage of construction materials
	Change in land use and utilization of local resources
II Construction Stage (Rehabilitation Work)	Procurement of construction materials and securing water supply
	Earth moving work such as excavation, cutting and mounting
	Work for exchange/renewal of dilapidated facilities /equipment and/or parts/devices to new ones
	Collection, transportation and storage of generated waste including hazardous materials such as PCBs and asbestos through exchange of older transformers and others to new ones
	Carrying out dilapidated facilities /equipment and/or parts/devices and carrying in new ones by manually and/or using machines and vehicles
	Workers, their working activities and worker's camp
III Operation Stage	Operation of hydropower plant and related facilities/equipment
	Spatial occupancy of hydropower plant and related facilities

(2) Setting of Environmental Components and Items

To grasp whole features of possible environmental impacts caused by the project, it is necessary to identify and evaluate environmental component and item, which compose of environmental and social considerations, one by one and to integrate the impacts.

According to the JICA Guidelines for Environmental and Social Considerations, possible impacts to be assessed include those on human health and safety, as well as on the natural environment, which are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.

In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational to do so.

Taking into consideration the JICA Guidelines, and relevant laws and regulations of Myanmar, together with environmental condition of the project area, three environmental components and 38 items (Social Environment 17, Natural environment 10, and Environmental pollution 11) as indicators expressing environmental and social conditions (See Table 7 below).

(3) Rating of Possible Impacts

Possible impacts are identified and the extent of the impacts are also evaluated one by one for each implementation stage by applying rating against the above mentioned 38 environmental items.

In the evaluation following rating criteria are adopted to examine extent of the possible impacts:

- In general, both positive impact (+) and negative impact (-) are expected due to the anticipated project activities.

- Ratings are as follows:
  (a) A (+/-) - Significant positive/negative impact is expected,
  (b) B (+/-) - Not significant but some positive/ negative impact is expected
  (c) C (+/-) - Extent of impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses.
  (d) D - Negligible or No impact is expected.

- Implementation stage: I - Planning Stage, II - Construction Stage, III - Operation Stage. T-Whole stages with worst rating among I, II, and III.

(4) Identification and Evaluation of Possible Impacts

Based on results of the Preliminary Scoping, necessary survey was carried out to fill up necessary information by collection of relevant data and by hearing and consultation with related central and local governmental departments and organizations as well as village and communities in the project area of Baluchaung No.1 HPP.

After the survey, by applying revised and upgraded information, possible impacts were also identified and the extent of the impacts were evaluated one by one with rating against 38 environmental items for rehabilitation of Baluchaung No.1 HPP.

Results are shown together with the results of the Scoping in Table 7.

Table 7 Identification and Evaluation of Possible Impacts due to Hydropower Plants Rehabilitation Project

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
(1) Social Environment						
1	Involuntary Resettlement (land acquisition/ resettle-ment etc.), migration of population etc.	D	D	D	D	(I) All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither land acquisition nor resettlement is expected for surrounding areas.
2	Local economy such as employment and livelihood etc.	B+	A+	B+	D	(II) Temporary employment of local people by construction work is somewhat anticipated.
3	Land use and utilization of local resources	D	D	D	D	(T) (1) All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither change of land use nor utilization of local resources is not anticipated in the surrounding areas. (2) Although it is out of scope of the proposed Project, former farmland of about 40 acres within the HPP site was enforced to use for station staff houses during construction of the HPP by the Government and has not been restituted yet. Thus, it is a matter of suit between farmers and local government.
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	B-	B-	(T) Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
						informed to relevant community peoples and community based organizations.
5	Existing social infrastructures and services (Traffic condition)	C	A+	B-	D	(II) It is anticipated to cause inconvenience to local traffic due to passing through vehicles for construction work and tracks loading heavy equipment and device access road to hydropower plant.
6	The poor, refugees, indigenous of ethnic minority people	C	C	B-	B-	(T) Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, there is found no situation for necessary considerations with the poor and vulnerable peoples such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and Loikaw Township. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
7	Gender	C	C	B-	B-	(T) At present, there is found no situation for necessary considerations with gender regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities and Loikaw Township. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
8	Children's Right	C	C	B-	B-	(T) At present, there is found no situation for necessary considerations with children regarding (1) Provision of adequate standard of living, education etc., (2) Protection from abuse, neglect and discrimination, (3) Participation in the communities in Loikaw Township. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
9	Misdistribution of benefit and damage	C	C	B-	B-	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
10	Local conflict of interests	C	C	B-	B-	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
11	Cultural property and heritage	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site. In addition, there are found no cultural, religious and historical heritage sites in and nearby. Thus, negative impact is not anticipated.
12	Fishing Rights, Water Rights and Rights of Common	C	C	D	D	(1) In Myanmar there are two types of fishing rights; one is "fishing grant", which is given with specified river area and another is "license", which is a permit of fishing. (2) Construction work will be limited within existing hydropower plant site. Thus, negative impact is not anticipated.
13	Public health and Sanitation	C	C	B-	D	(II) (1) There is a possibility of air pollutants emissions such as NOx and PM by operation of construction machines and vehicles for rehabilitation work may cause some adverse effect of respiratory organ. (2) In addition, solid waste containing hazardous material such as toxic metals (Hg, Pb)and asbestos generated even in very small amount through replacing dilapidated equipment and/or devices with new ones, may cause some adverse effect on human health in case of direct dermal contact or inhalation.
14	Infectious diseases such as HIV/AIDS	C	C	D	D	(II) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of migrating workers with affected peoples at their camp in construction work. However, according to the rehabilitation plan workers engaged in the work will be basically EPGE employees having skill and experience working in hydropower plant. Thus, infectious diseases

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
						such as HIV/AIDS is not anticipated.
15	Working condition	C	C	B-	D	(II) Adverse impacts on working condition including occupational safety are expected somewhat due to inadequate management of workers at construction work.
16	Hazard/risk (disaster, security)	B-	C	B-	D	(II) In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of leakage of hazardous materials, even a small amount, through replacement of dilapidated equipment and/or devices with new ones. (III) It is hardly anticipated any additional risk by the plant operation.
17	Accidents	B-	C	B-	D	(II) Occurrence of accidents is somewhat anticipated, if inappropriate handling and management of construction work. (III) Through rehabilitation upgrading in efficiency and reliability of operation will be attained resulting in reduction of accidental power failure.
(2) Natural Environment						
18	Topography and Geology	D	D	D	D	(II) Construction work will be limited to exchange of dilapidated equipment and/or devices within existing hydropower plant site. In addition, there is no specific/valuable feature of topography and geology in and surrounding areas of the plant site.
19	Soil erosion/sand movement	C	C	D	D	(II) All the activities for rehabilitation will be carried out within existing hydropower plant site, which has flat and good soil condition.
20	Movement of water/ Hydrological situation	C	C	D	D	(II, III) No change from existing condition in quantity and quality of water intake and sluice from dam by hydropower generation is anticipated during construction and operation stage.
21	Groundwater condition	C	C	D	D	(II) All the activities for rehabilitation will be carried out within existing hydropower plant site. In addition, no large scale pumping of groundwater will be planned. Water use for construction work will be done by supplying surface water of dam and river. Thus, negative impact on groundwater is not anticipated.
22	Environmentally sensitive areas (Protected Areas, IBAs etc.)	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site, where no Environmentally sensitive areas are found. Thus, no negative impact isanticipated due to the project.
23	Flora, Fauna, Ecosystem and Biodiversity (Terrestrial)	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site, where no endangered terrestrial species as well as valuable habitat is found. Thus, no negative impact is anticipated due to the project.
24	Flora, Fauna, Ecosystem and Biodiversity (Aquatic)	C	D	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site, where no endangered aquatic species as well as valuable habitat is found. Thus, no negative impact is anticipated due to the project.
25	Landscape and visual amenity	C	C	D	D	(T) Construction work will be limited to exchange of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing hydropower plant site. Thus, negative impact on landscape is not anticipated.
26	Micro-climate	C	C	D	D	(II) Construction work will be limited to replacement and/or repair of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing hydropower plant site. Thus, negative impact on micro-climate is not anticipated.
27	Global Warming/Climate Change	B-	C	B-	B+	(II) Through the construction work generation of greenhouse gases (GHG) emissions from vehicles and construction machines is anticipated even in a small scale. (III) Reduction of GHG emissions is a little anticipated by improving the efficiency of hydropower plant operation.
(3) Environmental pollution						
28	Air pollution	B-	C	B-	D	(II, III) (1) In Myanmar at present air quality standards are not established. (2) Air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for rehabilitation work even in a little amount. (3) Emission of air pollutants such as PM and NOx is not anticipated from hydropower

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
						plant operation.
29	Water Pollution	B-	C	B-	D	(II, III) (1) In Myanmar at present water quality standards are not established. (2) Discharge of wastewater by construction work is anticipated by operation of construction machines and vehicles for construction work even in a little amount. (3) Discharge of water pollutants is not anticipated from hydropower plant operation.
30	Soil contamination	B-	C	B-	D	(II) There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for construction work. In addition, there is also a possibility of leakage of hazardous materials such as toxic metals (Hg and Pb) and asbestos even in very small amountthrough replacement of dilapidated equipment and/or devices with new ones.
31	Bottom sediment contamination	B-	C	D	D	(II) All the activities for rehabilitation will be carried out within existing hydropower plant site, where there is no water body. Thus, bottom sediment contamination is not anticipated.
32	Solid waste	B-	B-	B-	D	(II) (1) Through construction work, considerable amount of industrial wastes will be generated by replacement of equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities. (2) In addition, it is anticipated that generation of solid waste containing hazardous materials, such as toxic metals (Hg, Pb) and asbestos even in very small amount, through replacement of dilapidated equipment and/or devices with new ones.
33	Noise and Vibration	B-	C	B-	B+	(II) Although construction work will be carried out within the plant site, generation of noise and vibration is somewhat anticipated by operation of construction machines and vehicles for rehabilitation work. (III) Through rehabilitation upgrading in efficiency and reliability of operation will be attained resulting in some reduction of noise and vibration.
34	Ground Subsidence	D	D	D	D	(II) Rehabilitation work will be limited within existing hydropower plant site. In addition, foundation is stable and no large scale extraction of groundwater is included in the project plan. Thus, anticipated impact is negligible.
35	Offensive odor	C	C	D	D	(T) There is a possibility of offensive odor generation due to construction work. However, the work will be limited within existing hydropower plant site. Thus, anticipated impact is negligible, if any.
36	Sunshine inhibition	D	D	D	D	(II) Construction work will be limited within existing hydropower plant site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, impact on sunshine inhibition is not anticipated.
37	Electromagnetic interference	C	C	D	D	(II) Construction work will be limited within existing hydropower plant site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, interference with receiving radio wave is not anticipated.
38	Safety from Electromagnetic Field	C	C	D	D	(II, III) Rehabilitation work will be limited within existing hydropower plant site. In addition, there is neither houses nor public facilities in neighborhood. Thus, potential health effect of electromagnetic field is hardly anticipated.

4. Possible Major Negative Impacts and Mitigation Measures

In Table 7 major items of negative impacts - rating of (B-) which means "not significant but some negative impact" are described with necessary mitigation measures as follows*:

*Item having negative impacts is described with serial number of the item {x}

(1) Planning Stage

No item.

For example, {1} Involuntary Resettlement (land acquisition/resettlement etc., migration of population etc. - All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither land acquisition nor resettlement is expected for surrounding areas.

(2) Construction Stage (Rehabilitation work)

1) Social Environment

(i) {5} Existing social infrastructures and services (Traffic condition)

a) Possible negative impacts - It is anticipated to cause inconvenience to local traffic due to passing through vehicles for construction work and tracks loading heavy equipment and device access road to hydropower plant.

b) Mitigation measures - (1) Prior to construction work, inform contents of the construction work and schedule. (2) Time shift of construction work. (3) Education of traffic safety and manner to construction workers and drivers. (4) Raise the traffic signal and arrange watchmen on approach road. (5) Equip sheet cover to prevent scattering dust from the bed of truck. (6) Setting staff in charge of complaints.

(ii) {13} Public health and Sanitation

a) Possible negative impacts - There is a possibility of air pollutants emissions such as NOx and PM by operation of construction machines and vehicles for rehabilitation work may cause some adverse effect of respiratory organ. (2) In addition, solid waste containing hazardous material such as toxic metals (Hg, Pb) and asbestos generated even in very small amount through replacing dilapidated equipment and/or devices with new ones, may cause some adverse effect on human health in case of direct dermal contact or inhalation.

b) Mitigation measures - (1) Preventive measures to control air pollutants emission in construction work. (2) Monitor public health condition by medical examination.

(iii) {15} Working condition

a) Possible negative impacts - Adverse impacts on working condition including occupational safety are expected somewhat due to inadequate management of workers at construction work

b) Mitigation measures - (1) In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). (2) Preparation of safety management plan and enlighten occupational safety to construction workers. (3) Tangible safety considerations should be prepared for individuals involved in the project. (a) The installation of safety equipment and management of hazardous materials. (b) Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction

works. (4) Monitoring health condition and occupational safety of workers.

(iv) {16} Hazards/risk

a) Possible negative impacts - In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of leakage of hazardous materials, even a small amount, through replacement of dilapidated equipment and/or devices with new ones.

b) Mitigation measures - (1) Inspection daily behavior of construction workers and instruction them to acquire good manners. (2) Prepare emergency action plan for hazard and public security risks.

(v) {17} Accidents

a) Possible negative impacts - Occurrence of accidents is somewhat anticipated, if inappropriate handling and management of construction work.

b) Mitigation measures - (1) Suitable planning and management over construction work to prevent and minimize the number and consequences of accidents. (2) To collect and analyze cases and causes of accidents. (3) Enlighten workers and local residents to prevent accidents by training and adequate notice. (4) Prepare emergency action plan for accidents.

2) Natural Environment

(i) {27} Global warming

a) Possible negative impacts - Through the construction work, greenhouse gases (GHG) emissions from vehicles and construction machines is anticipated even in a small scale.

b) Mitigation measures - (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) To inspect condition of good maintenance for construction machines and vehicles. (3) Physical observation of exhaust emissions and collect complaints, if any.

3) Environmental Pollution

(i) {28} Air pollution

a) Possible negative impacts – In general, air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for construction work within plant site and along access roads. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling, structure construction are not expected. In addition, traffic volume of access roads by trucks delivering replaced facilities, equipment and devices are in a small number. Further, surrounding areas farmland and a lone straggling village. Therefore, possible impacts will be in a small scale and temporary.

b) Mitigation measures - (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (3) Possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(ii) {29} Water pollution

a) Possible negative impacts – In general, discharge of wastewater is anticipated. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling ground and soil as well as road construction are not expected. Thus, wastewater is in a small amount and water pollutants such as soil and oil are seldom contained. Thus, possible impacts will be in a small scale and temporary.

b) Mitigation measures - (1) Preventive measures to control water pollutants discharge in construction work.
(2) Major pollutants such as suspended solid and oily components will be discharged to existing drainage after simple treatment by filter. As mentioned above, possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(iii) {30} Soil contamination

a) Possible negative impacts – There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for construction work. In addition, there is also a possibility of leakage of hazardous materials such as toxic metals (Hg and Pb) and asbestos even in very small amount through replacement of dilapidated equipment and/or devices with new ones.

b) Mitigation measures - (1) To prevent leakage and contamination of soil as well as human contact, the concrete and gravels heavily contaminated with hazardous materials will be removed and renewed. Then, they will be sealed in drums, and stored in the strict management area for hazardous wastes as mentioned in below (iv).

(iv) {32} Solid waste

a) Possible negative impacts - (1) Through construction work, considerable amount of industrial wastes will be generated by replacement of equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities. (2) In addition, it is anticipated that generation of solid waste containing hazardous materials such as toxic metals (Hg, Pb) and asbestos even in very small amount, through replacement of dilapidated equipment and/or devices with new ones as shown in Table 8.

b) Mitigation measures - (1) To consider and to carry out possible preventive measures for reduction, proper treatment and disposal of solid waste during construction work. 2) Reflect concept of 3R (Reduce, Reuse and Recycle) to the plan. For example, in case of rehabilitation work for Baluchaung No.2 HPP, some parts of non-hazardous industrial waste and construction waste were reused for roofs and walls by villagers. (3) Enlighten awareness of waste management to workers and employees. (4) In general, all wastes will be properly managed considering their characteristics, such as volume, materials, conditions, extent of hazardous risk, etc. as follows: (a) record list of wastes with characteristics and put name tag on waste, (b) remove and segregation at source, (c) transfer and store in containers or warehouses in HPP site, (d) deliver to designated disposal site with taking care of traffic disturbance and accident, if they have no hazardous risk, (e) reuse for structure materials of wall, roof, etc., if they have no hazardous risk, (f) store in leak-proof drums, if waste oil is generated. (5) Among generated wastes, hazardous materials and wastes containing toxic metals (Hg, Pb) and asbestos will be segregated and removed at source. Then, they are transferred and

stored in sealed containers and/or designated warehouses in the site. As for asbestos, wrap with leak-proof clothes and plastic seat and store in designated warehouse. (6) To set an organization or an officer in charge of solid waste management in HPP. (7) At present, however, there is no regulation or guidelines of solid waste management including industrial and hazardous waste in Myanmar. Thus, proper solid waste management including treatment and final disposal will be carried out by consultation with relevant government organizations such as ECD and concerned department of local government.

Table 8 List of Possible Hazardous Materials Contained in Wasted Equipment and Devices

Hazardous Materials	Equipment and Devices	
PCB	Not contained	
Asbestos	Generator Rotor	Phase to phase insulator
	Excitation system	Field circuit switch
		Field discharging resistor
		Initial flushing resistor
	Piping system	Packings
Hg	Measuring equipment	Pressured switch
Pb	Electric components	Soldering component

(v) {33} Noise and vibration

a) Possible negative impacts - Although construction work will be carried out within the plant site, generation of noise and vibration is anticipated to some extent by the operation of construction machines and vehicles for rehabilitation work.

b) Mitigation measures - (1) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (2) Use equipment with low-noise and vibration. (3) Installation of soundproof walls/acoustic enclosures and provision of buffer zones. (4) Setting staff in charge of complaints.

(3) Operation Stage

It is anticipated that there is no change of scheme, conditions and schedule of operation from those of existing operation after rehabilitation. Thus, no additional negative impacts are expected.

(4) Whole Stages

1) Social Environment

(i) {3} Land use and utilization of local resources

a) Possible negative impacts - Although it is out of scope of the proposed Project, former farmland of about 40 acres within the HPP site was enforced to use for station staff houses during construction of the HPP by the Government and has not been restituted yet. Thus, it is a matter of suit between farmers and local government. At the 1st stakeholder meeting the above issue was asked to local government and HPP manager.

b) Mitigation measures –Before the 2nd stakeholder meeting it was confirmed by hearing to corresponding Village Tract Chief that the sue issue is considerably progressed to come out to conclusion of providing a large portion of former land

to farmers. However, it will be followed up to conclusion.

(ii) {4} Social institutions such as social infrastructure and local decision-making institutions, a split of communities

a) Possible negative impacts - Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts, such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly informed to relevant community peoples and community based organizations.

b) Mitigation measures -(1) Information disclosure and public participation should be fully considered for all the stakeholders including local residents and road users from planning stage to operation stage for obtaining thorough understanding and consensus of the people and communities. (2) EPGE should set up a section in charge of public communication and complaints from peoples.

(iii) {6} The poor, refugees, indigenous of ethnic minority people

a) Possible negative impacts - Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, it was observed that there is no situation for necessary considerations with the poor and vulnerable peoples, such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and Loikaw Township area. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - (1) No serious situation was observed for vulnerable such as the poor, refugees, IDPs, indigenous of ethnic minority, disabled at present. However, in order to take care for them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. For example, to give them priority of employment over simple construction work

(iv) {7} Gender

a) Possible negative impacts - At present, no situation has been found for necessary considerations with gender regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities and related Township area. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - No serious situation was observed for gender issues in Loikaw Township and surrounding area of the plant site at present However, in order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. One of necessary measures is to give women priority of employment in construction work.
In this IEE level study women were selected as the master of ceremony in the stakeholder meetings as well as the participation to Q & A session.

(v) {8} Children's Right

a) Possible negative impacts -At present, no situation has been found for necessary considerations with children regarding (1) provision of adequate standard of living, education etc., (2) protection from abuse, neglect, discrimination, (3) participation in the communities and in Loikaw Township. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - No serious situation was observed for for children's right in surrounding area and Loikaw Township of the plant site at present. However, in order to take care for them continuously EPGE and local government will watch the situation such as abuse and health condition, carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.

(vi) {9} Misdistribution of benefit and damage

a) Possible negative impacts - Through rehabilitation, improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.

b) Mitigation measures - Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to share equally benefits and damage. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.

(vii) {10} Local conflict of interests

a) Possible negative impacts - Through rehabilitation, improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted ~~to~~ by the relevant stakeholders including communities through proper information disclosure and public participation.

b) Mitigation measures - (1) Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to avoid local conflict of interests. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from people.

5. Preparation of Environmental Management Plan (EMP)

For each negative impact, mitigation measures were examined for respective items in planning, construction and operation stage as well as whole stages in order that the plan can achieve intended objectives with avoiding, minimizing or reducing accompanied environmental impacts at implementation. The mitigation measures are shown together with implementing organizations and responsible organizations as Environmental Management Plan (EMP) in Table 9.

Table 9 Environmental Management Plan (EMP)

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
(I / II) Planning Stage/ Construction Stage				
(1) Social Environment				
5	Social Infrastructure and Services (Traffic condition)	(1) Prior to construction work, inform contents of the construction work and schedule. (2) Time shift of construction work. (3) Education of traffic safety and manner to construction workers and drivers. (4) Raise the traffic signal and arrange watchmen on approach road. (5) Equip sheet cover to prevent scattering dust from the bed of truck. (6) Setting staff in charge of complaints.		
13	Public health and Sanitation	(1) Preventive measures to control air pollutants emission in construction work. (2) Monitor public health condition by medical examination.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
15	Working condition	(1) In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). (2) Preparation of safety management plan and enlighten occupational safety to construction workers. (3) Tangible safety considerations should be prepared for individuals involved in the project. (i) The installation of safety equipment and management of hazardous materials. (ii) Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction works. (4) Monitoring health condition and occupational safety of workers.		
16	Hazard/risk (disaster, security)	(1) Inspection daily behavior of construction workers and instruction them to acquire good manners. (2) Prepare emergency action plan for hazard and public security risks.		
17	Accidents	(1) Suitable planning and management over construction work to prevent and minimize the number and consequences of accidents. (2) To collect and analyze cases and causes of accidents. (3) Enlighten workers and local residents to prevent accidents by training and adequate notice. (4) Prepare emergency action plan for accidents.		
(2) Natural Environment				
27	Global Warming/Climate Change	(1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) To inspect condition of good maintenance for construction machines and vehicles. (3) Physical observation of exhaust emissions and collect complaints, if any.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
(3) Environmental pollution				
28	Air pollution	Following measures will be incorporated into EMP and to be monitored in the construction work: (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (3) Possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
29	Water Pollution	(1) Preventive measures to control water pollutants discharge in construction work. (2) Monitor water pollutants discharge and environmental water quality. (3) Possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
30	Soil contamination	(1) To prevent leakage and contamination of soil as well as human contact, the concrete and gravels heavily contaminated with hazardous materials will be removed and renewed. Then, they will be sealed in drums, and stored in the strict		

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
		management area for hazardous wastes. (2) Soil contamination may occur little. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
32	Solid waste	(1) To consider and to carry out possible preventive measures for reduction, proper treatment and disposal of solid waste during construction work. 2) Reflect concept of 3R (Reduce, reuse and recycle) to the plan. For example, in case of rehabilitation work for Baluchaung No.2 HPP, some parts of non-hazardous industrial waste and construction waste were reused for roofs and walls by villagers. (3) Enlighten awareness of waste management to workers and employees. (4) In general, all the wastes will be properly managed considering their characteristics such as volume, materials, conditions, extent of hazardous risk, etc. as follows: (a) record list of wastes with characteristics and put name tag on waste, (b) remove and segregation at source, (c) transfer and store in containers or warehouses in HPP site, (d) deliver to designated disposal site with taking care of traffic disturbance and accident, if they have no hazardous risk, (e) reuse for structure materials of wall, roof, etc., if they have no hazardous risk, (f) store in leak-proof drums, if waste oil is generated. (5) Among generated wastes, hazardous materials and wastes containing toxic metals (Hg, Pb) and asbestos will be segregated and removed at source. Then, they are transferred and stored in sealed containers and/or designated warehouses in the site. As for asbestos, wrap with leak-proof clothes and plastic seat and store in designated warehouse. (6) To set an organization or an officer in charge of solid waste management in HPP. (7) At present, however, there is no regulation or guidelines of solid waste management including industrial and hazardous waste in Myanmar. Thus, proper solid waste management including treatment and final disposal will be carried out by consultation with relevant government organizations such as ECD and concerned department of local government.		
33	Noise and Vibration	(1) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (2) Use equipment with low-noise and vibration. (3) Installation of soundproof walls/acoustic enclosures and provision of buffer zones. (4) Possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
(III) Operation Stage				
No item				
(T) Whole stages				
3	Land use and utilization of local resources	Before the 2nd stakeholder meeting it was confirmed by hearing to corresponding Village Tract Chief that the sue issue is considerably progressed to come out to conclusion of providing a large portion of former land to farmers. However, it will be followed up to conclusion.		
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	(1) Information disclosure and public participation should be fully considered for all the stakeholders including local residents and road users from planning stage to operation stage for obtaining thorough understanding and consensus of the people and communities. (2) EPGE should set up a section in charge of public communication and complaints from peoples.		
6	The poor, refugees, indigenous of ethnic minority people	No serious situation was observed for vulnerable such as the poor, refugees, IDPs, indigenous of ethnic minority, disabled at present. However, in order to take care for them continuously		

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
		EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. For example, to give them priority of employment over simple construction work		
7	Gender	No serious situation was observed for gender issues in Loikaw Township and surrounding area of the plant site at present However, in order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.One of necessary measures is to give women priority of employment in construction work. In this IEE level study women were selected as the master of ceremony as well as the participation to Q&A section.		
8	Children's Right	No serious situation was observed for children's right in Loikaw Township and surrounding area of the plant site at present. However, in order to take care them continuously EPGE and local government will watch the situation such as abuse and health condition, carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.		
9	Misdistribution of benefit and damage	Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to share equally benefits and damage. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.		
10	Local conflict of interests	(1) Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to avoid local conflict of interests. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.		

Note 1: * Implementing Organization: EPGE (Head Quarter and/or Manager of Hydropower Plant, CT - Contractor, Local
Note 2: ** Responsible and/or supervising organization - Local Government (Township, District and/or State Government), ECD (Environmental Conservation Department, MONREC), MOEE (Ministry of Electricity and Energy).
Note 3: *** Cost for EMP will be covered withinordinary budget of EPGE and contract fee of contractor.

6. Preparation of Environmental Monitoring Plan (EMoP)

Considering mitigation measures against negative impacts in the EMP, environmental monitoring plan which may support implementation of the measures, was prepared and shown together in Table 10.

Table 10 Environmental Monitoring Plan

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Implementation organization*, ***	Responsible and/or supervising org.**
(I) Planning Stage (Pre-Rehabilitation Stage)					
Environmental Compliance Certificate (ECC) and approval/ permission for the project implementation	(1) To get Environmental Compliance Certificate (ECC) from MONREC (2) Other permit/ approval, if necessary	MONREC	Before commencement of construction (rehabilitation) work	EPGE	MOEE, ECD (MONREC)
(II) Construction Stage (Rehabilitation Stage)					
(1) Social Environment					
Traffic condition	Cases and causes of complaints to traffic condition	Visual observation and hearing with residents and road users	Daily	Hydropower Station	EPGE, ECD, Local Government
Public health and Sanitation	Monitoring health condition of workers and local residents by medical examination.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Monthly	Hydropower Station	EPGE, ECD, Local Government
Working condition	Monitoring health condition and occupational safety of workers.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
Hazard/risk (disaster, security)	(1) Inspection daily behavior of construction workers and instruction them to acquire good manners. 2) Prepare emergency action plan for hazard and public security risks.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
Accidents	Records of accidents in the project area	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
(2) Natural Environment					
Global Warming/Climate Change	Monitoring maintenance condition and exhaust emissions of construction vehicles and machine	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
(3) Environmental Pollution					
Air pollution	(1) Visual observation, 2) Complaints from residents 2) Monitor air pollutants emission and ambient air quality.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
Water Pollution	(1) Visual observation, 2) Complaints from residents. 2) Monitor water pollutants	(1) Hydropower plant site, (2) Access road for	Daily	Hydropower Station	EPGE, ECD, Local Government

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Implementation organization*, ***	Responsible and/or supervising org.**
	discharge and environmental water quality.	rehabilitation work			
Soil contamination	(1) In Myanmar measurement of PCB and mercury content in soil is not yet established. Thus, visual observation leakage of hazardous materials. (2) Inspection proper handling and storage situation of solid waste contaminated with hazardous materials in storage containers and facilities.	(1) Hydropower plant site, (2) Solid waste storage area	Every time with exchanging dilapidated equipment and devices Rehabilitation work	Hydropower Station	EPGE, ECD, Local Government
Solid waste	(1) Record of collection, transportation and disposal of generated solid waste. (2) Visual observation leakage of hazardous materials from dilapidated equipment and devices such as transformers by rehabilitation work. (3) Inspection proper handling and storage situation of solid waste contaminated with hazardous materials in storage containers and facilities.	(1) Hydropower plant site, (2) Solid waste storage area	Daily	Hydropower Station	EPGE, ECD, Local Government
Noise and Vibration	(1) Physical observation. (2) Noise measurement by sound level meter, as necessary. (3) Collection of complaints.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
(III) Operation Stage					
No item					
(T) Whole Stages					
1) Social Environment					
Land use issue around Baluchaung No.1 HPPsite	Record of consultation and meeting among local government, EPGE (station manager) and farmers	Farmland with 40 acre near Baluchaung No.1 HPP site	By the end of sollution	Hydropower Station	EPGE, ECD, Local Government
Social institutions such as social infrastructure and local decision-making institutions, a split of communities	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
The poor, refugees, indigenous of ethnic minority people	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
Gender	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations (3) Number of women workers in construction work.	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Implementation organization*, ***	Responsible and/or supervising org.**
Children's Right	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
Misdistribution of benefit and damage	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
Local conflict of interests	(1) Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government

Note 1: * Implementing Organization: EPGE (Head Quarter and/or Manager of Hydropower Plant, CT - Contractor,
Note 2: ** Responsible and/or supervising organization - Local Government (Township, District and/or State Government), ECD (Environmental Conservation Department, MONREC), MOEE (Ministry of Electric Power and Energy)
Note 3: *** Cost for EMoP will be covered within ordinary budget of EPGE and contract fee of contractor.

7. Results of Stakeholder Meetings

Stakeholder meetings were held two times in two villages near the Baluchaung No.1 HPP site.

First stakeholder meeting was held on July 2nd Saturday 2016 to disseminate outline the rehabilitation project plan and second stakeholder meeting was held on September 17th Saturday 2016 to discuss the results of IEE.

(1) First Stakeholder Meeting

1) Date and Time– 2 July, Saturday 2016 (From 9AM to 11AM)

2) Venue –So Le Sel village, Loikaw Township, Loikaw District, Kayah State

3) Participants –66 persons (Including village chiefs andelder peoples, key informants,NGOs, Local Government Officers from several departments such as Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Baluchaung Hydropower Plants employees)

4) Presentations, Questions & Answers and Discussions

(i) The GAD township officer gave the opening speech about of the project and work for environmental and social considerations including Initial Environmental Examinations (IEE) and emphasized the importance of the participation with peoples of local communities and officers of related departments.

(ii) JICA Survey Team briefly explained the purpose and scope of the JICA project, “Preparatory Survey for the Project of Hydropower Plant Rehabilitation in the Myanmar”. In addition, they mentioned the importance of information disclosure and public participation in the work for environmental and social aspects of the project.

(iii) Station Manager of EPGE explained the history since 1992 and presents features of the Baluchaung No.1 Hydropower Plant. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of

power generation capacity due to dilapidation by continuous operation for more than 25 years.

(iv) Local Consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and Myanmar legislations. Then, she explained an IEE level study was required and now the study is in progress according to the JICA Guidelines. At the same time, she also explained that any project is required to obtain prior permission, i.e. Environmental Compliance Certificate (ECC) from Ministry of Natural Resources and Environmental Conservation (MONREC) prior to implementation according to recently enacted Environmental Impact Assessment Procedure 2015 (EIA Procedure) of Myanmar. In addition, the Consultant insisted roles of community participation and information disclosure in the project by using power point and hand out paper.

5) Q & A Section

- The village chief of So Le Sal village, mentioned that people of villages near the Hydropower Station have not been served sufficient electric power supply until now. According to the Vision of Myanmar Government (2020), all the peoples in the country have the right to benefit from sufficient power supply. In this regard, he requested EPGE and local government to install distribution network for more and easy access to electric power supply by the communities

- Station Manager answered that there are many governmental organizations relevant to electric power supply under the Ministry of Electricity and Energy (MOEE). The EPGE, which he belongs to is in charge of power generation. Regarding power distribution, the duty is of another organization and he cannot make the decision for distribution of electric power. However, he recognized community's need, took note to inform EPGE and suggested that the community should request to local government and MOEE.
- A Villager told the location of existing Baluchaung No.1 HPP is very close to his village. However, his village and neighboring other villages have been not provided sufficient electric power supply since operation of the Hydropower Plant. He requested EPGE? and local government to make effort providing sufficient electric power supply.
- A villager from Kan Nyi village, expressed a welcome to the rehabilitation project. At the same time, he requested EPGE and local government to provide electric power supply to local communities, which are.in insufficient supply condition.

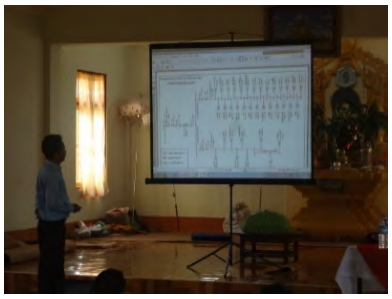
(1) Venue – Monastery of Lopita Village

(2) Most of Village Peoples came by motorbikes

(3) Opening speech b GAD Deputy Officer

(4) Introduction of JICA Survey Team

(5) Presentation by Hydropower Station Manager



(6) Presentation by Hydropower Station Officer

(7) Presentation by Local Consultant

(8) Participants at the meeting

(9) Question and Comment by Participant - 1

(10) Question and Comment by Participant - 2

(11) Question and Comment by Participant - 3

(12) Attendants List

Photo 2 Scenes of 1st Stakeholder Meeting

(2) Second Stakeholder Meeting

1) Date and Time – 17 September, Saturday 2016 (From 9 AM to 11 AM)

2) Venue – So Le Sel village, Loikaw Township, Loikaw District, Kayah State

3) Participants – 65 persons (Including village chiefs and elder peoples, key informants, NGOs, Local Government Officers from several departments such as Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Baluchaung Hydropower Plants employees)

4) Presentations, Questions & Answers and Discussions

(i) The GAD township officer gave the opening speech about of the project and work for environmental and social considerations including Initial Environmental Examination and second time of stakeholder meeting. He explained the purpose of the meeting and to emphasize the importance of the participation with peoples of local communities and officers of related departments. And also he requested to local community to be patient for the delay in some times of implementation of development programs by the local government and departments because of the budget situation of the Kayah State.

(ii) JICA Survey Teambriefly explained the purpose and scope of the JICA project, “Preparatory Survey for the Project of Hydropower Plant Rehabilitation in Myanmar by using the example of a mobile equipment and battery" Rehabilitation is necessary for the sustainable use in a longer term.

(iii) Baluchaung No.1 HPP Managerexplained the history since 1992 and presents features of the Baluchaung No.1 HPP. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power generation capacity due to dilapidation by continuous operation for more than 25 years.

(iv) Local Consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and existing Myanmar legislations. Then, she explained the summary of the IEE level study for the possible impacts of this project on the people and environment. The impacts were estimated by different project stages, such as planning (before operation), during operation and after operation. It includes environmental issues, such as land use and topography, air and water pollution, soil contamination, solid wastes problem, etc. For the social environment and social services, township level social infrastructure, local economy, livelihoods, situation of gender and children, vulnerable groups -the poor, refugees, and indigenous of ethnic people etc. were discussed. It was generally estimated that there will be no significant negative impact of the rehabilitation project on the environment and the community.

5) Q & A Section

- A villager from the Law Ka Htuee village said that if there have some negative impact from project activities, particularly it will affect the women and children. If it is possible, women from targeted villages are willing to participate in monitoring activities of the project

- A villager from the Sal Mile village said that "Today we receive the supplied water from dam but sometime insufficient. He wanted to know whether the Project have a plan to support water more regularly and sufficiently for target villages"

- HPP Manager answered that there are many governmental organizations relevant to electric power supply and distribution under the Ministry of Electricity and Energy (MOEE). The EPGE (Electric Power Generation Enterprise), which he belongs to, is in charge of power generation. Regarding with power distribution, the responsibility is of another organization and he cannot make any decision for distribution of electric power. But He agreed that the villages near the dam should receive enough power supply and irrigation water, in priority,

- A villager of Law Ka Hteuu, requested that location of existing Baluchaung No.1 HPP is very close to his village. Last month from the department of EPGE made a survey in their village to set up a transformer for more distribution of electricity to his village. He asked EPGE and related departments whether the program is possible to realize soon or not.

- HPP Manager answered that until now he cannot answer that question. Because of his duty is just for the power generation and not directly concern with this. But he hoped that it will become in reality soon.

- A member of NGO, asked the reason that SHM was not held in city hall of Kayah State. He suggested this project was related to the whole community and country, not only with the surrounding of the project site.

- Local Consultant answered as follows: SHM is mainly based on the target community and environment which will be affected by the project. The surrounding villages near the

project site will have more interest on the project and possible impacts and they need to know about the project.

- Village tract administrator of Law Pi Ta Village Tract requested to related department and General Administration Department officials to consider for the local community who are residing near the power plant. The villagers are willing to participate for the rural development activities to join hands with the government. They will follow the leadership of related department personnel for implementation activities.

1) Opening remarks by Loikaw Township Deputy GAD Officer

2) Presentation by Station Manager of Hydropower Plant

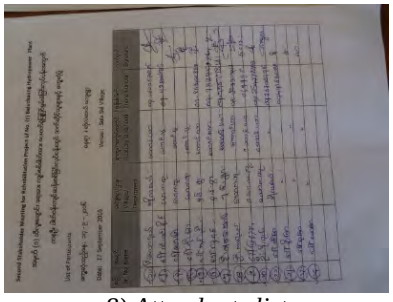
3) Presentation by the Local Consultant

4) Question and Comment by Participant - 1

5) Question and Comment by Participant – 2

6) Question and Comment by Participant – 3

7) Question and Comment by Participant - 4



8) Attendants list

9) Attendants came by motor bikes and cars as well as by walk

Photo 3 Scenes of 2nd Stakeholder Meeting

Environmental Management Plan (EMP) for Rehabilitation Project of Sedawgyi Hydropower Plant

Electric Power Generation Enterprise (EPGE)
Ministry of Electricity and Energy (MOEE)

October 2016

Executive Summary

8. Outline of the Project Plan
9. Laws, Rules and Regulations related to Environmental and Social Considerations
10. Results of Preparation for Environmental Management Plan
11. Possible Major Negative Impacts and Mitigation Measures
12. Preparation of Environmental Management Plan (EMP)
13. Preparation of Environmental Monitoring Plan (EMoP)
14. Results of Stakeholder Meetings

Environmental Management Plan (EMP) for Rehabilitation Project of Sedawgyi Hydropower Plant

Executive Summary (Sedawgyi)

- In the scheme of the National Electricity Master Plan, it is suggested that rehabilitation of hydropower plants is recommended from a standpoint of preventive measures against failures. It is because deterioration of major equipment and parts of existing Sedawgyi hydropower plants (Sedawgyi HPP) is progressing. Rehabilitation of existing hydropower plants is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel and so on.

- The project aims to conduct rehabilitation of existing Sedawgyi HPP through replacement, repair or addition of facilities/equipment/devices without expansion of site / facilities and increase in power generation capacity with Electric Power Generation Enterprise (EPGE) as the proponent.

- As for the implementation schedule, the Project will start with preparation work such as selection of consultant, detailed design study and tender from March of 2017. Then, construction work will start at the end of 2018 at earliest and continued for about 2 years.

- The Project site is located in the Chaunmagyi River of the Ayeyarwady River system, which is a hydropower plant equipped with multi-purpose dam for irrigation and power was constructed by ADB's finance.As an administrative area, the site belongs to Madaya Township, which is one of the 31 townships of Mandalay Region

- After screening the proposed Project by MONREC (ECD), the Project is required to prepare an Environmental Management Plan (EMP).

- Outline of the EMP prepared are as follows:

    1. Possible impacts were identified and the extent of the impacts were evaluated one by one with rating against 38 environmental items (Social Environment 17, Natural environment 10, and Environmental pollution 11) as indicators expressing environmental and social conditions for the Project.

    2. Results of identification and evaluation of expected environmental and social impacts indicate that (a) there is no affected item with rating of (A-), which means significant negative (adverse) impact and (b) other affected items are classified into rating (B-), which means not significant but some negative impact, or rating (D), which means no or negligible negative impact

    3. An EMP was prepared with tabular form for major items having negative impacts and for implementation stages with describing possible negative impacts, necessary mitigation measures, implementing organization, responsible and supervising organizations as follows:

        (1) Planning stage – No item.

        (2) Construction stage
            1) Social Environment -Existing social infrastructures and services (Traffic condition), Public health and Sanitation, Working condition, Hazards/risk, Accidents
            2) Natural Environment – Global warming
            3) Environmental pollution – Air pollution, Water pollution, Soil contamination, Solid waste, Noise and vibration

        (3) Operation stage – No item

        (4) Whole stages
            1) Social Environment - Social institutions such as social infrastructure and local decision-making institutions, a split of communities, The poor, refugees, indigenous of

ethnic minority people, Gender, Children's right, Misdistribution of benefit and damage, Local conflict of interests

4. An Environmental Monitoring Plan (EMoP) was also prepared in tabular form for same items as the EMP and ECC and other necessary approval with describing method of monitoring/parameter to be monitored, monitoring place/point, frequency, implementation organization as well as responsible and/or supervising organization.

5. Stakeholder meetings were held two times (June 25thand September 10th) for information disclosure and public participation. In the first meeting outline of the project plan and method for required study of environmental and social considerations were presented and discussed. In the second meeting results of the study were presented and discussed.

Executive Summary (Myanmar Version)

စီမံကိန်းလုပ်နှင်းအကျဉ်း □
အမ်ိ□းသားေရးဆိုင်ရာလွှ်ပ်စွာတ့်အား ရရှိေရးစီမံခ်က့်အရေရအားလွှ်ပ်စ့်အရင်းအျမစ်ွားအားအရည်
အေသြး
ေလ့လာတိုင်းတာရာတြင်စက်ရိယာမ်ား၏ အဓိကအစိတ့်အပိုင်းမ်ားသည့်အရည်အေသြးက်ဆင်းလာခဲ့ပါ
သည်။
လက်ရှိလည်ပတ့်ေနေသာဘီလူးေခ်ာင်းအမွတ့်(၁)ေရအား လွှ်ပ်စ့က်၏ အဓိကစကွစ □ည်းအစိတ့်အပိုင်းမ်
ားအား
အစားထိုးလဲလွှည့်ရန်အလ်ာပါသည်။အစားထိုးလဲလည့်ျခင်းလုပ်နှင်းေဆာင်ရွက်နှေလ့လာမ □မ်ားျပ □လုပ်ာ
တြ ့
□ိုင်ငံ၏ စီပြားေရးဖြ□ိ□းတိုးတက်မ □အားအေထာက့်အကူျပ □မ □၊လူမ □သဘာဝပတ့်ဝန်းက်ငိုခ်ိမ □မ
ရှိေစေရး၊ တိုးခ်ဲ□မ □ျပ □လုပ်ငေဆာင်ရွက်ိုင်ေရးတို□အား ထည့်သြင်းစဉ်းစားခဲ့ပါသည်။

□ လွှ်ပ်စွာိတ့်အားထုတ်လုပ်ေရးလုပ်နှင်း □ွင့်ပူးေပါင်းကာ အရြယ်အစားတိုးခ်ဲ□မ □ျပ □လုပ်ငွ □ွွင့်
စကွစ □ည်းမ်ား အစားထိုးလဲလွယ်ျခင်း၊
ျပန်လည်ျပ □ျပင်ျခင်းတို□ျဖင့်စီမံကိန်းအား ေဆာင်ရွက်ထည့်သြင်းစဉ်းစားခဲ့ပါသည်။

□ လုပ်နှင်းအေကာင်အထည်ေဖာ်ေဆာင်ရွက်မည့်အစီအစဉ်အရ စီမံကိန်းေဆာင်ရွက်ာတြင်
စီမံကိန်းအ □က်ေပး ေရြးခ်ယ်ျခင်း၊ စီမံကိန်းပံုစံေရးဖြဲခ်မွတ်ျခင်း၊
စီမံကိန်းအတြက်တင်ွ်ိေခ □ျခင်း၊ စီမံကိန်းလုပ်နှင်း အေကာင်အထည်
ေဖာ်ေဆာင်ရွက်ျခင်းစသည်ို□ျဖင့် ေဆာင်ရွက်ြားမည် ျဖစ်ပါသည်။ စီမံကိန်းလုပ်နှင်း
အေကာင်ထည်ေဖာ် ေဆာင်ရွက်ျခင်း လုပ်နှင်းကို ၂၀၁၈
ခု □ွစ့ေ □ွာင်းပိုင်းတြင်ေဆာင်ရွက်မည်ျဖစ်ပါသည်။ စီမံကိန်းအား(၂) □ွစ့ □ကာ
ေဆာင်ရွက်မည်ျဖစ်ပါသည်။ □ လွှ်ပ်စွာိတ့်အားထုတ်လုပ်ေရးလုပ်နှင်း □ွင့်ပူးေပါင်းကာ
အရြယ်အစားတိုးခ်ဲ□မ □ျပ □လုပ်ငွ □ွွင့် စကွစ □ည်းမ်ား အစားထိုးလဲလွယ်ျခင်း၊
ျပန်လည်ျပ □ျပင်ျခင်းတို□ျဖင့်စီမံကိန်းအား ေဆာင်ရွက်ထည့်သြင်းစဉ်းစားခဲ့ပါသည်။ □
စီမံကိန်းသည့်ဧရာဝတီျမစ့်မ္ချမစ်ွားခံလာေသာ ေခ်ာင်းမ □ကီးေခ်ာင်းေပ □တြင် တည်ရှိသည်။
မ □ □ေလးတိုင်းေဒသ □ကီး၊ မတ □ရာ □မိ □□နယ်တြင်တည်ရှိပါသည်။ □ တင်သြင်းခဲ့ေသာ
အစီအရင်ခံစာအားသယံဇာတ □ွင့် သဘာဝပတ့်ဝန်းက်ငွ ထိန်းသိမ်းေရးဝန □ကီးဌာနမှ □ကည့်ရ□
စစ်ေဆး □ပီးေနာက်တြင် စီမံကိန်းသည် သဘာဝပတ့်ဝန်းက်ငိမ်ခန□ခြံမ □အစီအစဉ်အားေရးဆြဲရန်
ည □န □ကားခဲ့ပါသည်။ □ သဘာဝပတ့်ဝန်းက်ငွ စီမံခန□ခြံမ□ အစီအစဉ်တင်သြွ

ေအာက္ေဖာ္ျပပါအခ်က္မ်ားအားထည့္သြင္းေရးဆြဲခဲ့ပါသည္။ ၁. ျဖစ္ေပ□□ိဳင္ေသာ သက္ေရာက္မ□မ်ားအား သတ္မွတ္ျခင္း၊ သက္ေရာက္မ□မ်ားအား တခုျခင္းစီအလိုက္ အဆင့္ခြဲျခားျခင္း ေဆာင္ရြက္ရာတြင္(၃၈)မ်ိဳ□း ပါဂင္ခဲ့ပါသည္။ လူမ□ေရး အမွတ္(၁၇)၊ သဘာဂပတ္ဂန္းက်င္ အေျခအေန အမွတ္(၁၀) □ွင့္ သဘာဂပတ္ဂန္းက်င္သစ္ထမ္းမ□ အမွတ္(၁၁) တို□ျဖစ္ပါသည္။ ၂. သတ္ေရာက္မ□မ်ားအား အဆင့္ခြဲျခား သတ္မွတ္ရာတြင္ (A-) သည္ ပတ္ဂန္းက်င္ ထိခိုက္မ□မရွိျခင္း (B-) သည္ ပတ္ဂန္းက်င္ ထိခိုက္မ□ အနည္းငယ္သာရွိျခင္း၊ (D) သည္ ပတ္ဂန္းထိခိုက္မ□ မရွိျခင္း စသည္တို□ျဖင့္ ခြဲျခား သတ္မွတ္ထားပါသည္။ ၃. သဘာဂပတ္ဂန္းက်င္စီမံခန္□ခြဲမ□အစီအစဥ္အားေရးဆြဲရာတြင္ လုပ္ငန္း အေကာင္အထည္ေဖာ္ေဆာင္ရြက္ျခင္း အဆင့္တြင္ ျဖစ္ေပ□လာ□ိဳင္ေသာ ထိခိုက္မ□မ်ားအတြက္ ေလွ်ာ့ခ်ေရးအစီအစဥ္၊ အေကာင္အထည္ေဖာ္ ေဆာင္ရြက္ မည့္အဖြဲ□အစည္း၊ တာဂန္ရွိေသာ အဖြဲ□အစည္း □ွင့္ □ကီး□ကပ္ေရးအဖြဲ□အစည္းတို□ကို ေအာက္ပါအတိုင္း ထည့္သြင္းေရးဆြဲပါသည္။ (၁) အစီအစဥ္ေရးဆြဲျခင္းအဆင့္ (၂) လုပ္ငန္းအေကာင္အထည္ေဖာ္ျခင္း - (၁) လူမ□သဘာဂပတ္ဂန္းက်င္- လက္ရွိလူမ□ပတ္ဂန္းက်င္အေျခအေန၊ က်မ္းမာေရး ေစာင့္ေရွာက္မ□ အေျခအေန၊ အလုပ္အကိုင္ အခြင့္အလမ္း၊ ေဘးအ□□ရာယ္မ်ား
(၂) သဘာဂပတ္ဂန္းက်င္- ကမ□ာေျမပူေ□ြးလာမ□ (၃) သဘာဂပတ္ဂန္းက်င္စစ္ထမ္းမ□- ေလထုညစ္ညမ္းမ□၊ ေရထုညစ္ညမ္းမ□၊ ေျမထုညစ္ညမ္းမ□၊ ဆူညံသံ မ်ား၊ တုန္ခါမ□မ်ား ၃. စီမံကိန္းအေကာင္အထည္ေဖာ္ေဆာင္ရြက္မ□ ၄. လုပ္ငန္းအဆင့္မ်ား (၁)လူမ□သဘာဂပတ္ဂန္းက်င္- ေျမယာအသံုးခ်မ□ □ွင့္ ေဒသတြင္းေျမယာ အသံုးျပ□ပံုမ်ား၊ ေဘးဒုက□သည္မ်ား၊ တိုင္းရင္းသားမ်ိဳ□း□ြယ္မ်ား၊ လိင္၊ ကေလးသူငယ္အခြင့္အေရး၊ ခြဲေဂမ□□ွင့္အသံုးခ်မ□မ်ား၊ ေဒသတြင္းျပ□နာမ်ား

၄.သဘာဂပတ္ဂန္းက်င္ ေစာင့္□ကည့္တိုင္းတာျခင္း အစီအစဥ္ကိုလည္း သဘာဂပတ္ဂန္းက်င္စီမံခန္□ခြဲမ□ အစီအစဥ္ အတိုင္းေရးဆြဲပါမည္။ ေရးဆြဲရာတြင္ စံ□□နး်မ်ား၊ ေနရာမ်ား၊ အ□ကိမ္အေရအတြက္၊ ေဆာင္ရြက္မည့္အဖြဲ□အစည္း၊ □ကီး□ကပ္မည့္အဖြဲ□အစည္း၊ တာဂန္ခံအဖြဲ□အစည္းတို□ပါဂင္မည္ျဖစ္ပါသည္။ ၅. ေဒသခံမ်ား□ွင့္ေတြ□ဆံုေဆြးေ□ြး၍သတင္းအခ်က္အလက္မ်ားရယူျခင္းကို(၂)□ကိမ္ျပ□ လုပ္ခဲ့ပါသည္။ ပထမအ□ကိမ္ေတြ□ဆံု ေဆြးေ□ြးပြဲတြင္ စီမံကိန္းအခ်က္အလက္မ်ား၊ လူမ□ေရး□ွင့္သဘာဂပတ္ဂန္းက်င္ ေလ့လာဆန္းစစ္ျခင္း ျပ□လုပ္မည့္ ပံုစံမ်ား အားရွင္းလင္း တင္ျပခဲ့ပါသည္။ ဒုတိယအ□ကိမ္ေတြ□ဆံုေွ့ဆြးေ□ြးပြဲတြင္ျပ□လုပ္ ေဆာင္ရြက္ခဲ့ေသာ အေ□ကာင္းအရာမ်ား ရွင္းလင္း တင္ျပခဲ့ပါသည္။

1. Outline of the Project Plan

(1) Objectives and Scope of the Project

1) Objectives

In the scheme of the National Electricity Master Plan, it is suggested that rehabilitation of hydropower plants is recommended from a standpoint of preventive measures against failures. It is because deterioration of major equipment and parts of existing Sedawgyi hydropower plants (hereafter referred to as Sedawgyi HPP) is progressing. Rehabilitation of existing hydropower plants is regarded as the top priority measure from viewpoint of high economic efficiency, low environmental burden, no need of additional fuel and so on.

As improvement of existing electric power supply conditions is expected in terms of such as increase of power generation efficiency and reduction of blackout occurrence by

rehabilitation of both hydropower plants

2) Necessity of the Project

Rehabilitation of existing Sedawgyi HPP through replacement, repair or addition of facilities/ equipment/devices without expansion of site / facilities and increase in power generation capacity.

Table 1 Necessity of Rehabilitation (Replacement, Repair or Addition) with Major Facilities/Equipment of Existing Hydropower Plant

1) Change in Existing Land Use	Rehabilitation work and subsequent operation of the hydropower plant will be done within the existing plant site. Thus, there will be no changes in the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities such as farming and livestock, and living conditions of residents in surrounding area are required.
2) Change in External of Existing Facilities or Civil Structures	No changes in space, capacity and dimension from the existing hydropower plant are not expected for following facilities and structures: (1) No raising / expansion of existing body of dam, (2) No changes in amount of length, and dimension and route of flow channel due to sluicing intake water, (3) No change in dimension of civil facilities such as powerhouse.
3) Change in Internal of Existing Facilities, Equipment or Devices	The preliminary inspection and records of the failure of existing SedawgyiHPP found considerable deterioration of major parts and systems relevantto turbine and auxiliary equipment, generator and auxiliary equipment, plant control and protection system, substation and transmission facilities, gates and penstock, as well as civil facilities. Therefore, rehabilitation through replacement and/or repair are expected to improve such equipment.
4) Operation of Hydropower Generation	There will be no change in conditions of operation for electric power generation such as power generation capacity, pattern and schedule of operation.

3) Implementation Schedule of the Project

As for the implementation schedule, the Project will start with preparation work such as selection of consultant, detailed design study and tender as shown in Table 2. Then, construction work will start at the end of 2018 and continued for about 2 years.

Table 2 Implementation Schedule for Rehabilitation Project of Hydropower Plant

	Subject	2016				2017				2018				2019				2020				2021			
		I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	JICA Preparatory Study	◄	─	─	►																				
2	Loan Agreement				◄	►																			
3	Consulting Services for Rehabilitation of Hydropower Stations Project (selction of Consultant, Detailed Design Study, Tender for Constructors)					◄	─	─	─	─	─	─	►												
4	Implementation of Constrcution Work for Rehabilitation												◄	─	─	─	─	─	─	─	►				
5	Power Plant Operation after Rehabilitation																				◄	─	─	─	─

4) Expected number of workers engaged to the construction work

About 50 skilled workers are mostly employees of EPGE will be engaged in the construction work. In addition, people of surrounding area will have chances to engage in temporary and no skill work.

5) Estimated Project Cost

Estimation of the project cost is not yet completed.

6) The Project Proponent

Electric Power Generation Enterprise (EPGE), Ministry of Electricity and Energy (MOEE)

7) Location of Hydropower Plants

Sedawgyi HPP is located in the Chaunmagyi River of the Ayeyarwady River system, which is a hydropower plant equipped with multi-purpose dam for irrigation and power was constructed by ADB's finance.

Upper Sedawgyi site in the upstream is selected as candidate development project, but it is under study stage and specific progress is not yet confirmed. MOAI (Ministry of Agriculture and Irrigation) has jurisdiction over the dam body and controls water utilization. MOAI operates the reservoir setting priority to irrigation usage.

The electric power generated by Sedawgyi Hydropower Plant is transmitted to Belin substation by 132 kV transmission line, which is connected to 230 kV bulk system. The plant is located about 60 km far from Mandalay. But it takes about three and half hours by car in the rainy season because condition of access road pavement from main road to the power plant is bad at present. This access road is owned and managed by MOAI.

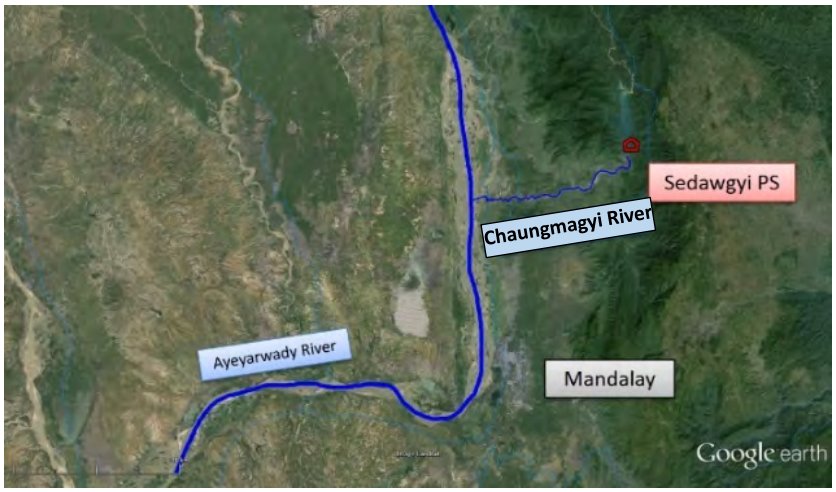


Figure 1 Location Map of Sedawgyi HPP along Sedawgyi River

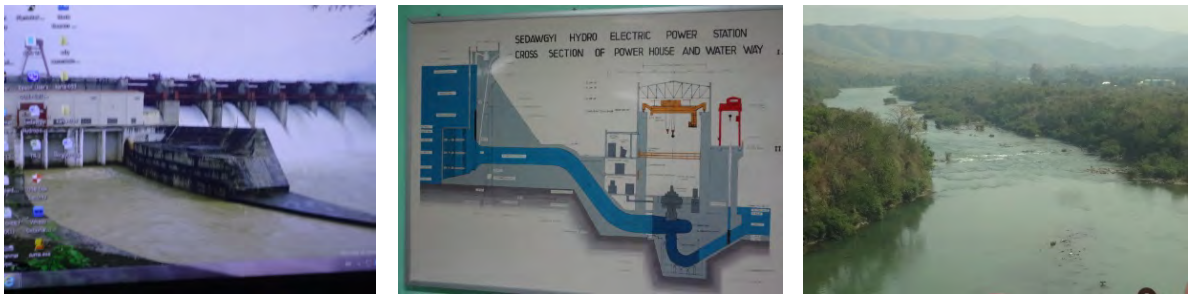
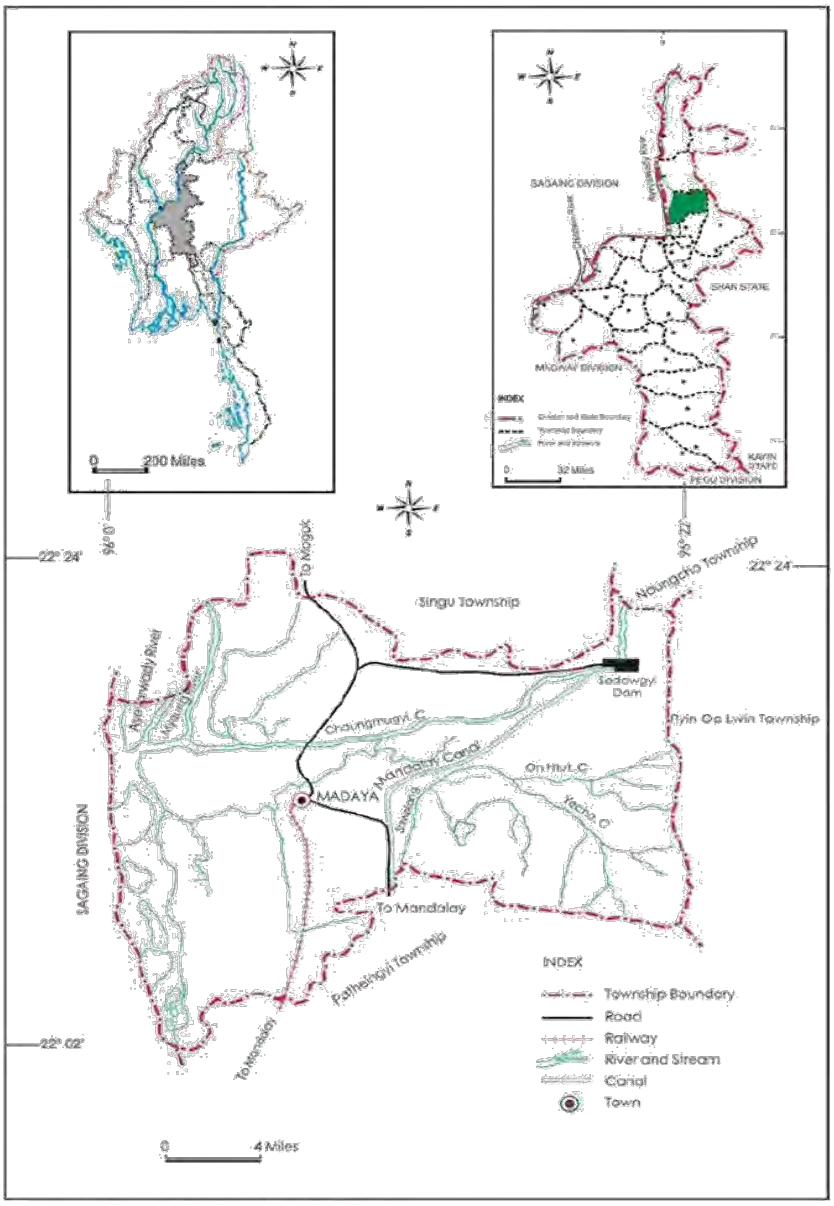


Photo 1 Existing Sedawgyi HPP

Table 3 Major Parameters of Sedawgyi HPP

Item	Sedawgyi Hydropower Plant
Max. power	25.0MW
Annual generated energy	134GWh (nominal) / 99.9GWh (2013 actual)
Annual operation hour	6,919 hours (2012 actual)
Commencement of operation	May-89
Power generation type	Multi-purpose (irrigation)
Region/state	Mandalay region
River	Ayeyarwady River system, ChaunmagyiRiver
Catchment area	3,384km^2
Max. power discharge	51.7m^3/s
Dam/weir	Rock-fill dam 40.6m high
Effective head	28.2m
Turbine type	Kaplan turbine (Toshiba), 12.5MW ´ 2 units

As an administrative area, Sedawgyi HPP site belongs to Madaya Township, which is one of the 31 townships of Mandalay Region as shown in Figure 2.



Source : Land Records Department, Madaya Township.

Figure 2 Location Map of Madaya Township

2. Laws, Rules and Regulations related to Environmental and Social Considerations

(1) General

Environmental Conservation Law (2012) and Environmental Conservation Rules (2014) are recently enacted laws to determine the comprehensive environmental conservation and management in Myanmar. Following laws, rules and regulations are related to environmental and social consideration in Myanmar.

Table 4 Major Laws and Regulations relevant to Environment

Name of Laws, Rules etc.	Year
1. Constitution and Environmental Policy	
Constitution of the Republic of the Union of Myanmar	2008
Myanmar National Environmental Policy	1994
National Sustainable Development Strategy 2009	2009
2. Environmental Conservation	
Myanmar Environmental Conservation Law 2012	2012
Environmental Conservation Rules 2014	2014
Environmental Impact Assessment Procedures 2015	2015
3. Biodiversity and Natural Conservation	
Wildlife Protection Act 1936	1936
Myanmar Marine Fisheries Law 1990	1990
Fresh Water Fisheries Law 1991	1991
The Law Relating to Aquaculture	1989
Forest Law 1992	1992
Animal Health and Development Law 1993	1993
Protection of Wildlife and Conservation of Natural Area Law 1994	1994
Conservation of Water Resources and River Law 2006	2006
National Biodiversity Strategy Action Plan in Myanmar	2012
4. Development and Management of Economic Activities	
Irrigation Laws and Regulations	1982
Factory Act	1951
Mines Law	1994
Electricity Law 1984 (amended 2014)	2014
Electricity Act 1948 (amended in 1967)	1967
Petroleum Act	1934
Petroleum Rules of 1937 (amended in 1946	1946
Law on Aquaculture (1989)	1990
Freshwater Fisheries Law	1991
5. Land Acquisition and Resettlement	
The Upper Burma Land and Revenue Regulation	1889
The Land Acquisition Act 1894	1894
Transfer of Immovable Property Restriction Act	1947
Land Nationalization Act	1953
Disposal of Land Tenancies Law	1963
Transfer of Immovable Property Restriction Law	1987
Wasteland Instruction	1991
Farmland Law 2012	2012
Farmland Rules 2012	2012
Vacant, Fallow, Virgin Land Management Law 2012	2012
Vacant, Fallow, Virgin Land Management Rules 2012	2012
6. Pollution Control and Occupational Health	
Factory Act	1951
Standing Order 2_95 Occupational Health Plan 1995	1995
Standing Order 3_95 Water and Air Pollution Control Plan 1995	1995
Occupational Safety and Health Law (Draft)	2012
The Science and Technology Development Law 1994	1994
Myanmar Mines Law 1994	1994
National Environmental Quality (Emissions) Guidelines	2015

(2) Environmental Conservation Law, 2012

The principal law governing environmental management in Myanmar is the Environmental Conservation Law (ECL), which was issued in March, 2012 (The Pyidaungsu Hluttaw Law No.9/2012).

The law stipulates that government bodies are in charge of environmental conservation as well as their relevant roles and responsibilities. It touches on water, noise, vibration and solid waste qualities but does not provide specific standards to be met.

It also mentions that any new development project must perform a system of Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) in order to find out whether or not a project or activity to be undertaken by any government department, organization or person may cause a significant impact on the environment or not. In the context of project development, it is important to note that the law adopts the notion of 'Polluter Pays Principle' as it implies that the project proponents are responsible for covering all environmental and social costs generated by the project.

The law serves as the basis for founding of Environmental Conservation Department (ECD) under the Ministry of Natural Resources and Environmental Conservation (MONREC)*

* In May of 2016 former Ministry of Environmental Conservation and Forestry (MOECAF) was changed to the MONREC adding with function of natural resources management.

Following the Environmental Conservation Law are two legal instruments: Environmental Conservation Rules (2014); and EIA Procedures (2015).

(3) Environmental Conservation Rules, 2014

Environmental Conservation Rules (ECR) No. 59/2014 emphasizes the importance of conservation of cultural heritage areas, natural heritage areas, cultural monuments, buildings and natural area and to set up the method to mitigate the impact of polluted waste during destruction, storage, placement and transportation of such waste.

In addition, ECR stipulates basic policy and concept of Environment Impact Assessment (EIA) application in developing Projects in Section 55 of Chapter XI) as follows:

Section 55. The Government department, organization or person which carry out the plan, business service or activity which are responsible to carry out the environmental impact assessment or initial environmental examination which is established before the issue of these rules;

(a) Shall submit to the Ministry, after drawing environment management plan in accord with the procedure relating to the environmental impact assessment.

(b) Shall implement and carry out the environment management plan which approved and scrutinized by the Ministry and matters stipulated by the Ministry within the time stipulated by the Ministry.

As described below, according to the EIA Procedure 2015, Prior Permission is required for economic activities including certain types of business, work-site or factory, workshops which may cause an impact on the environmental quality.

(4) Environmental Assessment (EIA) Procedure, 2015

In December 2015 Environmental Assessment (EIA) Procedure, which was long-awaited was enacted by MONREC at last.

Major statements stipulated are as follows.

1) Chapter II - Establishment of the EIA Process

a) Section 3

Pursuant to Section 21 of the Law and Articles 52, 53 and 55 of the Rules, all Projects and Project expansions undertaken by any ministry, government department, organization, corporation, board, development committee and organization, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual (and/or all Projects, field sites, factories and businesses including expansions of such Projects, field sites, factories and businesses identified by the Ministry, which may cause impact on environmental quality and are required to obtain Prior Permission in accordance with Section 21 of the Law, and Article 62 of the Rules) having the potential to cause Adverse Impacts, are required to undertake Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) or to develop an Environmental Management Plan (EMP), and to obtain an Environmental Compliance Certificate (ECC) in accordance with this Procedure.

b) Section 5

In accordance with Article 68 of the Rules, small-scale Projects, field sites, factories or businesses which are not specifically identified by the Ministry, but which may impact on environmental quality and as such are required to obtain Prior Permission in accordance with Section 21 of the Law or Article 62 of the Rules, and which are also not included in Annex 1 'Categorization of Economic Activities for Assessment Purposes', shall obtain the recommendation of the Department as to whether or not such a Project has Environmental Impacts and shall comply with the terms and conditions prescribed by the Department before applying for a permit or license from the relevant ministry or governmental organization.

- EIA procedures describe types of categories of business which are necessary to carry out IEE/EIA studies before the implementation of the project. In the Annex 1 of the EIA Procedure, guidance as to whether an IEE or an EIA is required for 141 types of projects or activities.

- In the Annex 1, economic activities relating to schemes of hydropower development are shown in Table 5.

Table 5 Categorization of Hydropower Development Schemes

Type of Economic Activity	Criteria for IEE Type Economic Activities	Criteria for EIA Type Economic Activities
(a) Energy Sector Development		
Hydro Power Plants	a) Installed capacity ≥ 1 MW but < 15 MW	a) Installed capacity ≥ 15 MW
	b) Reservoir volume (full supply level) <20,000,000 m^3	b) Reservoir volume (full supply level) ≥20,000,000 m^3
	c) Reservoir area (full supply level) < 400 ha	c) Reservoir area (full supply level) ≥ 400 ha
Electrical Power Transmission Lines (≥ 115 kV 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

Note: Edited from Annex I of EIA Procedure 2015, in which 141 types of economic activities are categorized with respective to types of their economic activities

c) Section 6

The ECC issued by the Ministry shall reflect any terms and conditions that are contained in any relevant Prior Permission.

d) Section 8

Any Project already in existence prior to the issuance of the Rules, or the construction of which has already commenced prior to the issuance of the Rules, and which, in either case, shall be required to undertake, within the timeframe prescribed by the Department, an environmental compliance audit, including on-site assessment, to identify past and/or present concerns related to that Project's Environmental Impacts, and to:

(a) develop an EIA or IEE or EMP;
(b) obtain an ECC; and
(c) take appropriate actions to mitigate Adverse Impacts in accordance with the Law, the Rules, and other applicable laws.

2) Chapter III - Screening

a) Section 23

(a) The Project Proponent shall submit the Project Proposal to the Ministry for Screening. In accordance with this Procedure, the submission of the Project Proposal for Screening is the same as the submission of an application for Prior Permission.

(b) The Ministry will send the Project Proposal to the Department to determine the need for environmental assessment.

(c) Following the preliminary Screening and verification that the Project Proposal contains all required documents and related materials, subject to Articles 8, 9, 10, 11, 26 and 27 the Department shall make a determination in accordance with Annex 1 'Categorization of Economic Activities for Assessment Purposes', taking into account Article 25 and the additional factors listed in Article 28 in order to designate the Project as one of the following, and then submit their designation to the Ministry:

i) an EIA Type Project, or
ii) an IEE Type Project, or
iii) A Non IEE or EIA Type Project, and therefore not required to undertake any environmental assessment.

b) Section 24

The Ministry shall also make a determination whether an EMP shall be required in respect of any Project.

3) Chapter VII - Environmental Management Plan

a) Section 76

For Project types which require EMP according to the Article 55 (a) of the Rules or Article 24 of the Procedure, the Project Proponent may prepare an EMP by itself or may appoint a person or organization who/which is registered according to the Article 18.

b) Section 77

The Project Proponent shall issue a letter of endorsement in a format prescribed by the Ministry according to the Article 63. Such letter shall be submitted to the Department prepared either in the Myanmar language, or in the English language or both. The Project Proponent shall submit the EMP to the Department in both digital form and complete paper copies, together with the required service fee as prescribed by the Department, and confirming:

(a) the accuracy and completeness of the EMP;

(b) that the EMP has been prepared in strict compliance with applicable laws including this Procedure; and

(c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EMP.

c) Section 78

Upon Receipt of the EMP from the Project Proponent, the Department shall review and submit to the Ministry to enable it to make a final decision on approval of the EMP.

d) Section 79

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

e) Section 80

Upon completion of its review of the EMP, the Ministry shall;

(a) approve the EMP, subject to any conditions it may prescribe, and issue an ECC; or

(b) require that the Project carry out an IEE or EIA, citing the reasons for this decision and informing the Project Proponent of its decision; and, in either case

(c) publicly disclose its decision.

f) Section 81

The Department shall deliver the final decision of the Ministry within thirty (30) working days of receipt of an EMP. If the Ministry requires an EMP to be amended, then the due date for delivery of the Ministry's decision shall be extended accordingly.

g) Section 82

Any additional costs associated with reaching a determination regarding Project types which require EMP shall be borne by the Project Proponent.

(5) Procedures of Environmental Assessment

The EIA Procedures are expected to stipulate the conditions under which EIA is required and the steps to be followed in conducting and assessing the EIA. Under the EIA Procedure, the Ministry, as the Executing Agency sets an EIA Review Committee, is to give recommendations from an environmental point of view whether to approve the EIA reports or not. Composition of the EIA Review Committee will be determined by the Minister of MOECAF but needs to include persons from the industry, academia, and civil society, as well as government officials. EIA includes an environmental management plan and a social impact assessment report. The Procedures may also

include a clause for public participation in implementing the Initial Environmental Examination (IEE), EIA, and Environmental Management Plan (EMP), yet only if deemed necessary by the Ministry.

If the proponent intends to obtain ECC for the project implementation from MONREC, a series of procedures described below (i) to (ix), which depend on the type and/or feature of the project, are required to the proponent with incorporating MONREC and other related organizations such as EIA Report Review Body, third person or organization undertaking IEE and EIA:

(i) Project proposal screening, (ii) IEE - IEE investigation and review, (iii) IEE - IEE review and approval, (iv) EMP review and approval, (v) Scoping of EIA, (vi) EIA investigation and review, (vii) EIA review and approval(viii) Appeal process.

A series of the procedures are shown in the Environmental Assessment Procedure Flowcharts.

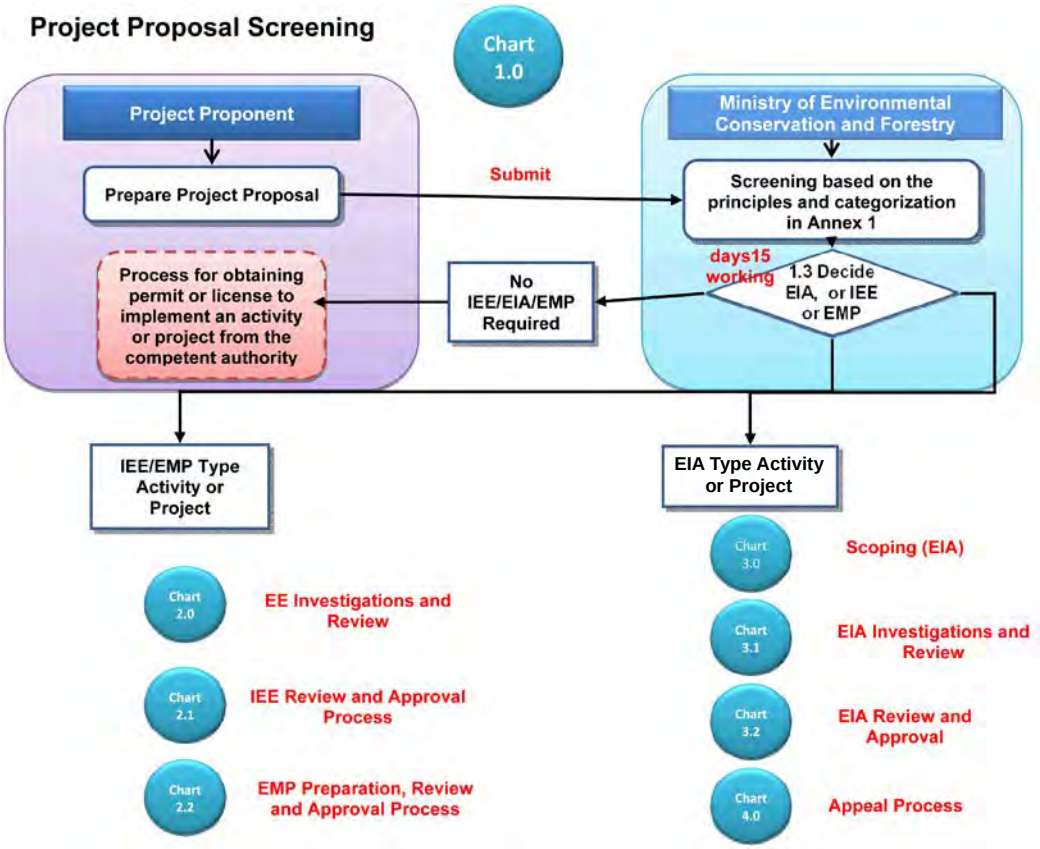


Figure 4 Project Proposal Screening

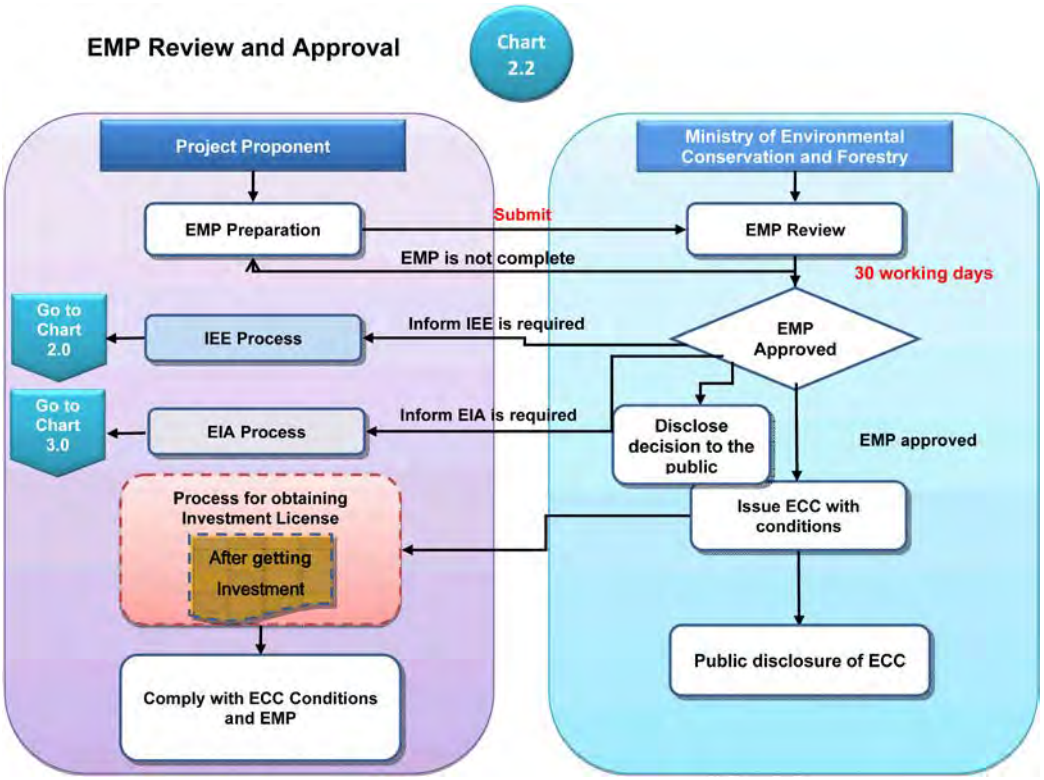


Figure 5 EMP Review and Approval

Source: EIA procedure 2015

(6) Environmental Quality Standards

National Environmental Quality (Emissions) Guidelines 2015 (hereafter referred to NEQEG) was enacted at the end of 2015.

NEQEG provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health.

The NEQEG have been primarily excerpted from the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries. The Guidelines are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of these Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

As specified in the EIA Procedure, all projects are obliged to use, comply with and refer to applicable national guidelines or standards or international standards adopted by the Ministry. The NEQEG will be applied by the Ministry in satisfying this requirement until otherwise modified or succeeded by other guidelines or standards. Following project approval, a project shall commence implementation strictly in accordance with the project EMP and any additional requirements set out in the project ECC, which will encompass conditions relating to emissions. In this regard, the Ministry will require that projects adhere to general and applicable industry guidelines as set out in Annex 1.

Projects shall engage in continuous, proactive and comprehensive self-monitoring of the project and comply with applicable guidelines and standards. For purposes of the NEQEG, projects shall be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC.

Guidelines regarding air emissions, wastewater, noise level and odor are explained and specified.

(7) Solid Waste Management

In Myanmar solid waste management is mostly under the control of local government. For example, large cities such as Yangon and Mandalay City, Township Development Committee has a principal function of solid waste management including industrial and hazardous waste as part of pollution control.

On the other hand, in national level ECD is preparing national policy of solid waste management. However, no regulation of solid waste management including hazardous waste has been established in Myanmar until now.

(8) Laws, Rules and Regulations concerning Land Use, Ownership and Acquisition

There are many significant laws which govern land issues, land administration, and land ownership in Myanmar such as Land Nationalization Act (1953), Disposal of Tenancies Law (1963), Land Acquisition Act (1894), Forest Law (1992), Farm Land Law (2012), and so on.

Among them, the Land Acquisition Act (1894) is even now the core law of land acquisition.

The Land Acquisition Act 1894 promulgated in the British Colonial Era is even now the core law for land acquisition and resettlement in Myanmar. As there are problems such as consistency of the procedures by MONREC with the procedures by Ministry of Home Affairs or by local governments, and problem of abilities in MONREC to do institutional management of the system, etc., the new effectual system is also undecided at present.

As mentioned in Table 1 and below (Table 4), construction work for rehabilitation and subsequent operation of the hydropower plant will be done within the existing plant site. Thus, there will be no changes in land use in the surrounding areas, such as involuntary resettlement including land acquisition, no resettlement or disturbance of other business activities.

3. Results of Preparation for Environmental Management Plan

Procedures of Preparation of EMP is schematically shown in Figure 2.

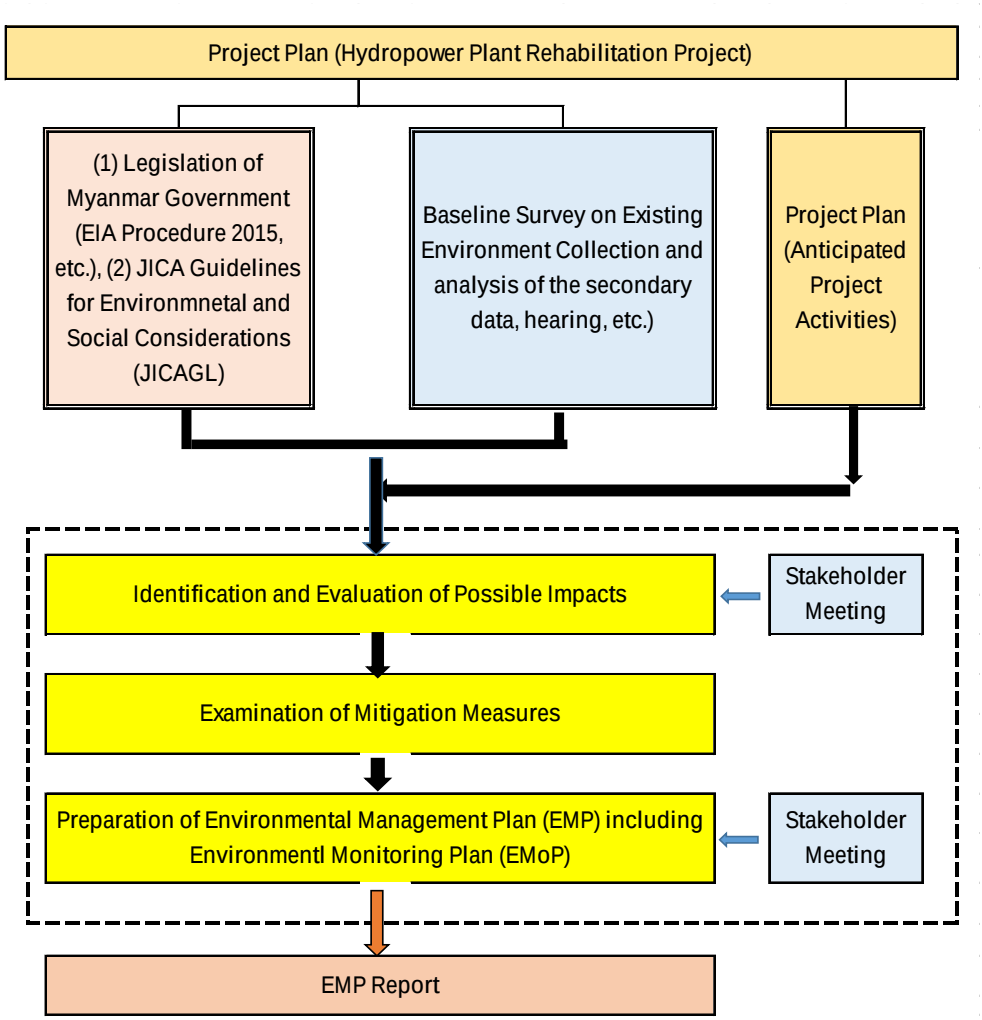


Figure 6 Schematic Flow of EMP Preparation

(1) Project Activities

Anticipated activities due to the proposed project plan for SeadwgyiHPPare shown in Table 6.

Table 6 Anticipated Activities due to the Rehabilitation of Existing Hydropower Plants

Stage	Anticipated Activities
I Planning Stage (Pre-construction Stage)	Securing land/space for hydropower plant and related facilities
	Securing construction yard including storage of construction materials
	Change in land use and utilization of local resources
II Construction Stage (Rehabilitation Work)	Procurement of construction materials and securing water supply
	Earth moving work such as excavation, cutting and mounting
	Work for exchange/renewal of dilapidated facilities /equipment and/or parts/devices to new ones
	Collection, transportation and storage of generated waste including hazardous materials such as PCBs and asbestos through exchange of older transformers and others to new ones
	Carrying out dilapidated facilities /equipment and/or parts/devices and carrying in new ones by manually and/or using machines and vehicles
	Workers, their working activities and worker's camp
III Operation Stage	Operation of hydropower plant and related facilities/equipment
	Spatial occupancy of hydropower plant and related facilities

(2) Setting of Environmental Components and Items

To grasp whole features of possible environmental impacts caused by the project, it is necessary to identify and evaluate environmental component and item, which compose of environmental and social considerations, one by one and to integrate the impacts.

According to the JICA Guidelines for Environmental and Social Considerations, possible impacts to be assessed include those on human health and safety, as well as on the natural environment, which are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.

In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational to do so.

Taking into consideration the JICA Guidelines, and relevant laws and regulations of Myanmar, together with environmental condition of the project area, three environmental components and 38 items (Social Environment 17, Natural environment 10, and Environmental pollution 11) as indicators expressing environmental and social conditions (See Table 16.4-5 below).

(3) Rating of Possible Impacts

Possible impacts are identified and the extent of the impacts are also evaluated one by one for each implementation stage by applying rating against the above mentioned 38 environmental items.

In the evaluation following rating criteria are adopted to examine extent of the possible impacts:

- In general, both positive impact (+) and negative impact (-) are expected due to the anticipated project activities.

- Ratings are as follows:
  (a) A (+/-) - Significant positive/negative impact is expected,
  (b) B (+/-) - Not significant but some positive/ negative impact is expected
  (c) C (+/-) - Extent of impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses.
  (d) D - Negligible or No impact is expected.

- Implementation stage: I - Planning Stage, II - Construction Stage, III - Operation Stage. T-Whole stages with worst rating among I, II, and III.

(1) Identification and Evaluation of Possible Impacts

Based on results of the Preliminary Scoping, necessary survey was carried out to fill up ~~lack of~~ necessary information by collection of relevant data and by hearing and consultation with related central and local governmental departments and organizations as well as village and communities in the project area of Sedawgyi HPP.

After the survey, by applying revised and upgraded information, possible impacts were also identified and the extent of the impacts were evaluated one by one with rating against38 environmental items for rehabilitation of Sedawgyi HPP.

Results are shown together with the results of the Scoping in Table 7.

Table 7 Identification and Evaluation of Possible Impacts due to Hydropower Plants Rehabilitation Project

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
(1) Social Environment						
1	Involuntary Resettlement (land acquisition/ resettlement etc.), migration of population etc.	D	D	D	D	(I) All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither land acquisition nor resettlement is expected for surrounding areas.
2	Local economy such as employment and livelihood etc.	B+	A+	B+	D	(II) Temporary employment of local people by construction work is somewhat anticipated.
3	Land use and utilization of local resources	D	D	D	D	(T) (1) All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither change of land use nor utilization of local resources is not anticipated in the surrounding areas.
4	Social institutions such as social infrastructure and local decision-making institutions, a split of communities	C	C	B-	B-	(T) Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly informed to relevant community peoples and community based organizations.
5	Existing social infrastructures and services (Traffic condition)	C	A+	B-	D	(II) It is anticipated to cause inconvenience to local traffic due to passing through vehicles for construction work and tracks loading heavy equipment and device access road to hydropower plant.
6	The poor, refugees, indigenous of ethnic minority people	C	C	B-	B-	(T) Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, there is found no situation for necessary considerations with the poor and vulnerable peoples such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and MadayaTownship. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
7	Gender	C	C	B-	B-	(T) At present, there is found no situation for necessaryconsiderations with gender regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities and MadayaTownship. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
8	Children's Right	C	C	B-	B-	(T) At present, there is found no situation for necessary considerations with children regarding (1) Provision of adequate standard of living, education etc., (2) Protection from abuse, neglect anddiscrimination, (3) Participation in the communities in MadayaTownship. However, if proper care and management by local Government and relevant organization are not given to them, discontent and some conflict may give rise.
9	Misdistribution of benefit and damage	C	C	B-	B-	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.
10	Local conflict of interests	C	C	B-	B-	(T) Through rehabilitation improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
11	Cultural property and heritage	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site. In addition, there are found no cultural, religious and historical heritage sites in and nearby. Thus, negative impact is not anticipated.
12	Fishing Rights, Water Rights and Rights of Common	C	C	D	D	(1) In Myanmar there are two types of fishing rights; one is "fishing grant", which is given with specified river area and another is "license", which is a permit of fishing. (2) Construction work will be limited within existing hydropower plant site. Thus, negative impact is not anticipated.
13	Public health and Sanitation	C	C	B-	D	(II) (1) There is a possibility of air pollutants emissions such as NOx and PM by operation of construction machines and vehicles for rehabilitation work may cause some adverse effect of respiratory organ. (2) In addition, solid waste containing hazardous material such as toxic metals (Hg, Pb)and asbestos generated even in very small amount through replacing dilapidated equipment and/or devices with new ones, may cause some adverse effect on human health in case of direct dermal contact or inhalation.
14	Infectious diseases such as HIV/AIDS	C	C	D	D	(II) In many developing countries spreading of infectious diseases such as HIV/AIDS were often reported due to contact of migrating workers with affected peoples at their camp in construction work. However, according to the rehabilitation plan workers engaged in the work will bebasically EPGE employees having skill and experience working in hydropower plant. Thus, infectious diseases such as HIV/AIDS is not anticipated.
15	Working condition	C	C	B-	D	(II) Adverse impacts on working condition including occupational safety are expected somewhat due to inadequate management of workers at construction work.
16	Hazard/risk (disaster, security)	B-	C	B-	D	(II) In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of leakage of hazardous materials, even a small amount, through replacement of dilapidated equipment and/or devices with new ones. (III) It is hardly anticipated any additional risk by the plant operation.
17	Accidents	B-	C	B-	D	(II) Occurrence of accidents is somewhat anticipated, if inappropriate handling and management of construction work. (III) Through rehabilitation upgrading in efficiency and reliability of operation will be attained resulting in reduction of accidental power failure.
(2) Natural Environment						
18	Topography and Geology	D	D	D	D	(II) Construction work will be limited to exchange of dilapidated equipment and/or devices within existing hydropower plant site. In addition, there is no specific/valuable feature of topography and geology in and surrounding areas of the plant site.
19	Soil erosion/sand movement	C	C	D	D	(II) All the activities for rehabilitation will be carried out within existing hydropower plant site, which has flat and good soil condition.
20	Movement of water/Hydrological situation	C	C	D	D	(II, III) No change from existing condition in quantity and quality of water intake and sluice from dam by hydropower generation is anticipated during construction and operation stage.
21	Groundwater condition	C	C	D	D	(II) All the activities for rehabilitation will be carried out within existing hydropower plant site. In addition, no large scale pumping of groundwater will be planned. Water use for construction work will be done by supplying surface water of dam and river. Thus, negative impact on groundwater is not anticipated.
22	Environmentally sensitive areas (Protected Areas, IBAs etc.)	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site, where no Environmentally sensitive areas are found. Thus, no negative impact isanticipated due to the project.
23	Flora, Fauna, Ecosystem and Biodiversity (Terrestrial)	C	C	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site, where no endangered terrestrial species as well as valuable habitat is found. Thus, no negative impact is anticipated due to the project.

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
24	Flora, Fauna, Ecosystem and Biodiversity (Aquatic)	C	D	D	D	(T) All the activities for rehabilitation will be carried out within existing hydropower plant site, where no endangered aquatic species as well as valuable habitat is found. Thus, no negative impact is anticipated due to the project.
25	Landscape and visual amenity	C	C	D	D	(T) Construction work will be limited to exchange of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing hydropower plant site. Thus, negative impact on landscape is not anticipated.
26	Micro-climate	C	C	D	D	(II) Construction work will be limited to replacement and/or repair of dilapidated equipment and/or devices and no change in scale, shape or design of existing plant within existing hydropower plant site. Thus, negative impact on micro-climate is not anticipated.
27	Global Warming/Climate Change	B-	C	B-	B+	(II) Through the construction work generation of greenhouse gases (GHG) emissions from vehicles and construction machines is anticipated even in a small scale. (III) Reduction of GHG emissions is a little anticipated by improving the efficiency of hydropower plant operation.
(3) Environmental pollution						
28	Air pollution	B-	C	B-	D	(II, III) (1) In Myanmar at present air quality standards are not established. (2) Air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for rehabilitation work even in a little amount. (3) Emission of air pollutants such as PM and NOx is not anticipated from hydropower plant operation.
29	Water Pollution	B-	C	B-	D	(II, III) (1) In Myanmar at present water quality standards are not established. (2) Discharge of wastewater by construction work is anticipated by operation of construction machines and vehicles for construction work even in a little amount. (3) Discharge of water pollutants is not anticipated from hydropower plant operation.
30	Soil contamination	B-	C	B-	D	(II) There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for construction work. In addition, there is also a possibility of leakage of hazardous materials such as toxic metals (Hg and Pb) and asbestos even in very small amount through replacement of dilapidated equipment and/or devices with new ones.
31	Bottom sediment contamination	B-	C	D	D	(II) All the activities for rehabilitation will be carried out within existing hydropower plant site, where there is no water body. Thus, bottom sediment contamination is not anticipated.
32	Solid waste	B-	B-	B-	D	(II)(1) Through construction work, considerable amount of industrial wastes will be generated by replacement of equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities. (2) In addition, it is anticipated that generation of solid waste containing hazardous materials, such as toxic metals (Hg, Pb) and asbestos even in very small amount, through replacement of dilapidated equipment and/or devices with new ones.
33	Noise and Vibration	B-	C	B-	B+	(II) Although construction work will be carried out within the plant site, generation of noise and vibration is somewhat anticipated by operation of construction machines and vehicles for rehabilitation work. (III) Through rehabilitation upgrading in efficiency and reliability of operation will be attained resulting in some reduction of noise and vibration.
34	Ground Subsidence	D	D	D	D	(II) Rehabilitation work will be limited within existing hydropower plant site. In addition, foundation is stable and no large scale extraction of groundwater is included in the project plan. Thus, anticipated impact is negligible.
35	Offensive odor	C	C	D	D	(T) There is a possibility of offensive odor generation due to construction work. However, the work will be limited within existing hydropower plant site. Thus, anticipated impact is negligible, if any.
36	Sunshine inhibition	D	D	D	D	(II) Construction work will be limited within existing hydropower plant site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and

Environmental Items *		Scoping		After		Reasons
		1/II	III	I/II	III	
						public facilities nearby the plant site. Thus, impact on sunshine inhibition is not anticipated.
37	Electromagnetic interference	C	C	D	D	(II) Construction work will be limited within existing hydropower plant site. In addition, neighboring areas are open space covered with grass and scattered trees, and there are found no houses and public facilities nearby the plant site. Thus, interference with receiving radio wave is not anticipated.
38	Safety from Electromagnetic Field	C	C	D	D	(II, III) Rehabilitation work will be limited within existing hydropower plant site. In addition, there is neither houses nor public facilities in neighborhood. Thus, potential health effect of electromagnetic field is hardly anticipated.

Note 1: * Environmental items are chosen based on JICA Guidelines for Environmental and Social Environment (2010.4) and relevant legislation of Myanmar Government as well as the project plan and environmental condition of the project area, as indicators expressing environmental and social conditions.

Note 3: *** Rating - In general, both positive impact (+) and negative impact (-) are expected due to the anticipated project activities. Thus the following rating criteria are adopted with respect to the extent of impacts: A (+/-) – Significant positive/negative impact is expected, B (+/-) – Positive/negative impact is expected to some extent, C (+/-) - Extent of positive/negative impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses.), Blank - Negligible or No impact is expected.

Note 4: **** I - Planning Stage, II - Construction Stage, III - Operation Stage, T – Whole Stages.

4. Possible Major Negative Impacts and Mitigation Measures

As shown Table 4, major items identified and evaluated as negative impacts with rating of (B-) which means “not significant but some negative impact” are described with necessary mitigation measures as follows*:

*Item having negative impacts is described with serial number of the item {x}

(1) Planning stage

No item.

For example, {1. Involuntary Resettlement (land acquisition/resettlement etc.), migration of population etc.} - All the activities for rehabilitation will be carried out within existing hydropower plant site. Thus, neither land acquisition nor resettlement is expected for surrounding areas.

(2) Construction stage (Rehabilitation work)

1) Social environment

(i) {5} Existing social infrastructures and services (Traffic condition)

a) Possible negative impacts - It is anticipated to cause inconvenience to local traffic due to passing through vehicles for construction work and tracks loading heavy equipment and device access road to hydropower plant.

b) Mitigation measures - (1) Prior to construction work, inform contents of the construction work and schedule. (2) Time shift of construction work. (3) Education of traffic safety and manner to construction workers and drivers. (4) Raise the traffic signal and arrange watchmen on approach road. (5) Equip sheet cover to prevent scattering dust from the bed of truck. (6) Setting staff in charge of complaints.

(ii) {13} Public health and Sanitation

a) Possible negative impacts - There is a possibility of air pollutants emissions such as NOx and PM by operation of construction machines and vehicles for rehabilitation work may cause some adverse effect of respiratory organ. (2) In addition, solid waste containing hazardous material such as toxic metals (Hg, Pb) and asbestos generated even in very small amount through replacing dilapidated equipment and/or devices with new ones, may cause some adverse effect on human health in case of direct dermal contact or inhalation.

b) Mitigation measures - (1) Preventive measures to control air pollutants emission in construction work. (2) Monitor public health condition by medical examination.

(iii) {15} Working condition

a) Possible negative impacts - Adverse impacts on working condition including occupational safety are expected somewhat due to inadequate management of workers at construction work

c) Mitigation measures - (1) In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). (2) Preparation of safety management plan and enlighten occupational safety to construction workers. (3) Tangible safety considerations should be prepared for individuals involved in the project. (i) The installation of safety equipment and management of hazardous materials. (ii) Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction works. (4) Monitoring health condition and occupational safety of workers.

(iv) {16} Hazards/risk

a) Possible negative impacts - In general, no additional risk of disaster and public security are expected due to rehabilitation work. However, there is a possibility of leakage of hazardous materials, even a small amount, through replacement of dilapidated equipment and/or devices with new ones.

c) Mitigation measures - (1) Inspection daily behavior of construction workers and instruction them to acquire good manners. (2) Prepare emergency action plan for hazard and public security risks.

(v) {17} Accidents

a) Possible negative impacts - Occurrence of accidents is somewhat anticipated, if inappropriate handling and management of construction work.

c) Mitigation measures - (1) Suitable planning and management over construction work to prevent and minimize the number and consequences of accidents. (2) To collect and analyze cases and causes of accidents. (3) Enlighten workers and local residents to prevent accidents by training and adequate notice. (4) Prepare emergency action plan for accidents.

2) Natural Environment

(i) {27} Global warming

a) Possible negative impacts - Through the construction work, greenhouse gases (GHG) emissions from vehicles and construction machines is anticipated even in a small scale.

b) Mitigation measures - (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) To inspect condition of good maintenance for construction machines and vehicles. (3) Physical observation of exhaust emissions and collect complaints, if any.

3) Environmental Pollution

(i) {28} Air pollution

a) Possible negative impacts – In general, air pollutants emissions such as NOx and PM is anticipated by operation of construction machines and vehicles for construction work within plant site and along access roads. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling, structure construction are not expected. In addition, traffic volume of access roads by trucks delivering replaced facilities, equipment and devices are in a small number. Further, surrounding areas farmland and a lone straggling village. Therefore, possible impacts will be in a small scale and temporary.

c) Mitigation measures - (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (3) Possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(ii) {29} Water pollution

a) Possible negative impacts – In general, discharge of wastewater is anticipated. However, construction work for rehabilitation is limited to replacement and repair of facilities, equipment or devices, and civil works such as earth moving, cutting or filling ground and soil as well as road construction are not expected. Thus, wastewater is in a small amount and water pollutants such as soil and oil are seldom contained. Thus, possible impacts will be in a small scale and temporary.

b) Mitigation measures - (1) Preventive measures to control water pollutants discharge in construction work. (2) Major pollutants such as suspended solid and oily components will be discharged to existing drainage after simple treatment by filter. As mentioned the above, possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.

(iii) {30} Soil contamination Possible negative impacts

a) Possible negative impacts – There is a possibility of leakage of materials such as lubricant oil by operation of construction machines and vehicles for construction work. In addition, there is also a possibility of leakage of hazardous materials such as toxic metals (Hg and Pb) and asbestos even in very small amount through replacement of dilapidated equipment and/or devices with new ones.

c) Mitigation measures - (1) To prevent leakage and contamination of soil as well as human contact, the concrete and gravels heavily contaminated with hazardous materials will be removed and renewed. Then, they will be sealed in drums, and stored in the strict management area for hazardous wastesas mentioned in below (iv).

(iv) {32} Solid waste

a) **Possible negative impacts –**(1) Through construction work, considerable amount of industrial wastes will be generated by replacement of equipment and devices, which make up turbine, generator, control and protection system, substation and transmission line facilities. (2) In addition, it is anticipated that generation of solid waste containing hazardous materials such as toxic metals (Hg, Pb) and asbestos even in very small amount, through replacement of dilapidated equipment and/or devices with new ones as shown in Table 8.

Table 8 List of Hazardous Materials Contained in Wasted Equipment and Devices

Hazardous Material	Equipment/Device	
PCB	Not contained	
Asbestos	Generator Stator	Insulator
	Generator brake	Brakepad
	Pipes	Packings
Hg	Measuring equipment	Dial-type thermometer
Pb	Electric components	Soldering component

b) Mitigation measures - (1) To consider and to carry out possible preventive measures for reduction, proper treatment and disposal of solid waste during construction work. 2) Reflect concept of 3R (Reduce, Reuse and Recycle) to the plan. For example, in case of rehabilitation work for Baluchaung No.2 HPP, some parts of non-hazardous industrial waste and construction waste were reused for roofs and walls by villagers. (3) Enlighten awareness of waste management to workers and employees. (4) In general, all wastes will be properly managed considering their characteristics, such as volume, materials, conditions, extent of hazardous risk, etc. as follows: (a) record list of wastes with characteristics and put name tag on waste, (b) remove and segregation at source, (c) transfer and store in containers or warehouses in HPP site, (d) deliver to designated disposal site with taking care of traffic disturbance and accident, if they have no hazardous risk, (e) reuse for structure materials of wall, roof, etc., if they have no hazardous risk, (f) store waste oil in transformers and other devices in leak-proof drums. (5) Among generated wastes, hazardous materials and wastes containing toxic metals (Hg, Pb) and asbestos will be segregated and removed at source. Then, they are transferred and stored in sealed containers and/or designated warehouses in the site. As for asbestos, wrap with leak-proof clothes and plastic seat and store in designated warehouse. (6) To set an organization or an officer in charge of solid waste management in HPP. (7) At present, however, there is no regulation or guidelines of solid waste management including industrial and hazardous waste in Myanmar. Thus, proper solid waste management including treatment and final disposal will be carried out by consultation with relevant government organizations such as ECD and concerned department of local government.

(v) {33} Noise and vibration

a) Possible negative impacts - Although construction work will be carried out within the plant site, generation of noise and vibration is anticipated to some extent by the operation of construction machines and vehicles for rehabilitation work.

b) Mitigation measures - (1) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (2) Use equipment with low-noise and vibration. (3) Installation of soundproof

walls/acoustic enclosures and provision of buffer zones. (4) Setting staff in charge of complaints.

(3) Operation Stage

It is anticipated that there is no change of scheme, conditions and schedule of operation from those of existing operation after rehabilitation. Thus, no additional negative impacts are expected.

(4) Whole Stages

1) Social Environment

(i) {4} Social institutions such as social infrastructure and local decision-making institutions, a split of communities

a) Possible negative impacts - Beneficial impacts such as creation of employment opportunity for construction work and improvement living condition by upgrading power supply. However, there is a possibility of negative impacts, such as missing in acceptance by the communities or resulting in split of community, if the project plan is not properly informed to relevant community peoples and community based organizations.

c) Mitigation measures -(1) Information disclosure and public participation should be fully considered for all the stakeholders including local residents and road users from planning stage to operation stage for obtaining thorough understanding and consensus of the people and communities. (2) EPGE should set up a section in charge of public communication and complaints from peoples.

(ii) {6} The poor, refugees, indigenous of ethnic minority people

a) Possible negative impacts - Based on the field survey, the ethnic minorities, refugees or IDPs residing in project area have a long association with the local area and these groups have generally been absorbed into the local communities. Thus, at present, it was observed that there is no situation for necessary considerations with the poor and vulnerable peoples, such as ethnic minorities, refugees, elderly and disabled in the communities of the project area and Madaya Township area. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

c) Mitigation measures - (1)No serious situation was observed for vulnerable such as the poor, refugees, IDPs, indigenous of ethnic minority, disabled at present. However, in order to take care for them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. For example, to give them priority of employment over simple construction work

(iii) {7} Gender

a) Possible negative impacts - At present, no situation has been found for necessary considerations with gender regarding opportunity to all activities, equality of enjoyment benefits and share responsibility in the communities and Madaya Township area. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - No serious situation was observed for gender issues in related Township and surrounding area of the plant site at present However, in

order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any. One of necessary measures is to give women priority of employment in construction work.
In this IEE level study women were selected as the master of ceremony in the stakeholder meetings as well as the participation to Q & A session.

(iv) {8} Children's Right

a) Possible negative impacts -At present, no situation has been found for necessary considerations with children regarding (1) provision of adequate standard of living, education etc., (2) protection from abuse, neglect, discrimination, (3) participation in the communities and in Madaya Township. However, if proper care and management by local Government and relevant organizations are not given to them, discontent and some conflict may give rise.

b) Mitigation measures - No serious situation was observed for children's right in surrounding area and related Township of the plant site at present. However, in order to take care for them continuously EPGE and local government will watch the situation such as abuse and health condition, carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.

(v) {9} Misdistribution of benefit and damage

a) Possible negative impacts - Through rehabilitation, improvement of electric supply condition will be attained. However, there is a possibility of misdistribution of benefit and damage, if the plan is not appropriately accepted to relevant stakeholders including communities through proper information disclosure and public participation.

b) Mitigation measures - Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to share equally benefits and damage. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.

(vi) {10} Local conflict of interests

a) Possible negative impacts - Through rehabilitation, improvement of electric supply condition will be attained. However, there is a possibility of local conflict of interest and/or split of community, if the plan is not appropriately accepted ~~to~~ by the relevant stakeholders including communities through proper information disclosure and public participation.

b) Mitigation measures - (1) Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to avoid local conflict of interests. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from people.

5. Preparation of Environmental Management Plan (EMP)

For each negative impact, mitigation measures were examined for respective items in planning, construction and operation stage as well as whole stages in order that the plan can achieve intended objectives with avoiding, minimizing or reducing accompanied environmental impacts at implementation. The mitigation measures are shown together with implementing organizations and responsible organizations as Environmental Management Plan (EMP) in Table 5.

Table 9 Environmental Management Plan (EMP)

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
(I / II) Planning Stage/ Construction Stage				
(1) Social Environment				
5	Social Infrastructure and Services (Traffic condition)	(1) Prior to construction work, inform contents of the construction work and schedule. (2) Time shift of construction work. (3) Education of traffic safety and manner to construction workers and drivers. (4) Raise the traffic signal and arrange watchmen on approach road. (5) Equip sheet cover to prevent scattering dust from the bed of truck. (6) Setting staff in charge of complaints.		
13	Public health and Sanitation	(1) Preventive measures to control air pollutants emission in construction work. (2) Monitor public health condition by medical examination.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
15	Working condition	(1) In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). (2) Preparation of safety management plan and enlighten occupational safety to construction workers. (3) Tangible safety considerations should be prepared for individuals involved in the project. (i) The installation of safety equipment and management of hazardous materials. (ii) Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction works. (4) Monitoring health condition and occupational safety of workers.		
16	Hazard/risk (disaster, security)	(1) Inspection daily behavior of construction workers and instruction them to acquire good manners. (2) Prepare emergency action plan for hazard and public security risks.		
17	Accidents	(1) Suitable planning and management over construction work to prevent and minimize the number and consequences of accidents. (2) To collect and analyze cases and causes of accidents. (3) Enlighten workers and local residents to prevent accidents by training and adequate notice. (4) Prepare emergency action plan for accidents.		
(2) Natural Environment				
27	Global Warming/ Climate Change	(1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) To inspect condition of good maintenance for construction machines and vehicles. (3) Physical observation of exhaust emissions and collect complaints, if any.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE
(3) Environmental pollution				
28	Air pollution	Following measures will be incorporated into EMP and to be monitored in the construction work: (1) Use construction machines and vehicles equipped with good exhaust emission system and filled with good quality fuel and oil. (2) Enlightenment and education of construction workers for prevention or minimize air pollutants generation. (3) Possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.	Contractor, EPGE	Local government (State, District or Township), ECD, MOEE

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
29	Water Pollution	(1) Preventive measures to control water pollutants discharge in construction work. (2) Monitor water pollutants discharge and environmental water quality. (3) Possible impacts will be temporary and in a small scale. Thus, it is thought to be enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
30	Soil contamination	(1) To prevent leakage and contamination of soil as well as human contact, the concrete and gravels heavily contaminated with hazardous materials will be removed and renewed. Then, they will be sealed in drums, and stored in the strict management area for hazardous wastes. (2) Soil contamination may occur little. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
32	Solid waste	(1) To consider and to carry out possible preventive measures for reduction, proper treatment and disposal of solid waste during construction work. 2) Reflect concept of 3R (Reduce, Reuse and Recycle) to the plan. For example, in case of rehabilitation work for Baluchaung No.2 HPP, some parts of non-hazardous industrial waste and construction waste were reused for roofs and walls by villagers. (3) Enlighten awareness of waste management to workers and employees. (4) In general, all wastes will be properly managed considering their characteristics, such as volume, materials, conditions, extent of hazardous risk, etc. as follows: (a) record list of wastes with characteristics and put name tag on waste, (b) remove and segregation at source, (c) transfer and store in containers or warehouses in HPP site, (d) deliver to designated disposal site with taking care of traffic disturbance and accident, if they have no hazardous risk, (e) reuse for structure materials of wall, roof, etc., if they have no hazardous risk, (f) store waste oil in transformers and other devices in leak-proof drums. (5) Among generated wastes, hazardous materials and wastes containing toxic metals (Hg, Pb) and asbestos will be segregated and removed at source. Then, they are transferred and stored in sealed containers and/or designated warehouses in the site. As for asbestos, wrap with leak-proof clothes and plastic seat and store in designated warehouse. (6) To set an organization or an officer in charge of solid waste management in HPP. (7) At present, however, there is no regulation or guidelines of solid waste management including industrial and hazardous waste in Myanmar. Thus, proper solid waste management including treatment and final disposal will be carried out by consultation with relevant government organizations such as ECD and concerned department of local government.		
33	Noise and Vibration	(1) Working during sensitive hours and locating construction machines close to sensitive receptors shall be avoided. (2) Use equipment with low-noise and vibration. (3) Installation of soundproof walls/acoustic enclosures and provision of buffer zones. (4) Setting staff in charge of complaints. (4) Possible impacts will be temporary and in a small scale. Thus, it is enough to apply qualitative monitoring by physical observation and collection of complaints from surrounding areas.		
(III) Operation Stage				
No item				
(T) Whole stages				
4	Social institutions such as social infrastructure and local decision-making institutions, a split of	(1) Information disclosure and public participation should be fully considered for all the stakeholders including local residents and road users from planning stage to operation stage for obtaining thorough understanding and consensus of the people and communities. (2) EPGE should set up a section in		

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
	communities	charge of public communication and complaints from peoples.		
6	The poor, refugees, indigenous of ethnic minority people	No serious situation was observed for vulnerable such as the poor, refugees, IDPs, indigenous of ethnic minority, disabled at present. However, in order to take care for them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.For example, to give them priority of employment over simple construction work		
7	Gender	No serious situation was observed for gender issues in Madaya Township and surrounding area of the plant site at present However, in order to take care of them continuously EPGE and local government will watch the situation carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.		
8	Children's Right	No serious situation was observed for for children's right in Madaya Township and surrounding area of the plant site at present. However, in order to take care for them continuously EPGE and local government will watch the situation such as abuse and health condition, carefully and make effort to solve the problem by consultation with local government and communities, if there happens any.		
9	Misdistribution of benefit and damage	Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to share equally benefits and damage. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.		
10	Local conflict of interests	(1) Consultation with stakeholders including local residents, community organizations etc., should be planned from an early stage to obtain understanding and consent among the stakeholders in order to avoid local conflict of interests. (2) Consider preference of employment to local residents and the poor for construction works, if necessary. (3) EPGE should set up a section in charge of public communication and complaints from peoples.		

Note 1: * Implementing Organization : EPGE (Head Quarter and/or Manager of Hydropower Plant, CT - Contractor, Local
Note 2: ** Responsible and/or supervising organization - Local Government (Township, District and/or State Government), ECD (Environmental Conservation Department, MONREC), MOEE (Ministry of Electricity and Energy).
Note 3: *** Cost for EMP will be covered within ordinary budget of EPGE and contract fee of contractor.

6. Preparation of Environmental Monitoring Plan (EMoP)

Considering mitigation measures against negative impacts in the EMP, environmental monitoring plan which may support implementation of the measures, was prepared and shown together in Table 10.

Table 10 Environmental Monitoring Plan

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Implementation organization*, ***	Responsible and/or supervising org.**
(I) Planning Stage (Pre-Rehabilitation Stage)					
Environmental Compliance Certificate (ECC) and approval/ permission for the project implementation	(1) To get Environmental Compliance Certificate (ECC) from MONREC (2) Other permit/ approval, if necessary	MONREC	Before commencement of construction (rehabilitation) work	EPGE	MOEE, ECD (MONREC)
(II) Construction Stage (Rehabilitation Stage)					
(1) Social Environment					
Traffic condition	Cases and causes of complaints to traffic condition	Visual observation and hearing with residents and road users	Daily	Hydropower Station	EPGE, ECD, Local Government
Public health and Sanitation	Monitoring health condition of workers and local residents by medical examination.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Monthly	Hydropower Station	EPGE, ECD, Local Government
Working condition	Monitoring health condition and occupational safety of workers.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
Hazard/risk (disaster, security)	(1) Inspection daily behavior of construction workers and instruction them to acquire good manners. 2) Prepare emergency action plan for hazard and public security risks.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
Accidents	Records of accidents in the project area	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
(2) Natural Environment					
Global Warming/ limate Change	Monitoring maintenance condition and exhaust emissions of construction vehicles and machine	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
(3) Environmental Pollution					
Air pollution	(1) Visual observation, 2) Complaints from residents 2) Monitor air pollutants emission and ambient air quality.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
Water Pollution	(1) Visual observation, 2) Complaints from residents. 2) Monitor water pollutants	(1) Hydropower plant site, (2) Access road for	Daily	Hydropower Station	EPGE, ECD, Local Government

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Implementation organization*, ***	Responsible and/or supervising org.**
	discharge and environmental water quality.	rehabilitation work			
Soil contamination	(1) In Myanmar measurement of PCB and mercury content in soil is not yet established. Thus, visual observation leakage of hazardous materials. (2) Inspection proper handling and storage situation of solid waste contaminated with hazardous materials in storage containers and facilities.	(1) Hydropower plant site, (2) Solid waste storage area	Every time with exchanging dilapidated equipment and devices Rehabilitation work	Hydropower Station	EPGE, ECD, Local Government
Solid waste	(1) Record of collection, transportation and disposal of generated solid waste. (2) Visual observation leakage of hazardous materials from dilapidated equipment and devices such as transformers by rehabilitation work. (3) Inspection proper handling and storage situation of solid waste contaminated with hazardous materials in storage containers and facilities.	(1) Hydropower plant site, (2) Solid waste storage area	Daily	Hydropower Station	EPGE, ECD, Local Government
Noise and Vibration	(1) Physical observation. (2) Noise measurement by sound level meter, as necessary. (3) Collection of complaints.	(1) Hydropower plant site, (2) Access road for rehabilitation work	Daily	Hydropower Station	EPGE, ECD, Local Government
(III) Operation Stage					
No item					
(T) Whole Stages					
1) Social Environment					
Social institutions such as social infrastructure and local decision-making institutions, a split of communities	(1) Collect complains, (3) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
The poor, refugees, indigenous of ethnic minority people	(1) Collect complains, (5) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
Gender	(1) Collect complains, (6) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
Children's Right	(1) Collect complains, (7) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government
Misdistribution of benefit and damage	(1) Collect complains, (8) Consultation with relevant chief of villages and	Surrounding villages and communities of	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government

Category	Method of Monitoring/ Parameter to be monitored	Monitoring Place/Point	Frequency (Period)	Implementation organization*, ***	Responsible and/or supervising org.**
	representatives of community organizations	the hydropower plant			
Local conflict of interests	(1) Collect complains, (9) Consultation with relevant chief of villages and representatives of community organizations	Surrounding villages and communities of the hydropower plant	(1) One time per year, (2) As required	Hydropower Station	EPGE, ECD, Local Government

Note 1: Implementing Organization: EPGE (Head Quarter and/or Manager of Hydropower Plant, CT - Contractor,
Note 2: * esponsible and/or supervising organization - Local Government (Township, District and/or State Government), ECD (Environmental Conservation Department, MONREC), MOEE (Ministry of Electric Power and Energy)
Note 3: ** ost for EMP will be covered within ordinary budget of EPGE and contract fee of contractor.

7. Results of Stakeholder Meetings

Stakeholder meetings were held two times in two villages near the Sedawgyi HPP site.

First stakeholder meeting was held on July10thSaturday 2016 to disseminate outline the rehabilitation project plan and second stakeholder meeting was held on September 10th Saturday 2016 to discuss the results.First stakeholder meeting was held on June 25th Saturday 2016 to disseminate outline the rehabilitation project plan and second stake holder meeting was held on September 10th Saturday 2016 to inform the summary of IEE.

(1) Fist Stakeholder Meeting

1) Date and Time - June, Saturday2016 (From 10AM to 12AM)

2) Venue – Gway Pin village, Madaya Township, Pyin Oo Lwi District, Mandalay Region

3) Participants – 95 persons (Including village chiefs and elder peoples, key informants, NGOs, Local Government Officers from several departments such as Irrigation, Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Sedawgyi Hydropower Plant employees)

4) Presentations, Questions & Answers and Discussions

(i) The GAD township officer gave the opening speech about of the project and work for environmental and social considerations including Initial Environmental Examinations (IEE) and emphasized the importance of the participation with peoples of local communities and officers of related departments. He also mentioned that existing multi-purpose Sedawgyi Dam have been contributing to the benefit to living and livelihood activities of communities with providing sufficient water resources for paddy land and farmland by irrigation dam as well as electric power supply by hydropower generation plant since 1989. As results, local economy of Madaya Township in agricultural and other sectors developed significantly.

(ii) JICA Survey Team briefly explained the purpose and scope of the JICA project, “Preparatory Survey for the Project of Hydropower Plant Rehabilitation in the Myanmar”.

(iii) Sedawgyi Hydropower Station Manager of EPGE explained the history since 1989 and present features of the Sadawgyi Hydropower Plant. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and without increase of power generation capacity due to dilapidation by continuous operation for more than 25 years.

(iv) Local Consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and Myanmar legislations. Then, Dr. explained an IEE level study was required and now the study is in progress according to the JICA Guidelines. At the same time, Dr. also explained that any project is required to obtain prior permission, i.e. Environmental Compliance Certificate (ECC) from Ministry of Natural Resources and Environmental Conservation (MONREC) prior to implementation according to recently enacted Environmental Impact Assessment Procedure 2015 (EIA Procedure) of Myanmar. In addition, Dr. insisted roles of community participation and information disclosure in the project by using power point and hand out paper.

5) Q & A Section

- Village leader from the village tract of Sale village, proposed to departments and survey team for the distribution of electric power to rural village near the hydropower station to get more and easily in accordance with the purpose of Myanmar Government vision.

- Station Manager respond to the question, there are money department of electric under the management of Ministry of Electricity and Energy. He is from the department of electric power production, so he cannot make the decision for distribution of electric power. However, he can understand of community's needs. He suggested that the community should submit to related department for their needs.

- A business man from the village of Gway Pin, said the Sedawygi Dam has been contributed the benefit of local community not only in agriculture sector but also in electric power supply. But unfortunately due to construction of the dam some displacement of peoples and houses occurred, and cattle were damaged. Thus, he would like to suggest to the project rehabilitation for hydropower plant for making proper management to avoid displacement and damage to animals and structures as well as to ensure safety.

- A farmer from the village of Gway Pin, expressed a welcome to the rehabilitation project. At the same time he requested to the Survey Team to inform possible impacts and mitigation measures to local people, because he would like to know the impacts and prepare necessary means in future.

a) Venue - Primary School of X Village

b) Most of Village Peoples using by Motorbikes

c) Pre-meeting with GAD Officer

d) Presentation by Station Manager

e) Photos of Sedawgyi Hydropower Plant

f) Presentation by Local Consultant

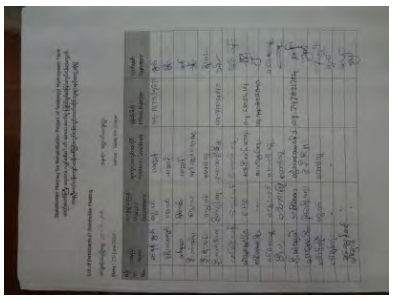
g) Presentation by Village Chief-1

h) Presentation by Village Chief-2

i) Participants - 1

j) Participants - 2

k) Closing remark by GAD Officer



l) Attendants List

Photo 2 Scenes of 1st Stakeholder Meeting

(2) Second Stakeholder Meeting

1) Date and Time– 10 September, Saturday2016 (From 9 AM to 11 AM)

2) Venue – Yay Nan Thar village, Madaya Township, Pyin Oo Lwin District, Mandalay Region

3) Participants – 195 persons (including village chiefs and elder peoples, key informants, NGOs, Local Government Officers from several departments, such as Irrigation, Agriculture, Forestry, Fishery, Environmental Conservation, Land Use Departments, and Sedawgyi Hydropower Plants employees)

4) Presentations, Questions & Answers and Discussions

(i) The GAD township officer gave an opening speech about of the project and work for environmental and social considerations including Initial Environmental Examinations (IEE). He emphasized the importance of the participation of local communities and officials of related departments. He also mentioned that existing multi-purpose Sedawgyi Dam have been contributing to the benefit to the living and livelihood activities of communities with providing sufficient water for paddy land and farmland irrigation as well as electric power supply from hydropower generation plant since 1989. As results, local economy of Madaya Township in agricultural and other sectors have been developed significantly.

(ii) JICA Survey Team briefly explained the purpose and scope of the JICA project, "Preparatory Survey for the Project of Hydropower Plant Rehabilitation in ~~the~~ Myanmar. He explained the important needs of rehabilitation work for an hydropower by giving an example of a mobile phone and its battery"

(iii) Sedawgyi Hydropower Station Manager explained the history of the hydropower since 1989 and mentioned the current features of the Sadawgyi Hydropower Plant. He emphasized the necessity of rehabilitation of major equipment and devices of the plant without expansion and no increase of power generation capacity. The rehabilitation work is necessary to perform urgently because of the continuous operation for more

than 25 years without performing any such rehabilitation work.

(iv) Local Consultant emphasized that the rehabilitation project is required to comply with both the JICA Guidelines and existing Myanmar legislations. Then, she explained the summary of the IEE level study for the possible impacts of this project on the people and environment. The impacts were estimated by different project stages, such as planning (before operation), during operation and after operation. It includes environmental issues, such as land use and topography, air and water pollution, soil contamination, solid wastes problem, etc. For the social environment and social services, township level social infrastructure, local economy, livelihoods, situation of gender and children, vulnerable groups -the poor, refugees, and indigenous of ethnic people etc. were discussed. It was generally estimated that there will be no significant negative impact of the rehabilitation project on the environment and the community.

Currently, the study is in progress and the report of the study team will be timely completed. The Consultant expected the Environmental Compliance Certificate (ECC) will be approved by the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation (MONREC). In addition, the Consultant insisted the roles of community participation and information disclosure and thanks all participants for their cooperation for successful completion of the project.

5) Q&A Section

- Village leader of Yay Nan Thar village, discussed on the current situation of the dam. The dam is under threat because of the high sedimentation problem caused by the gold mining activities in the upper part of the dam. The timber extraction of the watershed area which become bigger and bigger damaged the dam day by day. It looks like a flat pan since the situation of sedimentation more prominent. It creates paddy fields and settlements of low land area seriously flooded in rainy season. He proposed and requested to the concerned departments and survey team for finding ways and means of the improvement of dam situation in a timely manner. Sedawgyi Dam and its watershed system is very important for all villages to make the sustainable of their livelihood.

- A villager of Yay Nan Thar village was asked to Irrigation Department. "Is there will sufficient water supply to villages while the project starts?"

- The question was answered by the township officer of the Department of Irrigation that there will be no concern with the rehabilitation process and irrigation, so that no disturbances on irrigation schedules to the rice fields. He added that from the side of Irrigation Department was ready to distribute for supply water to the villages as before.

- A farmer from Sa Lay village, asked to the local consultant's presentation. In the presentation was shown for the environmental study results that air pollution is expected no problem for the villagers. But he worries about waste water and vibration produced by the project operation. He wants to know how to control that problem.

- The Local Consultant interpreted the question to civil engineer and sub team leader, Mr. Matsunaga and he answered that waste water will not be released to the dam and river. The waste will be kept and stored in steel container before release to environment/ surrounding. The vibration may occur in a very small intensity.

- The Local consultant took the question to civil engineer of JICA survey sub team leader and answer that waste water will not release to dam and river, every waste will keep and store in steel container for environmental consideration. Other thing of vibration may occur very small, if any.

Venue – Community hall, Yay Nan Thar village

2) Registration of attendants

3) Opening remarks by Madaya Township GAD Officer

4) Presentation by Station Manager of Sedawgyi Hydropower Plant

5) Presentation by Local Consultant

6) Presentation by attendant -1

7) Presentation by attendant -2

8) Attendants of the Meeting

9) Attendants came by motor bikes and cars as well as by walk

Photo 3 Scenes of Second Stake

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန
ရုံးအမှတ်(၅၃)၊နေပြည်တော်

စာအမှတ်၊ အီး-အိုင်အေ - ၂ / ၂ (ဂျလ(ခ)/၂၀၁၆)
ရက်စွဲ၊ ၂၀၁၆ ခုနှစ် အောက်တိုဘာလ ၇ ရက်

ဦးဆောင်ညွှန်ကြားရေးမှူး
လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း
လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန

အကြောင်းအရာ။ **ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံနှင့် ဆည်တော်ကြီးရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံတို့အား အကြီးစား မွမ်းမံပြင်ဆင်ခြင်းလုပ်ငန်းများ ပြုလုပ်ရန်အတွက် အဆိုပြုတင်ပြလာခြင်းအပေါ် သဘောထားမှတ်ချက်ပြန်ကြားခြင်း**

ရည်ညွှန်းချက်။ (၁) လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း၏ ၂၇-၇-၂၀၁၆ ရက်စွဲပါ စာအမှတ်၊ ၂၃၃၁/လစထလ/ပစရအ/လစ-၂၅/၂၀၁၆

(၂) JICA Study Team ၏ ၈-၇-၂၀၁၆ ရက်စွဲပါစာအမှတ်၊ NJC_HPR-00*

(၃) JICA Study Team မှ ပြန်လည်ပြင်ဆင်ပေးပို့သည့် ၂၆-၈-၂၀၁၆ ရက်စွဲပါစာအမှတ်၊ NJC_HPR-00*

၁။ အထက်အကြောင်းအရာပါကိစ္စနှင့်ပတ်သက်၍ လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်းနှင့် ဂျပန်အပြည်ပြည်ဆိုင်ရာပူးပေါင်းဆောင်ရွက်ရေးအေဂျင်စီ (JICA) တို့သည် ဘီလူးချောင်းအမှတ်(၁) ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံနှင့် ဆည်တော်ကြီးရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံတို့ကို အကြီးစားမွမ်းမံပြင်ဆင်ခြင်း (Rehabilitation) လုပ်ငန်းများ ပြုလုပ်ရန်အတွက် JICA survey team မှ ပြုစုထားသော စီမံကိန်းအဆိုပြုလွှာကို စိစစ်၍ သဘောထားမှတ်ချက်ပြန်ကြားပေးရန် ရည်ညွှန်းစာများဖြင့် အကြောင်းကြားလာပါသည်။

၂။ ပူးတွဲပေးပို့လာသည့် စီမံကိန်းအဆိုပြုလွှာတွင် ဘီလူးချောင်းအမှတ်(၁) ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် နမ်ပေါမြစ်လက်တက်ဖြစ်သည့် ဘီလူးချောင်းပေါ်တွင် တည်ရှိ၍ ကယားပြည်နယ်၊ လွိုင်ကော်မြို့မှ ၂၀ ကီလိုမီတာခန့်ကွာဝေးပြီး ၁၉၉၂ ခုနှစ် ဩဂုတ်လမှ စတင်တည်ထောင်လုပ်ကိုင်ခဲ့ကြောင်း၊ ဆည်တော်ကြီးရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံသည် ဧရာဝတီမြစ်လက်တက်ဖြစ်သည့် ဆည်တော်ကြီးမြစ်ပေါ်တွင်တည်ရှိ၍ မန္တလေးမြို့ နှင့် ၆၀ ကီလိုမီတာခန့် ကွာဝေးပြီး ၁၉၈၉ ခုနှစ် မေလမှ စတင်တည်ထောင် လုပ်ကိုင်ခဲ့ကြောင်း စိစစ်တွေ့ရှိရပါသည်။

၃။ အဆိုပြု ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံ (၂) ခုကို အကြီးစားမွမ်းမံပြင်ဆင်ရန်အတွက် (၂) နှစ်စီကြာမြင့်မည်ဖြစ်ပြီး ဓာတ်အားပေးစက်ရုံများနှင့် ဆည်များ၏ တည်နေရာအရွယ်အစားများ၊ စက်အင်အားနှင့် ဓာတ်အားထုတ်လွှတ်မှုပမာဏတို့ကို တိုးချဲ့ပြောင်းလဲခြင်းမရှိဘဲ ယိုယွင်းနေသော စက်ပစ္စည်းကိရိယာများကို ပြင်ဆင်ခြင်း နှင့် အသစ်လဲလှယ်ခြင်းတို့ကိုသာ ပြုလုပ်မည်ဖြစ်ကြောင်း စာမျက်နှာ (၂) အပိုဒ် (၂) နှင့် ဇယား (၁၊ ၂၊ ၃၊ ၄၊ ၅) တို့တွင် ဖော်ပြထားသည်ကို စိစစ်တွေ့ရှိရပါသည်။

၄။ သို့ဖြစ်ပါ၍ အဆိုပြုစီမံကိန်းတွင်ဖော်ပြပါရှိသည့် ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံ(၂)ခုသည် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေများ မပြဋ္ဌာန်းမီက စတင်တည်ထောင်လုပ်ကိုင်ခဲ့သော လုပ်ငန်းများဖြစ်သောကြောင့်လည်းကောင်း၊ အကြီးစားမွမ်းမံပြင်ဆင်ခြင်းပြုလုပ်ရာတွင် တပ်ဆင် အသုံးပြုမည့် စက်ပစ္စည်းကိရိယာများ၊ ဓာတ်အားပေးစက်ရုံများ၏ တည်နေရာနှင့်အတိုင်းအတာ မတူညီခြင်းတို့ကြောင့်လည်းကောင်း ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေများ၊ နည်းဥပဒေ ၅၅ (က) အရ စီမံကိန်းအပေါ် ပတ်ဝန်းကျင်ဆိုင်ရာစီစစ်မှု ပြုလုပ်၍ အောက်ပါအချက်အလက်များပါဝင်သည့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (Environmental Management Plan-EMP) ကို ကျွမ်းကျင်ပညာရှင်များဖြင့် ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံ (၁) ခုချင်းအလိုက်ရေးဆွဲ၍ သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တင်ပြရမည်ဖြစ်ကြောင်း ပြန်ကြားအပ်ပါသည်။

(က) အကြို့တည်ဆောက်ခြင်း၊ တည်ဆောက်ခြင်း၊ လုပ်ငန်းလည်ပတ် ဆောင်ရွက်ခြင်း၊ ရပ်ဆိုင်းခြင်း၊ ပိတ်သိမ်းခြင်းနှင့် ပိတ်သိမ်းပြီးကာလစသည့် စီမံကိန်းလုပ်ငန်း အဆင့်အလိုက် အကြောင်းအရာဖော်ပြချက်၊

(ခ) စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် လူမှုစီးပွားရေးဆိုင်ရာနှင့် လိုအပ်ပါက ကျန်းမာရေးဆိုင်ရာ မူဝါဒ၊ ကတိကဝတ်၊ ဥပဒေဆိုင်ရာလိုအပ်ချက်နှင့် ဖွဲ့စည်းမှုဆိုင်ရာစီစဉ်ဆောင်ရွက်မှုများ၊

(ဂ) ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုများနှင့် လျော့နည်းစေရန် ဆောင်ရွက်မည့် လုပ်ငန်းများအကျဉ်းချုပ်၊

(ဃ) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အား အကောင်အထည်ဖော်ဆောင်ရွက်ရန် ယေဘုယျအသုံးစရိတ်၊

(င) အကြို့တည်ဆောက်ခြင်း၊ တည်ဆောက်ခြင်း၊ လုပ်ငန်းလည်ပတ်ဆောင်ရွက်ခြင်း၊ ရပ်ဆိုင်းခြင်း၊ ပိတ်သိမ်းခြင်းနှင့် ပိတ်သိမ်းပြီးကာလစသည့် စီမံကိန်းလုပ်ငန်းအဆင့်အလိုက် စီမံခန့်ခွဲမှုနှင့် စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးမှုအစီအစဉ်ခွဲများနှင့် စပ်လျဉ်း၍ ဆူညံမှု၊ တုန်ခါမှု၊ စွန့်ပစ်ပစ္စည်း၊ စွန့်ပစ်ရေနှင့်ရေဆိုးများ၊ လေအရည်အသွေး၊ အန္တရာယ်၊ ဓာတုပစ္စည်း၊ ရေအရည်အသွေး၊ တိုက်စားမှုနှင့်နုန်းအနည်ကျမှု၊ ဇီဝမျိုးစုံမျိုးကွဲ၊ လုပ်ငန်းခွင်ဆိုင်ရာနှင့် လူမှုအဖွဲ့အစည်းဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ်ကင်းရှင်းရေး၊ ယဉ်ကျေးမှုအမွေအနှစ်၊ အလုပ်အကိုင်နှင့် လေ့ကျင့်သင်ကြားမှုနှင့်

အရေးပေါ်တုန့်ပြန်မှုစသည့် သက်ဆိုင်ရာပက်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲမှုနှင့် စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးမှုကိစ္စရပ်များ ဖော်ပြချက်၊

(စ) အစီအစဉ်ခွဲအလိုက် ပါဝင်ရမည့် အကြောင်းအရာများ၊

(၁) ရည်ရွယ်ချက်များ၊

(၂) ဥပဒေဆိုင်ရာလိုအပ်ချက်များ၊

(၃) လွှမ်းခြုံမြေပုံကြိုးများ၊ လုပ်ငန်းခွင်အလိုက် မြေပုံများ၊ ဓာတ်ပုံများ၊ ကောင်းကင်ဓာတ်ပုံများ၊ ဂြိုလ်တုဓာတ်ပုံများ၊

(၄) အကောင်အထည်ဖော်ဆောင်ရွက်မည့် အစီအစဉ်၊

(၅) စီမံခန့်ခွဲမှုဆောင်ရွက်ချက်များ၊

(၆) စောင့်ကြပ်ကြည့်ရှုမည့် အစီအစဉ်များ၊

(၇) ရန်ပုံငွေလျာထားချက်နှင့် တာဝန်များ။

(ဆ) အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက်များ ထုတ်ဖော်တင်ပြခြင်း၊

(၁) နည်းလမ်းသတ်မှတ်မှုနှင့် ချဉ်းကပ်မှု၊

(၂) ဆွေးနွေးညှိနှိုင်းမှုအကျဉ်းချုပ်နှင့်ဆောင်ရွက်သည့်လှုပ်ရှားဆောင်ရွက်မှုများ၊

(၃) ဆွေးနွေးညှိနှိုင်းမှုများ၏ ရလဒ်များ၊

(၄) ဆက်လက်ဆောင်ရွက်မည့်တိုင်ပင်ဆွေးနွေးမှုများ၊

(၅) သတင်းအချက်အလက်ထုတ်ဖော်ချက်။

(လှမောင်သိန်း)
ညွှန်ကြားရေးမှူးချုပ်

မိတ္တူကို

ပြည်ထောင်စုဝန်ကြီးရုံး၊
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၊ ရုံးအမှတ်(၂၈)
ရုံးလက်ခံ၊ မျှောစာတွဲ၊ အမှုတွဲချုပ်

English Translation

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL CONSERVATION
ENVIRONMENTAL CONSERVATION DEPARTMENT
OFFICE BUILDING NO.(53), NAY PYI TAW

Letter No. EIA- 2/2 (827(B)/2016
Date: 12th, October, 2016

To
Managing Director
Electric Power Generation Enterprise
Ministry of Electricity and Energy

Subject- Comment on Project Proposal for Rehabilitation of Baluchaung No.1 and Sedawgyi Hydropower Plants

Reference – (1) Letter of No. 2331/La Sa Hta La/Pa Sa Ya/La Sa-25/2016 by the Electric Power Generation Enterprise, Ministry of Electricity and Energy dated on 27th, July, 2016
(2) Letter of NJC-HPR00** by JICA Survey Team dated on 8th, July, 2016
(3) Letter of NJC-HPR00** by JICA Survey Team Revised Project Proposal dated on 26th, August, 2016

1- Regarding of above matter, JICA and Electric Power Generation Enterprisee, Ministry of Electricity and Energy have planned to rehabilitate the existing Baluchaung No.(1) and Sadawgyi hydropower plants. JICA Survey Team was submits the proposal to Ministry Resource and Environmental Conservation.

2- In the proposal, it was observed that Baluchaung No.1 Hydropower Plant is located in the Baluchaung River which is a tributary of the Nam Pawn River of the Thanlwin River system and was commenced in operation in August 1992. It is located 20 kilometers far from Loikaw City, the capital of Kayah state. Sedawgyi Hydropower Plant is located in the Sedawgyi River of the Ayeyarwady River system, Which is located 60 kilometers far from Mandalay and it was established in May 1989.

3- For rehabilitation work of two Power Plants will take two years for each. There will be no change and no extension of the working size of dams and hydropower plant engine power, electric power generation due to sluicing intake water. No changes in space and dimension of civil facilities such as powerhouse. No raising / expansion of existing body of which was described in table (1, 2, 3, 4 and 5).

4- The above said hydropower plants were established before enacting of environmental conservation procedure. Rehabilitation work will use different equipment and machines for two power plants. Their location and size were not same. According to the Environmental Impact Assessment procedure No. 55 (A), the project needs to draw (Environmental Management Plan-EMP) for each power plant with relevant consultants and to submit to Ministry of Natural Resource and Environmental Conservation with following items.

(A) Planning Stage (Preconstruction Stage), Construction Stage (Rehabilitation Work), Completion Stage,

(B) Management on Environmental Conservation, Socio-economical, Health Policy, Rules and Regulations

(C) Brief mitigation measure of Environmental Impact

(D) General Expenditure to Implement the Environmental Management Plan

(E) Environmental Monitoring Plan during Preconstruction, Construction, Operation, Termination, After termination concerning with the noise, vibration, solid waste, water quality, air quality, erosion and siltation, biodiversity, occupational and social health, safety, culture, job opportunity, training and emergency relief, etc.…

(F) Sub Titles are:
(1) Objectives
(2) Law and Regulation
(3) Area Map, Project Map, Photos, Satellite Map, GIS maps
(4) Implementation Plan
(5) Management Plan
(6) Monitoring Plan
(7) Estimated Budget and Responsibilities

(G) Consultation with local community and Reporting and disclosure
(1) Methodology and Approach
(2) Summary of consultation report and meeting Activities
(3) Consultation Results
(4) Future consultation on
(5) Disclosure

(Hla Maung Thein)
Director General

Copy to- Union Minister's office
Ministry of Natural Resource and Environmental Conservation, Office No.(28)
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