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)

Turbi	Je S	ite Ins	pection	Check	List	[Plant Name]: <u>Baluchaun No.</u> 1 [Uni Inspection Date; February 2016, ″1 – 11″	it No].:	#1&#	5		Note: Good・O Bad・× ※・specially noted
Equipment	Majour Class	Sub- class 1	Sub- class 2	Inspecti	on Item	Inspection Point	Method	Resu Unit-1	lts Unit-2	Photo	Remarks
Turbine	Turbine Interior	Casing	Casing Body	Casing Interior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, Foreign Materials, etc.	Visual Inspection	0	0	0	to damage and defectc
		(Inner portion)	Man Hole	Surface, Packing	Visual Condition	Water Leak, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	litto
			Stay Ring	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	litto
			Stay Vanes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	litto
		Guide Vanes		Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	vo damage and defect
				Seat Plates	Visual Condition	Defects, Erosion and Corrosion, etc.	Visual Inspection	0	0	0	litto
				Side Gaps	Visual Condition	Upper and lower clearance conditions	Visual Inspection	*	*	0	Jpper and lower gap measurement: approx.0.7mm (average), which is larger than he design value of 0.3mm ⁻ oreign 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	×	×	0	Javitation 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. lepth of
			Runner Cone/Hub	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	×	×	0	Javitation erosion at the portion of runner band outer periphery; max. depth of 5^- smm
			Runner Liner	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	n.a.	n.a	I	
			Seal Rings	Surface, Seal Gaps	Visual Condition	Gap Condition, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	to damage and defect
			_								
		Draft Tube	Upper Draft Tube	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	vo damage and defect
			Air Admi. Pipes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	vo damage and defect
			Discharge Ring	Surface	Visual Condition	Peripheral Gap. Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	*	*	0	Slight cavitation pitting on the surface just downstream of the root of air pipe
	Turbine Exterior	Casing	Casing Body	Casing Exterior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	to damage and defect
		(Exposed portion)	Man Hole	Surface	Visual Condition	Bolting condition, openab;e/closable condition, damages, etc.	Visual Inspection	0	0	0	to damage and defect

Gude Vane Servomot or	t Body	Genera	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
	Oil piping	Genera	Visual Condition	Oil leakage. damages, Bolting condition, etc.	Visual Inspection	0	0	0	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
	Connectin g Device	Genera	Visual Condition	BacklLash, Damages, Bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
G.V. Mecha-	Mechanis m parts	Genera	Visual Condition	Back lash, Damage, Bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
uism	Shear Pin	Genera	Visual Condition	Setting condition, Damage, lead wire condition, etc.	Visual Inspection	*	*	0	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	0	0	0	No damage and defect
Turbine Shaft		Surface	Visual Condition	Damages, Bolting conditiond, etc.	Visual Inspection	0	0	0	No damage and defect, but slight rust on thesurface was found
Turbine Bearing	Oil tank	Genera	Visual Condition	Oil/Water leakage. Damage, bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
	Temp. device	General	Visual Condition	Mounting condition, Lead wire condition, etc.	Visual Inspection	0	0	0	No damage and defect
	Oil/Water pipings	General	Visual Condition	Oil/Water leakage. Damage, bolting condition, etc.	Visual Inspection	*	*	0	Heavily rusted portions were found on water pipes
Head Cover		Surface	Visual Condition	Damage. Water leakage, Accumulation of earth/sand, Bolting condition	Visual Inspection	0	0	0	No damage and defect, but thin soil film covered the upper surface of the cover
Pipings	Oil/Water/ Air pipings	Genera	Visual Condition	Oll/Water/Air leakage, damage, Fixing condition, etc.	Visual Inspection	*	*	0	Heavily rusted portions were found on the outer surfaces of water pipes
(in turbine ait)									
Electrical Wirerings		Genera	Visual Condition	Damage. Fixing condition, etc.	Visual Inspection	0	0	0	No damage and defect
(in turbine	e pit)								
Runner V Operating Mechanisı	ane T	General	Visual Condition	Return lod/wire condition, Damage, bolting condition, etc.	Visual Inspection	n.a.	n.a.	I	

The inspection was carried out by S. Kushinoto,	<u> </u>	Others							-
The inspection was carried out by S. Kushimoto.									-
	<u>т</u>	he inspectic	on was carried	out by S. Kush	himoto,				

(Turbir	le] S	ite Ins	pection	Check	List	[Plant Name]: Sedawgyi [Unit No]. Inspection Date; February 2016, 715 – 257	#1 &	¥			Note : Good-O Bad- x
Equipment	Majour Class	Sub- class 1	Sub- class 2	Inspecti	on Item	Inspection Point	Method	Resu Unit-1	tts Unit-2	Photo	Remarks
Turbine	Turbine Interior	Casing	Casing Body	Casing Interior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, Foreign Materials, etc.	Visual Inspection	1	*	0	to damage and defect, but many potions having rust blisters were found. No oreign material are in the casing.
	(Note-1)	(Inner portion)	Man Hole	Surface, Packing	Visual Condition	Water Leak, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	1	0	0	to damage and defect
			Stay Ring	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	I	*	0	to 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	1	0	0	to damage and defect
		Guide Vanes		Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	I	0	0	to damage and defect
				Seat Plates	Visual Condition	Defects, Erosion and Corrosion, etc.	Visual Inspection	1	0	0	litto
				Side Gaps	Visual Condition	Upper and lower clearance conditions	Visual Inspection	1	*	0	Joper and lower gap measurement; .1.5–2.0mm (average), which is larger than he design value of 0.5mm lo Foreign material were tucked at side gaps.
		Runner	Runner Vanes	Surface	Visual Condition	Orack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	1	×	0	Savitation erosion at below portions 1) At around runner vane periphral inlet portion on suction surface: <u>heavy erosion</u> having max. depth of 10–(14)mm 2) And portions having cavitation erosion, max. depth of 1– 3mm, on the fin urface near the portions of (1). 3) Slightly cavitated portions at the root of vanes on the disk surfaces, suction 3) Slightly cavitated portions at the root of vanes on the disk surfaces, suction 3) Slightly cavitated portions at the root of vanes on the disk surfaces, suction 3) Slightly cavitated portions at the root of vanes on the disk surfaces.
			Runner Cone/Hub	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	I	0	0	to damage and defect
			Runner Liner	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	1	n.a	ı	
			Seal Rings	Surface, Seal Gaps	Visual Condition	Gap Condition, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	I	n.a	1	
		Draft Tube	Upper Draft Tube	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	I	0	0	to damage and defect
			Air Admi. Pipes	Surface	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	n.a	n.a	1	
			Discharge Ring	Surface	Visual Condition	Peripheral Gap, Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	I	*	0	some abration signatures on the surface facing the runner vane outer periphery were found. The measuring results of <u>gaps between runner vane peripheries and the</u> corresponding surface of discharge ring were scattered between 0.55–5.34mm <u>.</u>
	Turbine Exterior	Casing	Casing Body	Casing Exterior	Visual Condition	Crack, Deformation, Erosion and Corrosion, Defects, etc.	Visual Inspection	0	0	0	to damage and defect

Speciallymotod × Barl• X Note Cont.O

(Exposed portion)	Man Hole	Surface	Visual Condition	Bolting condition, openab:e/closable condition, damages, etc.	Visual Inspection	0	0	0	No damage and defect
Gude Vane Servomot	Body	Genera	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
;	Oil piping	General	Visual Condition	Oil leakage, damages, Bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
	Connectin g Device	Genera	Visual Condition	BacklLash, Damages, Bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
G.V. Mecha-	Mechanism parts	Genera	Visual Condition	Back lash. Damage, Bolting condition, etc.	Visual Inspection	*	*	0	Generally no damage and defect, but excess water leakage from the shaft seal packing of some guide vane stems
nism	Shear Pin	Genera	Visual Condition	Setting condition, Damage, lead wire condition, etc.	Visual Inspection	*	*	0	No experience of shear pin fracture, but <u>some troubles of malfunction alert by the</u> fracture detector atached to the shear pin portion occurred.
	Sliding parts	Surface	Visual Condition	Damages, lubricating condition, etc.	Visual Inspection	0	0	0	No damage and defect
Turbine Shaft		Surface	Visual Condition	Damages, Bolting conditiond, etc.	Visual Inspection	*	*	0	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	01/Water leakage, Damage, bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
	Temp. device	Genera	Visual Condition	Mounting condition, Lead wire condition, etc.	Visual Inspection	0	0	0	No damage and defect, but its deterioration might be developed.
	Oil/Water pipings	Genera	Visual Condition	01/Water leakage. Damage. bolting condition, etc.	Visual Inspection	0	0	0	No damage and defect
Head Cover		Surface	Visual Condition	Damage, Water leakage. Accumulation of earth/sand. Bolting condition	Visual Inspection	0	0	0	No damage and defect, and considerably clean despite of the long operation
Pipings	Oil/Water/ Air pipings	General	Visual Condition	011/Water/Air leakage, damage, Fixing condition, etc.	Visual Inspection	*	*	0	No damage and defect, but the inside of small water pipes might be deteriorated.
(in turbine pit)	brainage Pumps	Genera	Visual Condition	Operating conditions, etc.	Visual Inspection	×	×	0	One of two pumps was gamaged and out of service, both units.
Electrical Wirerings		General	Visual Condition	Damage. Fixing condition, etc.	Visual Inspection	0	0	0	No damage and defect
(in turbine	e pit)								

No damage and defect				
0				
0				
0				
Visual Inspection				
Return lod/wire condition. Damage, bolting condition. etc.			carried out because of much water leakage from the intake stop log.	
Visual Condition		iimoto,	#1 was not c	
Genera		out by S. Kusl	terior of unit–	
Runner Vane Operating Mechanism	 Others	The inspection was carried	The inspection of the turbine ir	
		[Special Note]	(Note-1) 1	

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.

<u>1. Guide vane clearance at the top and bottom portion</u>

						(unit: mm)
		Unit #1			Unit #2	
Position		Location			Location	
	(1)	(2)	(3)	(1)	(2)	(3)
а	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





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
1 10:4 #0	G1	2.5
Unit #2	G2	2.8
	H design value	13
Unit #2	Н	14
Unit #1	Н	15

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Sedawgyi Hydropower Plant / Turbine internal inspection <u>Measurement on the clearance of mechanical components (for Unit</u> #2)

<u>#2)</u>

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.

<u>1. Guide vane clearance at the top and bottom portion</u>



No	Wicket Gate No	a	a'	a+a'	b	b,	b+b'
1	l	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



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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 F

Plant Name; Baluchaung No.1 Unit No; 1

Date; February 8, 2016

•	Remarks		no abnormal condition	ditto	ditto	frequent water leakage, not much rust inside of cooling water piping	no abnormal condition	detrioration of pump/motor and control equipment.					several slide scaring		detrioration of control equipment		no spare valve	no abnormal condition	oil leakage from welding points, oil leakage from upper bearing tank	no abnormal condition	oil leakage on upper bracket
	Photo		0	0	0	0		0				0	0	0	0	0	0		0	0	0
	Result	د	د	Г	د	د	د	4	⊲	Q	د	د	4	د	4	4	د	د	×	Г	4
•	Inspection point	Oil leakage, Water leakage	Transformation, Dust. Looseness, Rust, etc.	Damage, Transformation, Looseness, oil, etc.	Damage, Crack, etc.	Water leakage, Looseness, etc.	oil leakage, Water Leakage, Looseness, etc.	Running condition, oil Leakage. Looseness, etc.	Bearing, Vibration, Noise, Wire, Terminal. Coupling. Bolt, Nut, Overheat etc.	Looseness, Damage of contact, etc.	Oil leakage, etc.	Air leakage, oil leakage, etc.	Crack, Transformation, etc.	Wear, Transformation, etc.	Looseness, Transformation. Damage, etc.	Damage, Transformation, Looseness, etc.	Leakage. Orack, etc.	Damage, Crack, Looseness, etc.	Damage, Crack, Looseness, etc.	Crack, Damage, Looseness, etc.	Water Contamination, Oil leakage. etc.
	Inspection Item	General	Core, Frame	Coil	Pole	Air cooler	Oil Cooler	Pump	Motor	Controller	Piping, Valve	Break	Break ring	Shoe	General	Limit SW	General	General	General	Shaft, Coupling	Oil tank
	Sub-class2							Pump	Motor	Controller	Piping, Valve				Controller		Air tank				
	Sub-class1		Stator		Rotor	Air cooler	Oil Cooler	Oil lifter				Break						Lower bracket	Upper bracket	Shaft	Thrust bearing
	Major Class	Generator																			
	Equipment	tenerator																			

 Condition, damage, Vater Leakage, Oil Leakage, etc. Condition, damage, etc. Damage, Looseness, Cable condition, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. 	 Condition, Jamage, Water Leakag Condition, damage, etc. Condition, damage, etc. Damage, Looseness, Cable conditi Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. Damage, Looseness, Overheat, et Looseness, Oil leakage, etc. Looseness, Oil leakage, etc. 	Oil tank Thermo sensor
 Condition, damage, etc. Damage, Looseness, Cable condition, etc. Looseness, Crack, Damage, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. 	 Condition, damage, etc. Damage, Looseness, Cable conditi Looseness, Crack, Damage, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. Damage, Looseness, overheat, et Looseness, Oil leakage, etc. Looseness, Oil leakage, etc. 	Thermo sensor
 Bamage, Looseness, Cable condition, etc. Looseness, Crack, Damage, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. 	Damage, Looseness, Cable conditi Looseness, Crack, Damage, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. Damage, Looseness, Overheat, et Looseness, Oil leakage, etc. Looseness, Oil leakage, etc.	
t Looseness, Crack, Damage, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc.	Looseness, Crack, Damage, etc. Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. Damage, Looseness, Overheat, et Looseness, Oil leakage, etc. Looseness, Oil leakage, etc.	Collector ring
Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc.	Lead wire damage, looseness, etc. Crack, Damage, Looseness, etc. Damage, Looseness, Overheat, et Looseness, Oil leakage, etc. Looseness, Oil leakage, etc.	Rotating part
Crack, Damage, Looseness, etc.	Crack, Damage, Looseness, etc. Damage, Looseness, Overheat, etr Looseness, Oil leakage, etc. Looseness, Oil leakage, etc.	General
Damage Lonceness Overheat etc	Damage, Looseness, Overheat, ett Looseness, Oil leakage, etc. Looseness, Oil leakage, etc.	Axis, gear
Uallage, L00001000, 0 101 1044, 000	Looseness, Oil leakage, etc. Looseness, Oil leakage, etc.	Flow
Looseness, Oil leakage, etc.	Looseness, Oil leakage, etc.	Oil level
 Looseness, Oil leakage, etc. 		Temperature

Check	List on	Generat	tor	Plant Na	me; Baluchaung No.1 Unit	No;2	_	Date	; February 3, 2016
Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	8	lesult	Photo	Remarks
enerator	Generator			General	Oil leakage, Water leakage		د		
		Stator		Core, Frame	Transformation, Dust, Looseness, Rust, etc.		د	0	no abnormal condition
				Coil	Damage, Transformation, Looseness, oil, etc.		د	0	ditto
		Rotor		Pole	Damage, Crack, etc.		د	0	ditto
		Air cooler		Air cooler	Water leakage, Looseness, etc.		⊲	0	<mark>frequent water leakage</mark> , not much rust inside of cooling water piping
		Oil Cooler		Oil Cooler	oil leakage, Water Leakage, Looseness, etc.		د		no abnormal condition
		Oil lifter	Pump	Pump	Running condition, oil Leakage. Looseness, etc.		⊲	0	detrioration of pump/motor and control equipment.
			Motor	Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, etc.	Overheat	⊲		
			Controller	Controller	Looseness, Damage of contact, etc.		⊲		
			Piping, Valve	Piping, Valve	Oil leakage, etc.		د		
		Break		Break	Air leakage, oil leakage, etc.		د	0	
				Break ring	Crack, Transformation, etc.		4	0	several slide scaring
				Shoe	Wear, Transformation, etc.		د	0	
			Controller	General	Looseness, Transformation. Damage, etc.		⊲	0	detrioration of control equipment
				Limit SW	Damage, Transformation, Looseness, etc.		Þ	0	
			Air tank	General	Leakage, Crack, etc.		د	0	no spare valve
		Lower bracket		General	Damage, Crack, Looseness, etc.		د		no abnormal condition
		Upper bracket		General	Damage, Crack, Looseness, etc.		4	0	oil leakage from upper baering tank
		Shaft		Shaft, Coupling	Crack, Damage, Looseness, etc.		د	0	no abnormal condition
		Thrust bearing		Oil tank	Water Contamination, Oil leakage. etc.		⊲	0	oil leakage on upper bracket
				Thermo sensor	Condition, Damage, etc.		د		

Remarks	oil leakage on lower bracket		rough surface of sliprings, much carbon powder, much oil leakage from uppert bearing tank		no abnormal condition		no abnormal condition	lower bearing oil level is not read (not functional)	no abnormal condition	
Photo	0		0		0		0	0	0	
Result	٩	د	×	د	د	د	د	4	۲	
Inspection point	Looseness, Damage, Water Leakage, Oil Leakage, etc.	Condition, damage, etc.	Damage, Looseness, Cable condition, etc.	Looseness, Crack, Damage, etc.	Lead wire damage, looseness, etc.	Crack, Damage, Looseness, etc.	Damage, Looseness, Overheat, etc.	Looseness, Oil leakage, etc.	Looseness, Oil leakage, etc.	
Inspection Item	Oil tank	Thermo sensor	Collector ring	Rotating part	General	Axis, gear	Flow	Oil level	Temperature	
Sub-class2					nerator					
Sub-class1	Guide bearing		Collector		Speed signal ge		Relay			
Major Class										
Equipment										Remarks

te;February 8, 2016	Remarks	no abnormal condition, no spare(FCB)					Stain		
Da	Photo	0				0			
<u> </u>	Result	Г	د	د	د	د	Δ	د	
Unit No									
Name; Baluchang No.1	Inspection point	Vear, Looseness, Breakage, Lubulication oil, etc.	Jamage, etc.	stain, Damage, Overheat, Looseness, etc.	-ooseness, Overheat, etc.	Stain, Damage, Overheat, Looseness, etc.	štain, Damage, etc.	Jamage, Oil leakage, etc.	
n Plant	Inspection Item	Mechanical part V	Indicator	Close/open coil S	Wire, Terminal L	Conductor S	Insulator	Meter	
n Systen	Sub-class2	aker	1		I	former	1		
Excitatio	Sub-class1	Field circuit bre				Excitation trans			
List on E	Major Class	Exciter							
Check	Equipment	Excitation system							Remarks

Check Li	st on E	xcitation	System	Plant	Name; Baluchang No.1	Unit No;	2	Da	te;February 3, 2016
Equipment	Major Class	Sub-class1	Sub-class2 Ir	nspection Item	Inspection point	<u>۳</u>	esult	Photo	Remarks
Excitation system	Exciter	Field circuit brea	aker	Aechanical part	Near, Looseness, Breakage, Lubulication oil, etc.		د	0	io abnormal condition, no spare(FCB)
			<u> </u>	Indicator	Jamage, etc.		د		
			<u> </u>	Close/open coil	Stain, Damage, Overheat, Looseness, etc.		د		
				Wire, Terminal I	-ooseness, Overheat, etc.		د		
		Excitation transf	ormer	Conductor (Stain, Damage, Overheat, Looseness, etc.		4	0	Jamage on lead
			<u> </u>	Insulator (Stain, Damage, etc.		4		stain
			<u> </u>	Meter	Damage, Oil leakage, etc.		د		
Remarks		FCB(41) frequ	lent troubles				-		

Remarks	no abnormal condition			
 Photo	0			
Result	L	۲	٦	
Inspection point	Crack, Breakage, Looseness, Rust, etc. on main devices	Damage, Looseness, etc. of grounding wire	Crack, Damage Transformation, Stain, Rust, etc. of resistance device	
 Inspection Item		General		
Sub-class2				
Sub-class1	ing Device			
Major Class	Neutral Ground			
Equipment	Veutral Grounding Device			Remarks

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

	esult Photo Remarks	U O no abnormal condition	۲	۷	
	Inspection point R	Crack, Breakage, Looseness, Rust, etc. on main devices	Damage, Looseness, etc. of grounding wire	Crack, Damage Transformation, Stain, Rust, etc. of resistance device	
)	Inspection Item		General		
	Sub-class2				
	Sub-class1	ling Device			
	Major Class	Neutral Ground			
	Equipment	Neutral Grounding Device			Remarks

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сh	eck List	t on Gen	erator	Plant	Name; Sedawgyi Unit	: No; 1	Date	; Feb	oruary 22, 2016
Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point		Result	Photo	Remarks
aenerator	Generator			General	Oil leakage, Water leakage		د		
		Stator		Core, Frame	Transformation, Dust, Looseness, Rust, etc.		د	0	no abnormal condition
				Coil	Damage, Transformation, Looseness, oil, etc.		د	0	ditto
		Rotor		Pole	Damage, Crack, etc.		د	0	ditto
		Air cooler		Air cooler	Water leakage, Looseness, etc.		د	0	a little bit rust inside of cooling water piping
		Oil lifter	Pump	Pump	Running condition, oil Leakage. Looseness, etc.		⊲	0	detrioration of pump/motor and control equipment.
			Motor	Motor	Bearing, Vibration, Noise, Wire, Terminal. Coupling, Eetc.	Bolt, Nut, Overheat	4		
			Controller	Controller	Looseness, Damage of contact, etc.		⊲		
			Piping, Valve	Piping, Valve	Oil leakage, etc.		د		
		Break		Break	Air leakage, oil leakage, etc.		د	0	
				Break ring	Crack, Transformation, etc.		4	0	a little bit hot spots
				Shoe	Wear, Transformation, etc.		⊲	0	brake ring contact with the protection material to prevent scattering of the break
			Controller	General	Looseness, Transformation. Damage, etc.		4	0	detrioration of control equipment
				Limit SW	Damage, Transformation, Looseness, etc.		⊲	0	
			Air tank	General	Leakage, Crack, etc.		د	0	
		Lower bracket		General	Damage, Crack, Looseness, etc.		⊲	0	oil leakage from lower baering tank
		Upper bracket		General	Damage, Crack, Looseness, etc.		⊲	0	oil leakage from upper baering tank
		Shaft		Shaft, Coupling	Crack, Damage, Looseness, etc.		د	0	no abnormal condition
		Thrust bearing		Oil tank	Water Contamination, Oil leakage. etc.		4	0	oil leakage on upper bracket
				Thermo sensor	Condition, Damage, etc.		د		

	Guide bearing	Oil tank	.ooseness, Damage, Water Leakage, Oil Leakage, etc.	4	0	oil leakage on lower bracket
		Thermo sensor	Condition, damage, etc.	د		
	Collector	Collector ring	Jamage, Looseness, Cable condition, etc.	×	0	different from original carbon brush, no spare brush, much carbon powder, not fuctional earthing brush and mecanical speed switch
		Rotating part	-ooseness, Crack, Damage, etc.	۲		
	Speed signal generator	General	-ead wire damage, looseness, etc.	×	0	4 of 6 sensors are not functinal
		Axis, gear	Jrack, Damage, Looseness, etc.	۲		
	Relay	Flow	Jamage, Looseness, Overheat, etc.	×	0	not functional
		Oil level	.ooseness, Oil leakage, etc.	4	0	gauge without numerals
		Temperature	.ooseness, Oil leakage, etc.	×	0	not functional
	Oil heat exchanger	Heat exchanger	Vater leakage, Oil Leakage. Looseness, etc.	د	0	
		Pump	Aunning 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	-ooseness, Damage of contact, etc.	×		detrioration of control equipment, loss of pressure gauge
		Piping	Vater leakage. Oil leakage, etc.	Ø		much oil leakage
		Sump tank	Vater leakage, Oil Leakage. Looseness, etc.	د		
	Generator Heater	Controller	.ooseness, Damage of contact, etc.	د	0	detrioration of control equipment
Remarks						

a little bit rust inside of cooling water piping was clogged. detrioration of pump/motor and control equipment. partial loss of protection material to oil leakage from upper baering tank oil leakage from lower baering tank detrioration of control equipment Date; February 16, 2016 oil leakage on upper bracket Remarks no abnormal condition no abnormal condition several hot spots ditto ditto Photo 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Result ⊲ ⊲ ⊲ ⊲ ⊲ د د د د د \triangleleft د د \triangleleft \triangleleft \triangleleft د د ⊲ د Bearing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat etc. Unit No;2 Running condition, oil Leakage. Looseness, etc. Damage, Transformation, Looseness, oil, etc. Inspection point Transformation, Dust, Looseness, Rust, etc. Looseness, Transformation. Damage, etc. Damage, Transformation, Looseness, etc. Water Contamination, Oil leakage. etc. Looseness, Damage of contact, etc. Plant Name; Sedawgyi Damage, Crack, Looseness, etc. Shaft, Coupling Crack, Damage, Looseness, etc. Damage, Crack, Looseness, etc. Water leakage, Looseness, etc. Air leakage, oil leakage, etc. Crack, Transformation, etc. Wear, Transformation, etc. Oil leakage, Water leakage Thermo sensor Condition, Damage, etc. Leakage, Crack, etc. Damage, Crack, etc. Oil leakage, etc. Inspection Item Piping, Valve Core, Frame Controller Air cooler General Break ring General Limit SW General General Oil tank General Pump Motor Break Shoe Pole Coil Sub-class2 Piping, Valve **Check List on Generator** Controller Controller Air tank Motor Pump Thrust bearing Sub-class1 ower bracket Upper bracket Air cooler Oil lifter Stator Break Shaft Rotor Major Class Generator Equipment Generator

	Guide bearing	Oil tank	.ooseness, Damage, Water Leakage, Oil Leakage, etc.	4	0	oil leakage on lower bracket
		Thermo sensor	Condition, damage, etc.	د		
	Collector	Collector ring	Jamage, Looseness, Cable condition, etc.	×	0	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	.ooseness, Crack, Damage, etc.	د		
	Speed signal generator	General	ead wire damage, looseness, etc.	×	0	3 of 6 sensors are not functinal
		Axis, gear	Drack, Damage, Looseness, etc.	د		
	Relay	Flow	Jamage, Looseness, Overheat, etc.	×	0	not functional
		Oil level	.ooseness, Oil leakage, etc.	4	0	gauge without numerals
		Temperature	.ooseness, Oil leakage, etc.	×	0	not functional
	Oil heat exchanger	Heat exchanger	Vater leakage, Oil Leakage. Looseness, etc.	د	0	
		Pump	Aunning condition, oil Leakage. Looseness, etc.	×		1 of 2 pumps has abnormal vibration. much oil leakage
		Motor	Searing, Vibration, Noise, Wire, Terminal. Coupling, Bolt, Nut, Overheat tto.	×		1 of 2 pumps has abnormal vibration. much oil leakage
		Controller	.ooseness, Damage of contact, etc.	Þ		detrioration of control equipment
		Piping	Vater leakage. Oil leakage, etc.	Þ		much oil leakage
		Sump tank	Vater leakage, Oil Leakage. Looseness, etc.	د		
	Generator Heater	Controller	.ooseness, Damage of contact, etc.	د	0	detrioration of control equipment
Remarks						

Chec	sk List o	n Excitat	ion Sys	tem Pla	ant Name; Sedawgyi Unit	No; 1	å	ate;	⁻ ebruary 23, 2016
Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point		Result	Photo	Remarks
Excitation system	Exciter	Field circuit brea	aker	Mechanical part	Wear, Looseness, Breakage, Lubulication oil, etc.		د	0	no abnormal condition, no spare(FCB)
				Indicator	Damage, etc.		د		counter(4045)
				Close/open coil	Stain, Damage, Overheat, Looseness, etc.		د		
				Wire, Terminal	Looseness, Overheat, etc.		د		
		Excitation transf	former	Conductor	Stain, Damage, Overheat, Looseness, etc.		د	0	
				Insulator	Stain, Damage, etc.		4		Stain
				Meter	Damage, Oil leakage, etc.		د		
		Generator cubicl	e	Conductor	Stain, Damage, Overheat, etc.		×	0	repaired power cables (2 lines)
				Insulator	Stain, Damage, etc.		د		
				PT, CT, SA, AR	Stain, Damage, etc.		د		
				Wire, Terminal	Looseness, Overheat, etc.		د		
Remarks									

Checl	k List or	n Excitat	ion Sys¹	tem Pla	ant Name; Sedawgyi Ur	nit No;2	Õ	ate;	⁻ ebruary 17, 2016	
Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point		Result	Photo	Remarks	
Excitation system	Exciter	Field circuit brea	aker	Mechanical part	Wear, Looseness, Breakage, Lubulication oil, etc.		د	0	no abnormal condition, no spare(FCB)	1
				Indicator	Damage, etc.		د		counter(4768)	
				Close/open coil	Stain, Damage, Overheat, Looseness, etc.		د			
				Wire, Terminal	Looseness, Overheat, etc.		د			1
		Excitation transf	former	Conductor	Stain, Damage, Overheat, Looseness, etc.		د	0		
				Insulator	Stain, Damage, etc.		4		Stain	
				Meter	Damage, Oil leakage, etc.		د			r
		Generator cubicl	e	Conductor	Stain, Damage, Overheat, etc.		د	0		-
				Insulator	Stain, Damage, etc.		د			
				PT, CT, SA, AR	Stain, Damage, etc.		د			
				Wire, Terminal	Looseness, Overheat, etc.		د			
Remarks										

	Check L	ist on Neu	ıtral Groui	nding Devi	ce Plant Name; Sedawgyi Unit No	:1 D	te;Feb	uary 23, 2016
Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Resu	t Photo	Remarks
Neutral Grounding Device	Neutral Ground	ling Device			Crack, Breakage, Looseness, Rust, etc. on main devices	د	0	no abnormal condition
				General	Damage, Looseness, etc. of grounding wire	٢		
				0	Crack, Damage Transformation, Stain, Rust, etc. of resistance de	vice		
Remarks	Neutral transfo	rmer is dry type.	The replacemen	t will be considere	9d.			

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	Check L	ist on Neut	tral Groun	Iding Devic	e Plant Name; Sedawgyi Unit No; 2	Dat	e;Feb	ruary 17, 2016
Equipment	Major Class	Sub-class1	Sub-class2	Inspection Item	Inspection point	Result	Photo	Remarks
Neutral Grounding Device	Neutral Ground	ding Device			Crack, Breakage, Looseness, Rust, etc. on main devices	د	0	no abnormal condition
				General	Damage, Looseness, etc. of grounding wire	د		
					Crack, Damage Transformation, Stain, Rust, etc. of resistance device	د		
Remarks	Neutral transfc	ormer is dry type.	The replacemen	t will be consider	φ α			

Plant Name ; Baluchaung No.1 Unit No. ; 2 Date ; February 2nd , 2016 Temperature ; 1 9 . 6 °C Humidity ; 4 7 %

1. Insulation Resistance

	Insulation Resistance $(M\Omega)$	Remarks
Stator Winding	$4000~{ m M}\Omega~$ over (at 56 sec.)	DC 1000V Megger 1 Min.
Rotor Winding	$23.7 \mathrm{M}\Omega$	DC 500V Megger 1 Min.

Criteria;

 $\begin{array}{l} \mbox{Stator Winding }; \ensuremath{\,\geqq\ } 1 \ \mbox{O} \ M \Omega \\ \mbox{Rotor Winding } ; \ensuremath{\,\geqq\ } 1 \ \mbox{M} \ \Omega \end{array}$

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

Time	Insulation Resistance $(M\Omega)$
1 min.	$4~0~0~0M\Omega$ over
2 min.	$4~0~0~0M\Omega$ over
3 min.	$4~0~0~0M\Omega$ over
4 min.	$4~0~0~0M\Omega$ over
$5 \min$	$4~0~0~0M\Omega$ over
6 min.	$4~0~0~0M\Omega$ over
7 min.	$4~0~0~0M\Omega$ over
8 min.	$4~0~0~0M\Omega$ over
9 min.	$4~0~0~0M\Omega$ over
10 min.	$4~0~0~0M\Omega$ over

Criteria ; ≥ 2 . 5

Plant Name ; Baluchaung No.1 Unit No. ; 1 Date ; February 18, 2016 Temperature ; 2 1. 0 °C Humidity ; 3 9 %

1. Insulation Resistance

	Insulation Resistance $(M\Omega)$	Remarks
Stator Winding	$4000~{ m M}\Omega~$ over (at 50 sec.)	DC 1000V Megger 1 Min.
Rotor Winding	$2000\;M\Omega$ over (at 7 sec.)	DC 500V Megger 1 Min.

Criteria ;

 $\begin{array}{l} \mbox{Stator Winding}\ ; \ \geqq \ 1 \ 0 \ M \ \Omega \\ \mbox{Rotor Winding} \ \ ; \ \geqq \ 1 \ M \ \Omega \end{array}$

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

Time	Insulation Resistance $(M\Omega)$	Time	Insulation Resistance $(M\Omega)$
10 sec.	$1\ 4\ 2\ 0\ \mathrm{M}\Omega$	1 min.	$4~0~0~0M\Omega$ over
20 sec.	2200 Μ Ω	2 min.	$4~0~0~0M\Omega$ over
30 sec.	$2\ 7\ 5\ 0\ \mathrm{M}\Omega$	3 min.	$4\ 0\ 0\ 0\ M\Omega$ over
40 sec.	$3\ 4\ 4\ 0\ \mathrm{M}\Omega$	4 min.	$4~0~0~0M\Omega$ over
50 sec.	$4~0~0~0M\Omega$ over	5 min	$4~0~0~0M\Omega$ over
		6 min.	$4\ 0\ 0\ 0\ M\Omega$ over
		7 min.	$4~0~0~0M\Omega$ over
		8 min.	$4~0~0~0M\Omega$ over
		9 min.	$4\ 0\ 0\ 0\ M\Omega$ over
		10 min.	$4 \ 0 \ 0 \ 0 \ M\Omega$ over

Criteria ; ≥ 2 . 5

Plant Name ; Sedawgyi Unit No. ; 2 Date ; February 15 , 2016 Temperature ; 2 7 . 5 °C Humidity ; 4 9 %

1. Insulation Resistance

	Insulation Resistance $(M\Omega)$	Remarks
Stator Winding	$2\ 2\ 0\ 0\ M\Omega$	DC 1000V Megger 1 Min.
Rotor Winding	620MΩ	DC 500V Megger 1 Min.

Criteria ;

 $\begin{array}{l} \mbox{Stator Winding}\ ; \ \geqq \ 1 \ 0 \ M \ \Omega \\ \mbox{Rotor Winding} \ \ ; \ \geqq \ 1 \ M \ \Omega \end{array}$

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

Time	Insulation Resistance $(M\Omega)$	時間	Insulation Resistance $(M\Omega)$
10 sec.	689MΩ	3 min.	$4\ 0\ 0\ 0\ M\Omega$ over
20 sec.	$1 \ 0 \ 7 \ 0 \ M\Omega$	4 min.	$4\ 0\ 0\ 0\ M\Omega$ over
30 sec.	$1 \ 3 \ 2 \ 0 \ M \Omega$	5 min	$4\ 0\ 0\ 0\ M\Omega$ over
40 sec.	$1 6 6 0 M \Omega$	6 min.	$4\ 0\ 0\ 0\ M\Omega$ over
50 sec.	$1910M\Omega$	7 min.	$4\ 0\ 0\ 0\ M\Omega$ over
1 min.	$2\ 2\ 0\ 0\ M\Omega$	8 min.	$4\ 0\ 0\ 0\ M\Omega$ over
1min30sec	$3 0 0 0 M\Omega$	9 min.	$4\ 0\ 0\ 0\ M\Omega$ over
2 min.	$3700M\Omega$	10 min.	$4\ 0\ 0\ 0\ M\Omega$ over
2min13sec	$4\ 0\ 0\ 0\ M\Omega$ over		

Criteria ; ≥ 2 . 5

Plant Name ; Baluchaung No.1 Unit No. ; 1 Date ; February, 1th, 2016 Temperature ; 2 6 . 2° Humidity ; 2 5 %

	Measuremen	t Portion	25%	50%	75%	100 %
			output	output	output	output
Vibration	Upper	1 (V)	5.4 / 100	5.9 / 100	3.4 / 100	4.8 / 100
(mm)	Bracket	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	5 (V)	88 / 100	38 / 100	18 / 100	17 / 100
	Head Cover	5 (H)	4.7 /100	4.1 / 100	3.1 / 100	2.9 / 100
Shaft	Upper Shaft		8 / 100	8 / 100	6 / 100	5 / 100
Vibration	Turbine Shaf	t	7 / 100	7 / 100	6 / 100	5 / 100
(mm)						

(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

Plant Name ; Baluchaung No.1 Unit No. ; 2 Date ; February, 8, 2016 Temperature ; 2 4 . 8 °C Humidity ; 3 3 %

	Measuremen	t Portion	25%	50%	75%	100 %
			output	output	output	output
Vibration	Upper	1 (V)	5.7 / 100	3.8 / 100	3.7 / 100	3.8 / 100
(mm)	Bracket	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	5 (V)	199 / 100	74 / 100	63 / 100	6.8 / 100
	Head Cover	5 (H)	4.0 /100	3.6 / 100	3.6 / 100	2.1 / 100
Shaft	Upper Shaft		7 / 100	6 / 100	5 / 100	5 / 100
Vibration	Turbine Shaf	ťt	7 / 100	7 / 100	5 / 100	4 / 100
(mm)						

(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

Plant Name ; Sedawgyi Unit No. ; 1 Date ; February, 15, 2016 Temperature ; 2 7 . 7 °C Humidity ; 4 9 %

	Measuremen	t Portion	25%	50%	75%	100 %
			output	output	output	output
Vibration	Upper	1 (V)	4.2 / 100	3.8 / 100	3.8 / 100	4.7 / 100
(mm)	Bracket	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	4 (V)	4.5 / 100	2.4 / 100	2.2 / 100	3.0 / 100
	Bracket	4 (H)	0.8 / 100	0.6 / 100	0.9 / 100	1.4 / 100
	Turbine	5 (V)	6.4 / 100	2.8 / 100	3.5 / 100	3.8 / 100
	Head Cover	5 (H)	2.5 / 100	1.6 / 100	2.1 / 100	3.3 / 100
Shaft	Turbine Shat	ft	5 / 100	5 / 100	4 / 100	4 / 100
Vibration						
(mm)						

(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

Plant Name ; Sedawgyi Unit No. ; 2 Date ; February, 19, 2016 Temperature ; 2 5 . 8 °C Humidity ; 5 3 %

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

(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

 $({\tt Legend}) \ \ V \ ; \ {\tt Vertical} \qquad {\tt H} \ ; \ {\tt Horizontal}$

Plant Name ; Sedawgyi Unit No. ; 1 Date ; February 18 , 2016 Temperature ; 2 7 . 8 °C Humidity ; 4 9 %

1. Insulation Resistance

	Insulation Resistance $(M\Omega)$	Remarks
Stator Winding	$2\ 4\ 4\ 0\ \mathrm{M}\Omega$	DC 1000V Megger 1 Min.
Rotor Winding	96.9MΩ	DC 500V Megger 1 Min.

Criteria;

 $\begin{array}{l} \mbox{Stator Winding }; \ensuremath{\,\geqq\)} 1 \ 0 \ M \ \Omega \\ \mbox{Rotor Winding } ; \ensuremath{\,\geqq\)} 1 \ M \ \Omega \end{array}$

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

Time	Insulation Resistance $(M\Omega)$	時間	Insulation Resistance $(M\Omega)$	
10 sec.	$6\ 5\ 7\ \mathrm{M}\Omega$	2 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
20 sec.	$1 1 1 0 M\Omega$	3 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
30 sec.	$1\ 4\ 5\ 0\ \mathrm{M}\Omega$	4 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
40 sec.	$1780M\Omega$	5 min	$4\ 0\ 0\ 0\ M\Omega$ over	
50 sec.	$2\ 1\ 2\ 0\ M\Omega$	6 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
1 min.	$2\ 4\ 4\ 0\ \mathrm{M}\Omega$	7 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
1min30sec	3300MΩ	8 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
1min53sec	$4\ 0\ 0\ 0\ M\Omega$ over	9 min.	$4\ 0\ 0\ 0\ M\Omega$ over	
		10 min.	$4\ 0\ 0\ 0\ M\Omega$ over	

Criteria ; $\geqq 2 \, . \ 5$

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

THE KANSAI ELECTRIC POWER

Power System Engineering

Hydro Power Group

Table of Contents

- (Distribution Panel, Automatic Control Panel, Operation Panel, Gate Operation Panel) 1. Control Equipment 1 Check List of Site Investigation and Photos
- Control Equipment 2 Check List of Site Investigation and Photos (AC Panel) <u>۲</u>
 - 3. Control Equipment 3 Check List of Site Investigation and Photos (DC Panel)
- Control Equipment 4 Check List of Site Investigation and Photos (Recording System) 4.
- Protective Device Check List of Site Investigation and Photos (Machine Protective Relay Panel, System Protection Panel) <u>ъ</u>.
- 6. Excitation System Check List of Site Investigation and Photos (Exciter Panel, AVR Panel)
- 7. Speed Governor Check List of Site Investigation and Photos (Governor-Regulator Panel, Governor-Actuator Panel)
- Turbine Control Cubicle Check List of Site Investigation and Photos <u></u>
- Water Level Regulator Check List of Site Investigation and Photos 6.
- 10. Auxiliary Equipment Control Check List of Site Investigation and Photos
- Fire Extinguishing System Check List of Site Investigation and Photos 11.
- Water Level Gauge (Civil Equipment) Check List of Site Investigation and Photos 12.
- 13. Communication Equipment Check List of Site Investigation and Photos
- Control Cable Route Map Check List of Site Investigation and Photos 14.

(1.Control Equip	ment 1)	Check I	ist of Sit	e Invest	igation		【date】 3-11, Feb	O: Acc	eptable ×:Not Acceptable X:Remarks
Equipment Major Cla:	ss Sub-Class 1	1 Sub-Class 2	hispec	tion	Inspection Point		Inspection Result	Photo	Remarks
Control Control Eq Equipment (CON)	uipment (Contr	ol Panel)			Board installation state		×		
					Installation state of connector and terminal		×		
					Mounting state of timer and auxiliary relays		×		-
			Control	Visual	Indicator, indicating lamp, and selector switch		×	1.19	 Mechanical type meter and operation switch Manufactured in 1988 (28 year-old)
			cubicle	Inspection	Test terminals		×	CI~1	•No inspection record after COD •Dust accumulation •Acting domadation
					Electrolytic capacitor		×		ogue ueganatou
					Cooling fan for power supply unit		×		
					Installation state of connector and terminal at power u	unit section	×		
					Board installation state		×		
					Installation state of connector and terminal		×		-Manufactured in 1988 (28 year-old)
			Relay Unit	Visual Inspection	Indicator		×	$1 \sim 13$	•Dust accumulation •Dust accumulation
					Electrolytic capacitor		×		switch •Aging degradation.
					Contact point		×		
Control ca (Control P:	ble and Wiring anel)		Wiring	Visual	Installation state of internal wire		×	6 T - T	•Dusts accumulation on wires and terminal
			Control cable	Inspection	Terminal and cable		×	۲∼۱	•Dusts accumulation on control cables
(Remarks)			-						
CONTROL DESK	Manufacture	d in 1988			AUTOMATIC CNTROL Manufactured in 19	988			
132kV LINE PANEL	Manufacture	d in 1988			No.1 AUTO CONTROL) 886	Control roon	ı) DISCHARC	E OLITI ET DEMOTE CONTROL DANEI
No.2 GENERATOR PANEL		1988			No.2 AUTO CONTROL	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Manufactured	in 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			

【date】 3-11, Feb	Remarks	 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 	 Mechanical type meter and operation switch Manufactured in 1988 (28 year-old) Dusts accumulation Aging degradation 	 Mechanical type meter and operation switch Manufactured in 1988 (28 year-old No inspection record after COD Dusts accumulation Aging degradation 	 Mechanical type meter and operation switch Manufactured in 1988 (28 year-old) No inspection record after COD Dusts accumulation Aging degradation
	(Control Equipment) Details				
ation	(Control Equipment) Details				
hoto) Check List of Site Investig	(Control Equipment) Overall				
(Site F	NO.	CON 1	CON 2	CON 3	CON 4

(Site]	Photo) Check List of Site Investig	ation		【date】 3-11, Feb
NO.	(Control Equipment) Overall	(Control Equipment) Details	(Control Equipment) Details	Remarks
5 5				 Mechanical type meter and operation switch Manufactured in 1988 (28 year-old) No inspection record after COD Dusts accumulation Aging degradation
6 6				 Mechanical type meter and operation switch Manufactured in 1988 (28 year-old) No inspection record after COD Dusts accumulation Aging degradation
CON 7	• • • • • • • • • • • • • • • • • • • •	TRANSITION OF A DESCRIPTION		-Manufactured in 1988 (28 year-old) -No inspection record after COD -Dusts accumulation -Aging degradation of timer and auxiliary relays
CON 8	••••	Transformation		-Manufactured in 1988 (28 year-old) -No inspection record after COD -Dusts accumulation -Aging degradation of timer and auxiliary relays

(Site I	Photo) Check List of Site Investig	ation	-	【date】 3-11, Feb
NO.	(Control Equipment) Overall	(Control Equipment) Details	(Control Equipment) Details	Remarks
9 9		SPACHGRINIZER		•Manufactured in 1988 (28 year-old) •No inspection record after COD •Dusts accumulation •Aging degradation of timer and auxiliary relays
CON 10		MALE AND CONTRACT OF A		-Manufactured in 1988 (28 year-old) -No inspection record after COD -Dusts accumulation -Aging degradation of timer and auxiliary relays
CON 11		TRA FAILT		-Manufactured in 1988 (28 year-old) -No inspection record after COD -Dusts accumulation -Aging degradation of timer and auxiliary relays
CON 12		A TABLE		-Manufactured in 1988 (28 year-old) -No inspection record after COD -Dusts accumulation -Aging degradation of timer and auxiliary relays

【date】 3-11, Feb	Remarks	-Manufactured in 1988 (28 year-old) -No inspection record after COD -Dusts accumulation -Aging degradation of timer and auxiliary relays		
	(Control Equipment) Details			
ation	(Control Equipment) Details			
noto) Check List of Site Investig	(Control Equipment) Overall			
(Site P	NO.	CON 13		

(2.Control	l Equipm	ient 2) (Check L	ist of Sit	e Invest	igation	(date】 -8, Feb	O: Acceptat	ole ×:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspec	tion	Inspection Point	Result	Photo No, (HAC)	Remarks
Control Equipment (Control Panel)	Control Equipment (Control	Control Power Unit (Control	AC Control Power Unit (Control			State of bus	0	\square	
	Panel) (CON)	Power Panel)	Power Panel)		<u> </u>	Installation state of teminal block	×		
		(CON-H)	(CON-HAC)		· · ·	Mounting state of timer and auxiliary relays	×	T	•Manufactured in 1988 (28 year-old) •Rust on the cover of isolation
					Visual	Indicator, indicating lamp, and selector switch	×	- -	transformer in the back of Unit 1 panel •Rust on the VT terminal block on the
				UVerall	Inspection	Test terminals	×	7 . 1	• Degradaded MCCB on the panel • Deformed insulating rubber in MCCB on
					<u>. '</u>	Electrolytic capacitor		ĸ	the panel •Dust accumulation
						Installation state of NFB and MCCB	×		
					· · ·	NFB and MCCB should be free from operation failure.	0		
						Board installation state	0		
						Installation state of connector and terminal	0		
				Relay Unit	Visual Inspection	Indicator	×		•Machanical tuna voltada relav unit
					· · ·	Electrolytic capacitor	×	ŝ	Manufactured in 1988 (28 year-old) •Manufactured in 1988 (28 year-old) •Dusts accumulation in the voltage relay
					<u>.</u>	Contact point	×	I	unit
	Control cable (Control Pane	e and Wiring al)		Wiiring	Visual	Instalktion state of internal wire	×	-	Dusts accumulation on wiring, terminal
				Control Cable	Inspection	Terminal and cable	×	4	and control cable
(Remarks)									
AC PA	NEL No.1	Manufae	ctured in 1988						
AC PA	NEL No.2	Manufa	ctured in 1988						

【date】 3-11, Feb	2) Details Remarks	-Manufactured in 1988 (28 year-old) -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	- 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	 Manufactured in 1988 (28 year-old) Mechanical type voltage relay unit Dusts accumulation in the voltage relay unit 	- Manufactured in 1988 (28 year-old) - Dusts accumulation on wires, terminals and control cables
	Control Equipment 2) Details (Control Equipment				
oto) Check List of Site Investigation	(Control Equipment 2) Overall (C	AC PANEL-1	AC PANEL-2		
(Site Ph	NO.	HAC 1	HAC 2	HAC 3	HAC 4

(3.Control F	Equipm	ent 3)	Check L	ist of Sit	e Invest	igation	【date】 3-8, Feb	O: Accepta	ble ×:Not Acceptable X:Remarks
Equipment Ma	ajor Class	Sub-Class 1	Sub-Class 2	Inspect	tion	Inspection Point	Result	Photo No, (HDC)	Remarks
Control Co Equipment Equ (Control Panel) (Cc	utrol upment ontrol	Control Power Unit (Control	DC Control Power Unit (Control		-	The state of bus	0		
Par local lo	unel) ON)	Power Panel)	Power Panel)			Installation state of teminal block	×		
		(CON-H)	(CON-HAC)			Mounting state of timer and auxiliary relays			
				l moro	Visual	Indicator, indicating lamp, and selector switch	×	- 1	•Manufactured in 1988 (28 year-old) •Degraded MCCB on the panel
				TRIANO	Inspection	Test terminals	×	1,4	- Defourted instatting rupper in MCCD on the panel • Dust accumulation
					/	Electrolytic capacitor		N	
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	0		
						Board installation state			
						Installation state of connector and terminal			
				Relay Unit	Visual Inspection	Indicator			
						Electrolytic capacitor			
					-	Contact point			
<u>3</u> 2	ontrol cable ontrol Pane	and Wiring I)		Wiiring	Visual	Installation state of internal wire	×	6	-Dust accumulation on wires, terminals
				Control Cable	Inspection	Terminal and cable	×	°	and control cables
(Remarks)									
DC PANEI DC PANEI	L No.1 L No.2	Manufa Manufa	ictured in 1988 ictured in 1988						

【date】 3-8, Feb	Remarks	-Manufactured in 1988 (28 year-old) - Degraded MCCB on the panel - Deformed insulating rubber on MCCB on the panel - Dust accumulation	-Manufactured in 1988 (28 year-old) - Degraded MCCB on the panel - Deformed insulating rubber on MCCB on the panel - Dust accumulation	-Manufactured in 1988 (28 year-old) -Dust accumulation on wires, terminals and control cables	
	(Control Equipment 3) Details			No,2DC	
ation	(Control Equipment 3) Details			No, 1DC	
hoto) Check List of Site Investig	(Control Equipment 3) Overall	DC PANEL-1	a co puter-z		
(Site I	NO.	HDC 1	HDC 2	HDC 3	

(4.Contro	d Equipm	ent 4) Check I	ist of Si	te Invest	igation	【date】 3-11, Feb	O: Acc	eptable x:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1 Sub-Class 2	hispe	ction	Inspection Point	Result	Photo No, (RD)	Remarks
Control Equipment (Control Panel)	Automatic Recording Svetom	Switching Board (SWB)			State of looseness and others of wires	×		
	System (Recording System)				Grounding wire	×		
	(RD)				Grounding wire should be free from wire break; Grounding wire tightening check	×		
			F	Visual	Indicator, indicating lamp, and selector switch	×	- -	Manufactured in 1988 (28 year-old)
			Uverall	Inspection	Visual Inspection of the parts where defect was detected during patrol and by alarm.	×	0∼1	· Broken meters • Dust accumulation
					Installation state of NFB and MCCB	×		
					NFB and MCCB should be free from operation failure.	×		
					Power supply unit	×		
			11-11-00	Visual	Installation state of connector and terminal			
			keay unu	Inspection	Indicator should be free from crack and damage.			
		Recording Machine (RM)	1O	Visual	State of recording sysytem operation and indication	×	1 2.6	·Broken meters
			UVerall	Inspection	Dust accumulation is not allowed in the recording machine and wiring.	×	0∼1	•Dust accumulation
		Resistor Temperature Detector (RDT)	Overall	Visual Inspection	State of wire, terminal, and element etc.			
	Control cable (Control Pane	and Wiring ()	Wiring	Visual	Installation state of internal wire	×	۲ o	Dust accumulation
			Control Cable	Inspection	Terminal and cable	×	1,0	Dust accumulation
(Remarks)								
TEMPI	ERATURE REC	ORDER PANEL	Manufactured i	n 1988				
132kV	LINE PANEL			1988				
No,1 G	ENERATOR P.	ANEL		1988				
No,2 G	ENERATOR P.	ANEL		1988				
STAT	ON SERUICE P	ANEL		1988				

(Site F	hoto) Check List of Site Investig	ation		【date】 3-11, Feb
NO.	(Control Equipment 4) Overall	(Control Equipment 4) Details	(Control Equipment 4) Details	Remarks
RD 1	Is mer and the first state of th			•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 transmistion and receiving is installed.

hot	0) Check List of Site Investig (Control Equipment 4) Overall	ation (Control Equipment 4) Details	(Control Equipment 4) Details	【date】 3-11, Feb Remarks
				•Manufactured in 1988 (28 year-old) •Malfunction of active and reactive power meter in generator panel of unit 1 and 2
			New York State	•Manufactured in 1988 (28 year-old) •Malfunction of voltage recorder on station service panel
				•Manufactured in 1988 (28 year-old) •Dust accumulation on the internal wirings and control cables
				-Manufactured in 1988 (29 year-old) -Dust accumulation on the internal wirings and control cables

(5.Protec	tive Dev	vice) Cl	heck List	of Site	Investig:	ation	date]	O: Acceptak	ole ×:Not Acceptable	
Equipment	Major Class	Sub-Class	1 Sub-Class 2	Inspec	ction	June Colon Point	Result	Photo No, (MPR)	Remarks	
Machine Protection	Machine Pro (MPR)	tection Relay				Board installation state	×			
ketay (analogue, static type)						Installation state of connector and terminal	×			
						Mounting state of timer and auxiliary relays	×		• Analos tyne relay unit	
					Visual	Indicator, indicating lamp, and selector switch	×	14 	• Manufactured in 1988 (28 year-old) • Dust accumulation on overall relay units	
				UVerall	Inspection	Test terminals	×	ĩ	• No maintenance record after CUD • No spare part for each relay unit • Aging degradation	
						Electrolytic capacitor	×			
						Cooling fan for power supply unit	×			
						Installation state of connector and terminal at power unit section	×			
						Board installation state	×			
						Installation state of connector and terminal	×		• Analog type relay unit • Manufactured in 1988 (28 year- old)	
				Relay Unit	Visual Inspection	Indicator	×	9	 Dust accumulation Oil leakage from electrolytic capacitor No maintenance record 	
						Electrolytic capacitor	×		• No spare part for each relay unit • Aging degradation	
						Contact point	×			
	Control cabl (Control Pan	e and wiring el)		Wiring	Visual	Installation state of internal wire	×		Dust accumulation	
				Control Cable	Inspection	Terminal and cable	×	ŝ	Dust accumulation	
(Remarks)										
132kV LINE F	ANEL		Manufactured	in 1988						
No,2 GENERA	ATOR PANEL			1988						
No,1 GENERA	ATOR PANEL			1988						
STATON SER	SUICE PANEI			1988						
11KV FEEDE	R PANEL			1988						

(Site I	Photo) Check List of Site Investig	ation		【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		STATION SERVICE		 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		NOT GENERATOR		 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

【date】 3-11, Feb	Remarks	 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 	-Manufactured in 1988 (28 year-old) •Oil leakage from electrolytic capacitor •Aalog type relay unit •Aging degradation						
	(Protective Device) Details		t.st.sovi Rcc.m						
ation	(Protective Device) Details								
hoto) Check List of Site Investig	(Protective Device) Overall								
(Site I	Photo No,	MPR 5	MPR 6						

(6.Excitati	on Syst	em (AV)	R)) Che	sck List c	of Site Ir	ivestigation			Cdate 3-11, F	eb O: A	cceptable ×:Not Acceptable X:Remarks
	5	Sub-Class	Sub-Class					Resu	It	hoto No,	-
Equipment	Major Class	1	2	Inspe	ction	Inspection Point		Juit 1	Jnit 2	(AVR)	Remarks
Excitation]	Excitation System	Relay (Rv)				Board installation state		×	×		. Analog tyme relav
(Control Panel)	(EX)			Control Panel	Visual Inspection	Installation state of connector and terminal		×	×	3	•Manufactured in 1989 (27 year-old)
						Electrolytic capacitor		×	×		NO Spare part.
		Thyristor (THY)		Arrestor, Thyristor, Rectifier,		Fouling, damage and errosion of elements; Loosen Overheat	ness of terminal;	×	×		• Fouling on thrystor • No spare part
				vitreous enamel resistor		Fouling and damage of elements; Looseness of te	erminal; Overheat	×	×	2	Dust accumulation
				パルスTr	Visual	Fouling and damage; Looseness of terminal; Overh	heat	×	×		Dust accumulation
				Fuse	mspection	Conduction; Looseness of terminal		×	×		Dust accumulation
				Grounding device		Grounding wire break; Removed grounding metal fi	fitting	0	0	\setminus	
				Arrestor		Grounding wire break; Looseness of grounding me	etal fitting	0	0	\setminus	
			Cooling Device (COOL)	Cooling Fan	Visual Inspection	Fouling and damage: Looseness of terminal: Overh	heat	×	×	2	• Replaced cooling fan • No spare part • Dust accumulation without dust - nroof
	-	Regulators		Printed board		Fouling and damage; Overheat		×	×		
		Automatic V	/oltage	90R and 70R Limit Switch		Operation state; Looseness of terminal		×	×		
		weguiator (A	V IV)	Arrestor and		Fouling and damage of elements; Looseness of ter	erminal; Overheat	×	×		• Manufactured in 1989 (27 year-old) • Analog type meters exceeding durable
		Regulator (A)	PFR)	Fuse		Conduction; Looseness of terminal; Overheat		×	×		lfte 0.1 Transistor tyna ragilators avraading
		Power Syste	em Stahilizer	Detective		Fouling and damage; Wire break of detection lamp		×	×	1,4	durable life
		(PSS)		Auxiliary relay	Visual	Operation state: Overheat; Looseness of terminal	1	×	×		• Spring type field CB whose arc- extinguishing chamber is vitreous enamel
		Field Circuit	Breaker	Insuration Transformer	Inspection	Fouling and damage; Overheat		×	×		resistor type • Dust accumulation
		(41)		Cooling Fan		Fouling and damage; Looseness of terminal; Overh	heat	×	×		
				Instrument		Operation state: damage; Looseness of terminal		×	×		
				Grounding		Grounding wire break; Removed grounding metal fi	fitting	0	0		
				device		Grounding wire break; Looseness of grounding me	etal fitting	0	0	\setminus	
				Control, PT and CT Circuit		Fouling, overheat, deformation and looseness of to and PCT circuit.	terminal on control	×	×	4	Dust accumulation
<u> </u>	Control cable (Control Pane	and wiring		Wiring	Visual	Installation state of internal wire		×	×	V	Dust accumulation
				Control cable	Inspection	Terminal and cable		×	×	۲	Dust accumulation
(Remarks)											
No.1 AVR PANE	I	Manuf	actured in 19	89	No.2 AVR P/	ANEL Manufactured in 19	989				
No.1 THYRISTO	R PANEL		19	89	No.2 THYRIS	STOR PANEL 19	686				
No.1 SURGE AB	SORBER PA	NEL	16	686	No.2 SURGE	ABSORBER PANEL	686				
No.1 FCB PANE	I		19.	68	No.2 FCB P/	ANEL 19	989				

<u>ц</u>	hoto) Check List of Site Investig	Ition		[date] 3-11, Feb
	(AVR) Overall	(AVR) Detail 1	(AVR) Detail 2	Remarks
	ND2 AVR			•Manufactured in 1989 (27 year-old) •Replaced power unit •Analog type meter exceeding durable life •Transistor type regulators exceeding durable life
	NOZ THYRISTOR		All THREETOR	•Manufactured in 1989 (27 year-old) •Meters exceeding the durable life •Replaced cooling fan •No dust-proof cover •No spare part
	NDI SURGE ABSOBER			-Manufactured in 1989 (27 year-old) -Analog type voltage detection relay -Aging degradation -No spare part
	NO1 FCB			 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	Governo	ır (GOV))) Chec	k List of	Site Inv	estigation	3-1 C	date】 11, Feb	O: Accept	table X:Not Acceptable X:Remarks
							Re	sult	Photo No,	
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspe	ection	Inspection Point	Unit 1	Unit 2	(Reg) (ACT)	Remarks
Speed Governor (Control Panel)	Speed Governor	Regulator Pai (Reg)	nel			Power unit, NFB	×	×		
	(COV)	A A A A A A A A A A A A A A A A A A A				Control, detection and Regulation unit	×	×		
						Indicated value of meters	×	×		•Manufactured in 1988 (28-vear-old)
						Motors for Regulator (77M, 65M)	×	×		-No counter measure against small
						hput/Output unit	×	×		annnais
					Visual	Cable and terminal	×	×	Reg	(Power Unit) • Replaced No.1 power unit (in 1994)
				Overall	Inspection	Indication panel/lamp	×	×	$1 \sim 3$	 electrolytic capacitor and cooling fan exceeding the durable life
						Regulator	×	×		-No spare part.
						Arrestor circuit and fuse	×	×		Analog type devices
						Installation state of primted board	×	×		•No spare part for detecting unit
						Restoration unit	×	×		
						Grounding wire	×	×		
		Actuator (ACT)				Pilot Valve	×	×		
						Primary distribution valve	×	×		
						Secaondary distribution valve	×	×		Grease adhering to the operation unit in
					Visual	Auxiliary servomotor	×	×	Act	actuator panel • Deterioration of operating oil
				OVERAL	Inspection	hydraulic booster	×	×	1, 2	·No maintenance record of counling and
						Coupling unit	×	×		return units in actuator panel after COD
						Return unit	×	×		
						Meters	×	×		
		Relay Unit (Rv)				Board installation state	×	×		
		(frank				Installation state of connector and terminal	×	×	Рад	
				Overall	Visual Inspection	Indicator	×	×	9 v	•Machine type alarm indicators exceeding the durable life
						Electrolytic capacitor	×	×	J	
						Contact point	×	×		
	Control cable (Control Pane	and wiring		Wiring	Visual	Installation state of internal wire	×	×	Reg 4	•Dust accumulation on control cables
				Control Cable	Inspection	Terminal and cable	×	×	Act 3	The counter measure against sman animals
(Remarks)										
GOV-Reg: No,1 (GOVERNOR R	egULATOR P	ANEL Man	ufactured in 19.	88	GOV-Act:No,1 GOVERNOR PANEL Manufactured in 1988	~			
No,2 +	GOVERNOR R	tegULATOR P	ANEL	19	88	No.2 GOVERNOR PANEL 198	88			

【date】 3-11, Feb	Remarks	-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	•Regulators of variable resistor, exceeding the durable life •Mechanical indicators exceeding the durable life	 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 umit exceeding the durable life. 	 No counter measure against the small animal in the back of GOV-Reg Panel Dusts accumulation on control cables
	(GOV-Reg) Detail 2	No, IReg		No, IReg	
ation	(GOV-Reg) Detail 1	No,2Reg		No.2Rag	
hoto) Check List of Site Investig	(GOV-Reg) Overall				
(Site F	Photo No,	Reg 1	Reg 2	Reg 3	Reg 4

【date】 3-11, Feb	Remarks	-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	 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 	
	(GOV-Act) Detail 2	No.1 Act	Servomotor Side		
ation	(GOV-Act) Detail 1	No.2 Act	Under Actuator		
hoto) Check List of Site Investig	(GOV-Act) Overall				
(Site I	Photo No,	Act 1	Act 2	Act 3	

(8.Turbine Co	ntrol	Cubic	le) Chec	ck List o	f Site Inv	/estigation	3-1 C	late】 1, Feb	O: Accep	table x:Not Acceptable X:Remarks
							Res	ult		
Equipment Major	Class 5	Sub-Class	1 Sub-Class 2	Inspe	ection	Inspection Point 1	Unit 1	Unit 2	Photo No, (WAC)	Remarks
Automatic Autom Turbine Control (Turbin Equipment	iatic Tur 1e Contr	bine Contro ol Cubicle)	ol Equipment			Terminal and wiring	×	×		•Manufactured in 1988 (28 year-old)
Control Panel)					Visual	Meter	×	×	-	•Meters and strainers exceeding the durable life
				Overal	Inspection	Distribution valve	×	×	-	
						Grounding wire	×	×		·No spare part of meters and strainer
		Solenoid Va SOLE)	lve			Main body and coil	×	×		•Manufactured in 1988 (28 year-old)
				Overall	Visual Inspection	Grounding fitting	×	×	2	•No spare part •No dust-proof cover
						Grounding wire	×	×		•Dust accumulation
	<u>ت رم</u>	Strainer STRA)		Overall	Visual Inspection	Dust accumulation and oil leakage	0	0		
	E C F	Ry) Ry)				Board installation state	×	×		
						Installation state of connector and terminal	×	×		.Manufactured in 1988 (98 voar-old)
				Relay Unit	Visual Inspection	Indicator should be free from crack and damage.	×	×	3	Bourdon tube pressure gauge for Hydraulic relays exceeding the durable life
						Electrolytic capacitor	×	×		·No spare part
						Contact point	×	×		
Contro (Contro	ol Cable : ol Panel	and wiring)		Wiring	Visual	Installation state of internal wire	×	×		
				Control Cable	Inspection	Terminal and cable	×	×	,	-root appearance
(Remarks) No.1 TURBINE CONTR	SOL PA	VEL								
No.2 TURBINE CONTR	ROL PAI	NEL								
Both are manufact	tured in	1988.								

【date】 3-11, Feb	Remarks	lanufactured in 1988 (28 year-old) leters and switches exceeding the rable life to spare part of meters and ritches itches o dust-proof cover	lanufactured in 1988 (28 year-old) olenoid valve exceeding the rable life o spare part o dust- proof cover. ust accumulation	lanufactured in 1988 (28 year-old) oundon tube pressure gauge for draulic relays exceeding the rable life lo spare part	lanufactured in 1989 (27 year-old) crowded terminal for grounding wire
	(Turbine Control Cubicle) Detail 2	. P. S. S. B. H.	Ý.S.B.Y.Y.	-W-	-M-
ation	(Turbine Control Cubicle) Detail 1				
hoto) Check List of Site Investig	(Turbine Control Cubicle) Overall		200000 00 00 00 00 00 00 00 00 00 00 00		
(Site F	Photo No,	WAC 1	WAC 2	WAC 3	WAC 4

(9.Water L	evel Re	gulator)) Check	List of S	Site Inve	stigation	[date] C	D: Acceptabl	<pre>> x :Not Acceptable Xx:Remarks</pre>
Equipment	Major Class	Sub-Class 1	Sub-Class 2	hspe	ction	Inspection Point	Result	Photo No, (WLR)	Remarks
Water Level	Water Level Regulator	Water Level (WLVG)	Gauge			Float type	×	4	•Fallen off float •No operation as a water level detector
	(MTR)			Water Level	Visual	Pressure type		\backslash	
				Detector	Inspection	Ultrasonic wave type		$\left \right\rangle$	
						Breakwater pipe	×	4	•Corrosion and deformation
		Control Unit (CON)				Data Transmission Line	×		
						Power Unit	×		•Manufactured in 1988 (28 year-old) •No innut from water level detector.
					Visual	Convertor, Inverter and Board	×	•	•Dust accumulation on the control cables and others
				UVerall	Inspection	Rylay and Timer	×	-	 Corrosion on grounding terminal. The Governor free operation is only available because of the broken water
						Water Level Indicator	×		level detector.
						Grounding wire	×		
		Transmission (CDT)	ı Equipmen			Power Unit and NFB	×		
				Transmission Equipment (CDT)	Visual Inspection	Control Unit, Detective Unit and Data Transmission Unit	×	2,3	Manuactured in 1990 (20 year-00) •No input from water level detector •Dust accumulation
				×		Grounding wire	×		Corrosion on grounding terminal
		Frozenness a condensation equipment	and dew 1 prevention	Overall	Visual Inspection	Heater Circuit	×	1~4	• Corrosion
	Control cable (Control Pane	and wiring		Wiring	Visual	Installation state of internal wire	×		Dust accumulation on the control cables
				Control Cable	Inspection	Terminal and cable	×	1~4	and others
(Remarks)									
WATER LEVEL (GOVERNOR	PANEL	Man	ufactured in 19	988				
CDT PANEL(PO	WER HOUSE	EQUIPMENT	Ē.	19	988				
CDT PANEL (IN	TAKE EQUIP	MENT)		19	388				
No.1 WATER LE	VEL GAUGE	OF INTAKE (WL1: 0- 1m/4-	20mA) 19.	88				

1988

No.2 WATER LEVEL GAUGE OF INTAKE (WL1: 0-4.9m/4-20mA)

(Site]	Photo) Check List of Site Investig	ation		【date】 5, Feb
Photo No,	(Water Level Regulator) Overall	(Water Level Regulator) Detail 1	(Water Level Regulator) Detail 2	Remarks
WLR 1	WATER LEVEL			 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	CDT (POWER STATION)			 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	CDT (INTAKE) SUPERNISORY EQUIPMENT			 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	Intake in Pondage Intake No.1 Water level gauge	Intake No.1 Water level gauge	Intake No.2 Water level gauge	 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.

[date] O: Acceptable ×: Not Acceptable %: Remarks 3-10, Feb	Result Result (C/C) Remarks	×	×	× •Manufactured in 1988 (28 vear-old)	× • • • • • • • • • • • • • • • • • • •	X A A Bug uegadation of MCCD and Switch X Meters and operating switches are mechanical type and have aging	x degradation.	×	×						× • • • • • • • • • • • • • • • • • • •	× · · · · · · · · · · · · · · · · · · ·					
e investigation	Inspection Point	State of bus	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.	Board installation state	Installation state of connector and terminal	Indicator	Electrolytic capacitor	Contact point	Installation state of internal wire	Terminal and cable					
list of site	ection				Visual	Inspection						Visual Inspection			Visual	Inspection					
) Check	2 Insp				C	OVELAL						Relay Unit			Wiring	Control Cable		ctured in 1988	1988	1988	
Control)	Sub-Class	0																Manufac			
ment (Sub-Class 1	pment Contr er)													and wiring I)			PANELS)	PANELS)	(2 PANELS)	
ury Equip	Major Class	Auxiliary Equi (Control Cent													Control cable (Control Pane			C PANEL (3 1	C PANEL (3 I	MCC PANEL	
(10.Auxilia	Equipment	Auxiliary Equipment	Control Panel)														(Remarks)	No,1 UNIT MC	No,2 UNIT MC	COMON UNIT	

(Site F	Photo) Check List of Site Investig	ation		【date】 3-10, Feb
Photo No,	(C/C) Overall	(C/C) Detail 1	(C/C) Detail 2	Remarks
- C C				-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	NO.4 UNIT MCC			-Manufactured in 1988 (28 year-old) -Rust on the terminal -No terminal cover -Dust accumulation on the machines and wirings
c/c 3	NO.2 UNIT MCC			-Manufactured in 1988 (28 year-old) -Rust on the terminal -No terminal cover -Dust accumulation on the machines and wirings
c/c 4	COMMON UNIT MCC.			-Manufactured in 1988 (28 year-old) -Rust on the terminal -No terminal cover -Dust accumulation on the machines and wirings

(11.Fire I	Extinguis	hing Sys	item) C	heck Lis	t of Site	Investigation	【date】 3-10, Feb	O: Accept	able ×: Not Acceptable X: Remarks
Equipment	Major Class	Sub-Class 1	Sub-Class 2	İnspec	ction	Inspection Point	Result	Photo No, (FAL)	Remarks
Fire Alarm System (Control Panel)	Fire Alarm Sy (Cenral Contr (FAL)	stem ol Center)				Power Unit	×		
				ImonO	Visual	Installation state of board	×	-	•Manufactured in 1987 (29 year-old) •No maintenance record after COD
				OVELAL	Inspection	Mounting state of timer and auxiliary relays	×	T	 Dust accumulation. Malfunctions of indicators
						Indicator, indicating lamp, and selector switch,	×		
		Detector (Sensor)	Smoke Detector (Soncor)			Installation state of detector	×	¢	-Manufactured in 1987 (29 year-old)
						Free from malfunction	×	o	-No manucularice record arter COD •Dust accumulation.
			Heat Detector (Sancor)	0	Visual	Installation state of detector			
			(Incluse)	Overall	Inspection	Free from malfunction			
			Optical Detector			Installation state of detector			
			(Instac)		· *	Free from malfunction			
		Indivisual Ala (Indicator and	rm 1 buzzer)			Power Unit	×		-Manufactured in 1987 (29 year-old) -No maintenance record after COD
				Overal	Visual Inspection	Installation state of alarm indication	×	2	Dust accumulation
					·	Operation state of alarm indication	×		•The connection to central control center is unknown.
	Control cable (Control Pane	and wiring		Wiring	Visual	Installation state of internal wire	×	1.2.0	•Dust accumulation on internal wiring and teminal
				Control Cable	Inspection	Terminal and cable	×	°∼1	•Dust accumulation on control cables
Fire Extinguisher Mobilo 4000	Fire Extinguis (Mobile type)	her				Free from cracks, damage and leakage	×		. Manufactured in 1987 (90 voor old)
				Overall	Visual Inspection	Fire hose	×	4	No record of replacement of
						Periodic replacement of fire extinguishing compositions	×		extinguishing compositions
(Remarks) FIRE ALARM (CONTROL PAN	JEL Ma	anufactured in	1987		Fire Extinguisher: BC50, ABC20 Manufactured in 1987			

【date】 3-10, Feb	Remarks	-Manufactured in 1987 (29 year-old) -No maintenance record after COD -Aging degradation	 Manufactured in 1987 (29 year-old) No maintenance record after COD Aging degradation The connection to central control center is unknown. 	-Manufactured in 1987 (29 year-old) -No maintenance record after COD -Aging degradation	-Manufactured in 1987 (29 year-old) •No maintenance record after COD •Aging degradation
	(Fire Extinguishing System) Detail 2	THE ALARY CONTROL OF ALAR	Fire Alarm Box	Smoke Detector (2 places)	Fire Extinguisher ABC20
ation	(Fire Extinguishing System) Detail 1		FIRE ALLARY CONTROL FAMIL	Smoke Detector (2 places)	Fire Extinguisher BC50
hoto) Check List of Site Investig	(Fire Extinguishing System) Overall				
(Site F	Photo No,	FAL 1	FAL 2	FAL 3	FAL 4

(12.Wateı	r Level C	auge) (Check L	ist of Sit	e Investi	igation	【date】 11, Feb	O: Accepta	ble x :Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspe	ction	Inspection Point	Result	Photo No, (WLVG)	Remarks
Water Level Gauge Water Level	Water Level Gauge (WI_VC)	Water Level Gauge Main Rodv)				Float type	×	1~5	•Corrosion and Deformation
Gauge Unit)	(0.4744)	(Anor IIIPIA)		Datactor	Visual	Pressure type			
(CIVII Equipment)					Inspection	Ultrasonic wave type			
						Breakwater pipe	×	$1 \sim 5$	•Corrosion and Deformation
		Control Equip (CON)	ment			Data Transmission Line		\square	
					_	Power Unit			
					Visual	Convertor, Inverter and Board			
					Inspection	Rylay and Timer			
						Water Level Indicator			
					_	Grounding wire			
		Data Transmissio		Data		Power Unit and NFB			
		(CDT) (VHF)		Transmission Equipment	Visual Inspection	Control Unit, Detective Unit and Data Transmission Unit			
				(CDI)		Grounding wire			
		Frozenness al condensation	nd dew prevention	Overal	Visual Inspection	Heater Circuit			
	Control cable (Control Pan	e and wiring el)		Wiring	Visual	Installation state of internal wire	×	2 · · · F	 Dust accumulation on internal wiring and teminal
				Control Cable	Inspection	Terminal and cable	×	C∼1	 Dust accumulation on control cables
(Remarks) Civ	vil Equipment								
Water Level g	auge at Mobye	Dam (1 unit)	Manu	factured in 198.	80				
Water Level g	auge at Loikaw	/ City Gauging :	Station (1 uni	it) 198	38				
Water Level g	auge at Dawtae	cha (Intake: 1 p	olace, Outlet :	? units) 198.	8				
Water Level g	auge at Podage	e (2 units)		198	8				
Water Level g	auge at outlet	of Baluchang N	Vo.1 (1 unit)	1988	~				

K List of Site Investigation	evel Gauge) Overall (Water Level Gauge) Detail 1 (Water Level Gauge) Detail 2 Remarks	gauge Dam Dam <td< th=""><th>gade Joing StationAnisotro<</th><th>vel gauge vol 3 (No,1) (No,2) (No,3) (No,1) (No,1) (No,2) (No,3) (No,3) (no,1) (No,1) (No,2) (No,3) (No,3) (no,1) (No,1) (No,1) (No,3) (No,3) (no,1) (No,1) (No,2) (No,3) (No,3) (no,2) (No,3) operation broken operation (no,2) (No,3) operation broken (No,3) (no,2) (No,3) operation (No,3) (No,3) (no,2) (No,2) (</th><th>ge at Podage Intake No.1 Water Level Gauge Intake No.1 Water Level Gauge Intake No.2 Water Level Gauge Intake No.2 Water Level Gauge Intake No.2 Water Level Gauge Intake No.1 Water Level Gauge Intake No.1 Water Level Gauge Intake No.1 Water Level Gauge Intake No.2 Water Level Gauge</th></td<>	gade Joing StationAnisotro<	vel gauge vol 3 (No,1) (No,2) (No,3) (No,1) (No,1) (No,2) (No,3) (No,3) (no,1) (No,1) (No,2) (No,3) (No,3) (no,1) (No,1) (No,1) (No,3) (No,3) (no,1) (No,1) (No,2) (No,3) (No,3) (no,2) (No,3) operation broken operation (no,2) (No,3) operation broken (No,3) (no,2) (No,3) operation (No,3) (No,3) (no,2) (No,2) (ge at Podage Intake No.1 Water Level Gauge Intake No.1 Water Level Gauge Intake No.2 Water Level Gauge Intake No.2 Water Level Gauge Intake No.2 Water Level Gauge Intake No.1 Water Level Gauge Intake No.1 Water Level Gauge Intake No.1 Water Level Gauge Intake No.2 Water Level Gauge
· ·	(Water Level Gauge) Overall	Water Level gauge at Mobye Dam	Water Level gauge t Loikaw City Gauging Station	Water Level gauge at Dawtacha (No,1)	Water Level gauge at Podage
(Site Ph	Photo No,	MLVG	wLVG 2	WLVG 3	

Site F	Photo) Check List of Site Investig	ation (Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	【date】 11, Feb Remarks
No,	(Water Level Gauge) Overall	(Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	Remarks
5 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.Commi	unicatio	n Equip	ment) (Check Lis	st of Site	hvestigation	【date】 [11, Feb	O: Acceptal	ole ×:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1	Sub-Class 2	hispe	ction	Inspection Point	Result	Photo No, (TC)	Remarks
Communication C Equipment o	Jommunicati m	Data Transm Equipment	ission			Power Unit and NFB	×		
(Communication	TC)	(VHF)		O	Visual	Control Unit, Detective Unit and Data Transmission Unit	×	- - -	•Manufactured in 1988 (28 year-old) •Aging degradation
Equipment)				UVERAIL	Inspection	Indicator, indicating lamp, and selector switch	×	ſ~1	 No operation as a communication tool Corrosion and rust on cables and grounding wire
						Grounding wire	×		
		Control Equi (TC-CON)	oment			Data Transmission Line	×		
						Power Unit	×		•Manufactured in 1988 (28 year-old) •Aging degradation
				LO	Visual	Convertor, Inverter and Board	×	1	 No operation as a communication tool Corrosion and rust on cables and grounding wire
				OVERAL	Inspection	Rylay and Timer	×	С <u>-</u> Т	•Degraded battery •Some part of communication and control
						Indicator, indicating lamp, and selector switch	×		• Corrosion and rust on cables and grounding wire
						Grounding wire	×		
		Utility Pole and Steel Tower				Steel tower for communication system		$\left \right\rangle$	
		(TC-TW)		Overall	Visual Inspection	Utility pole for communication system	×	14 	 Corrosion, deformation and rust
						lightning rod and grounding wire	×	C≥ I	•Melted lighting rod on utility pole
		Frozenness a condensation	und dew 1 prevention	Overall	Visual Inspection	Heater Circuit	×	$1 \sim 5$	 Corrosion, deformation and rust
	Communicati Viring	on, Control C;	able and	Wiring	Visual	Installation state of internal wire	×	2.01	•Dust accumulation on control cables and
				Control Cable	Inspection	Terminal and cable	×	С - Т	•Some part of cables immersed
(Remarks) Comm	unication Eq.	uipment							
Mobye Reservoir	Intake Office	(1 VHF trans	sciever)		Manufactured	in1988			
Loikaw City Gaug	ing Station (VHF Transcie	ver 1 unit)			1988			
Dawtacha Intake	Office (VHF	Transciever 2	t units)			1988			
Podage Intake Ofi	fice (CDT: 1	mit)				1988			
Baluchang No.1 P	//S (VHF Tra	nsciever: 1un	it, CDT: 2 unit	s, PLC: 1 unit)		1988			

[date] 11. Feb	Remarks	 •Manufactured in 1988 (28 year-old) •Deformation and rust •Degraded battery •Some part of communication and •Control cables immersed •Controsion and dust accumulation on internal wiring •Wrong communication and control cable 	 •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 	 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 	 Manufactured in 1988 (28 year-old) Deformation and rust No operation as a communication tool Wrong battery Dust accumulation on control cables and others
	(Water Level Gauge) Detail 2				
gation	(Water Level Gauge) Detail 1			VHF Transciever for Mobye and Loikaw) broken operation	
hoto) Check List of Site Investig	(Water Level Gauge) Overall	Mobye Reservoir Intake Office	Loikaw City Gauging Station	Dawtacha Intake Office	Podage Intake Office CDT (for Baluchang No.1 broken
(Site F	Photo No,	TC 1	Z Z	TC 3	4 IC

Site P	hoto) Check List of Site Investig	ution		【date】 11, Feb		
N0,	(Water Level Gauge) Overall	(Water Level Gauge) Detail 1	(Water Level Gauge) Detail 2	Remarks		
TC 5	Baluchang No. 1 P/S CDT/VHF/PLC Equipment	CDT (No.1) Equipemnt (for Pondage) broken	PLC Equipment	 Manufactured in 1988 (28 year-old) Deformation and rust No operation as a communication Broken CDT and PLC Dust accumulation on control cables and others 		
(14.Contr	ol Cable Route map) Check List of Site Inv	vestigation				【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 Ph	oto No,	Remarks
3 F Control Room	 (川) (川) (川) (川) (川) (川) (福) (福) (福) (福) (市) (日) (日) (日) 	(III.E) (III.E) (III.E) (III.T) (III.T) (III.T) (III.T) (III.T) (III.T) (III.T)	Cables to Control Room about 640	Vertical Direction 1m Total on 3F 640m	3 H	8F : 1m * 640 cables = 640m
2 F Cable Room	(2F天井ケーブルラック)	(2F 陸側垂直 (2F 陸側垂直 (2- アーブルラック)	Cables Passing Cable Room about 580	Horizontal Direction 15m Vertical Direction 3.4m 70tal 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.	Hee DC盤 開品 開 日 日 日 日 日 日 日 日 日 日 日 日 日	上 中 D D	Cables Passing 1F about 580	Vertical Direction 4.5m 1F Total 2,610m	1 F	LF Total: 4.5m * 580 cables = 2,610m
B 1 F Turbine Pit etc.	補機 (/C繼 //C/證 AVR盤 GOV盤 盤 (GOV盤 盤 (GOV盤) 盤 (GOV盤) 盤	 () 2G <li< td=""><td>Cables Used on B1F about 200 Outdoor S/S almost 60</td><td>Horizontal Direction 21.5m Vertical Direction Direction BIF Total 11,932m</td><td></td><td>Vumber of cables to outdoor S/S : about 00 100m(distance to S/S) * 60 cables = 100md 1.5m * 200 cables = 4,300m 21.5m * 200 cables = 4,300m Cables passing B1F: 5.1m * 320 cables = 1,632m Total: 6,000 + 4,300 + 1,632 = 11,932m</td></li<>	Cables Used on B1F about 200 Outdoor S/S almost 60	Horizontal Direction 21.5m Vertical Direction Direction BIF Total 11,932m		Vumber of cables to outdoor S/S : about 00 100m(distance to S/S) * 60 cables = 100md 1.5m * 200 cables = 4,300m 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.	1 (((((((((((((2G	Cables to B2F about 320	Horizontal Direction Vertical Direction 2m B1F Total 16,000m	$B2F = \frac{1}{6}$	Vumber of cables used on B2F: about 320 25m * 2m * 320 cables = 16,000m Total Length of removed cables 340 + 30,480 + 2,610 + 11,932 + 16,000 =61,662m \Rightarrow Suppose the error rate is 1.2 =73,994m $\doteq 74,000$ m
(Remarks) •Since all contr	ol cables are heavily degaraded such as corrosion, deformation and rust, th	che replacement is recommended.				

1. The number of removed cables: about 640 cables

(Total amount of estimated cables to remove)

·Control Cables are manufactured by Mitsubishi Cable Industries, ltd. in 1988

(Site F	Photo) Check List of Site Investig	ation	(Control Cable) Datail 9	[date] 5-11, Feb
No	(Control Cable) Uverall	(Control Cable) Detail 1	(Control Cable) Detail 2	Remarks
بي بر بر	Protective Relay Panel	Automatic Control Panel	Gate Operating Panel	
н 5	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	
BIF	C/C Panel	11kV Switch Gear Cubicle for Unit 1	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
- (Distribution Panel, Automatic Control Panel, Operation Panel, Gate Operation Panel) Control Equipment 2 Check List of Site Investigation and Photos (AC/DC Panel) <u>z</u>.
- 3. Control Equipment 3 Check List of Site Investigation and Photos (Recording System)
- Protective Device Check List of Site Investigation and Photos (Machine Protective Relay Panel, System Protection Panel) 4.
- Excitation System Check List of Site Investigation and Photos (Exciter Panel, AVR Panel) <u></u>.
- Speed Governor Check List of Site Investigation and Photos (Governor-Regulator Panel, Governor-Actuator Panel) 6.
- 7. Turbine Control Cubicle Check List of Site Investigation and Photos
- Auxiliary Equipment Control Check List of Site Investigation and Photos <u></u>
- Fire Extinguishing System Check List of Site Investigation and Photos
- 10. Ventilation System Check List of Site Investigation and Photos
- 11. Air-conditioning System Check List of Site Investigation and Photos
- 12. Water Level Gauge (Civil Equipment) Check List of Site Investigation and Photos
- 13. Communication Equipment Check List of Site Investigation and Photos
- Control Cable Route Map Check List of Site Investigation and Photos 14.

(1.Contro	l Equipn	tent 1)	Check]	List of Sit	e Invest	tigation	【date】 15-24, Feb	0: h	cceptable ×:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class	1 Sub-Class 2	Inspec	ction	Inspection Point	Inspect Resul	t (CON)	Remarks
Control Equipment (Control Panel)	Control Equi (CON)	pment (Conti	ol Panel)			Board installation state	×		
						Installation state of connector and terminal	×		
						Mounting state of timer and auxiliary rekys	×		•Manufactured in 1985 (31 year-old)
				Control	Visual	Indicator, indicating lamp, and selector switch	×	1	• No maintenance record after CUD • Dust accumulation • Mechanical meters and operation
				cubicle	Inspection	Test terminals	×	021	switches • Aging degradation • Defects on the semiconce of automatic
						Electrolytic capacitor	×		generator stop
						Cooling fan for power supply unit	×		
						Installation state of connector and terminal at power unit sect	ion ×		
						Board installation state	×		
						Installation state of connector and terminal	×		•Manufactured in 1985 (31 year-old)
				Relay Unit	Visual Inspection	Indicator	×	1~8	•Dust accumulation •Mechanical meters and operation
						Electrolytic capacitor	×		switches • Aging degradation
						Contact point	×		
	Control cabl (Control Pan	e and Wiring el)		Wiring	Visual	Installation state of internal wire	×	<u>~</u>	•Dust accumulation on internal wires and terminals
				Control cable	Inspection	Terminal and cable	×	021	Dust accumulation on control cables
(Remark)									
CONTROL DESK		M	anufactured in	1985					
No.1 GENERATO	R TRANSFO	RMER PANE	L (2 panels)	1985		WATER LEVEL MEASURING PANEL Manufacture 1985	od in *It is ree	quested that 33	ikV FEEDER PANEL is removed.
132kV MANDAL#	AY FEEDER I	ANEL		1985		JOINT CONTROL PANEL 1985	*It is rec	quested that J	JINT CONTRO PANEL is removed.
No.2 GENERATO	R TRANSFO	RMER PANE	L (2 panels)	1985		SYNCHRONIZING DETECTION PANEL 1985			
33kV FEEDER P	ANEL			1985					
132kV KYAUKPA	HTOE FEED	ER PANEL		1985					

【date】 15-24, Feb	1ent) Detail Remarks	Operation Panel Mechanical meters and operation switches Manufactured in 1988 (28 year-ol Namifactured in 1988 (28 year-ol Namitactured in 1988 (28 year-ol Antifactured in 1988 (28 year-ol Antifactu	Genetaor Panel Mechanical meters and operation Switches •Manufactured in 1985 (31 year-ol •No maintenace record after COD •Dust accumulation •Aging degradation	 132kV Mandalay Feeder Panel Mechanical meters and operation switches Manufactured in 1985 (31 year-ol •No maintenace record after COD Dust accumulation Aging degradation 	33kV Feeder Panel (not used) 33kV Feeder Panel (not used) •Mechanical meters and operation switches •Manufactured in 1985 (31 year-ol •No maintenace record after COD
_	(Control Equipment) Detail (Control Equipm				
hoto) Check List of Site Investigation	(Control Equipment) Overall				
(Site P	Photo	CON 1	CON 2	3 3	CON 4

【date】 15-24, Feb	Remarks	 132kV Kyaukpahtoe Feeder Panel Mechanical meters and operation switches Manufactured in 1985 (31 year-old) No maintenace record after COD Dust accumulation Aging degradation 	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	Water Level Measuring Panel •No maintenace record after COD •Dust accumulation •Aging degradation on timer and auxiliary relay units	Joint Control Panel (not used) •No maintenace record after COD •Dust accumulation •Aging degradation on timer and auxiliary relay units
	(Control Equipment) Detail	12265 KIAUKPAIITOF FEEDER			
ation	(Control Equipment) Detail			MATER LEVEL MEASURING	TOBELINDOS INITO"
hoto) Check List of Site Investig	(Control Equipment) Overall				
(Site I	Photo	5	CON 6	CON 7	CON 8

(2.Contro	l Equipm	lent 2)	Check L	ist of Site	e Invest	igation	【date】 3-8, Feb	O: Accept	able ×:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspect	ion	Inspection Point	Inspection Result	Photo (HADC)	Remarks
Control Equipment (Control Panel)	Control Equipment (Control	Control Power Unit (Control	AC/DC Control Power Unit			State of bus	×		
	Panel) (CON)	Power Panel)	Control Power			Installation state of teminal block	×		
		(CON-H)	Panel) (CON-HAC)			Mounting state of timer and auxiliary relays	×		-Manufactured in 1985 (31 vear-old)
				C	Visual	Indicator, indicating lamp, and selector switch	×	- -	•Analog type meters of voltage and current
				OVELAI	Inspection	Test terminals	×	7 . 1	-mechanical operation switches •No maintenance record •Aging degradation
						Electrolytic capacitor	×		• Dust accumulation
						Installation state of NFB and MCCB	×		
						NFB and MCCB should be free from operation failure.	×		
						Board installation state		\backslash	
						Installation state of connector and terminal		\backslash	
				Relay Unit	Visual Inspection	Indicator		\backslash	
						Electrolytic capacitor			
						Contact point		\backslash	
	Control cable (Control Pane	e and Wiring el)		Würing	Visual	Installation state of internal wire	×	c	•Dust accumulation on internal wires and
				Control Cable	Inspection	Terminal and cable	×	N	terminals • Dust accumulation on control cables
(Remark)									
AC/DC CONTR	tol power p	ANEL: DR GO	HRE KG-BAD	VILBEL PANEL	Maı	ufactured in 1985			

【date】 16-23, Feb	Remarks	-Manufactured in 1985 (31 year-old) -Analog type meters of voltage and current -Mechanical operation switches -Aging degradation	•Manufactured in 1985 (31 year-old) •Aging degradation on MCCB •Dust accumulation on internal wires and control cables	
	(Control Equipment 2) Detail			
ation	(Control Equipment 2) Detail			
hoto) Check List of Site Investig	(Control Equipment 2) Overall			
(Site I	Photo	HADC 1	HADC 2	

Equipment Major Class Control Automatic Equipment Recording (Control Panel) System System) (RD)	Sub-Class 1 Sub-Class					Dhoto	
Control Automatic Equipment Recording (Control Panel) System System) (RD)		2 Inspe	ction	Inspection Point	Inspection Result	(RD)	Remarks
(RD) (RD) (RD)	Switching Board (SWB)			State of looseness and others of wires	×		
				Grounding wire	×		
				Crounding wire should be free from wire break; Grounding wire tightening check	×		
		L	Visual	Indicator, indicating lamp, and selector switch	×		-Manufactured in 1985 (31 year-old)
		OVERAIL	Inspection	Visual Inspection of the parts where defect was detected during patrol and by alarm.	×	I~4	-Au recorders are proken •Dust accumulation
				Installation state of NFB and MCCB	×		
			·	NFB and MCCB should be free from operation failure.	×		
			·	Power supply unit	×		
		Dolow Ilat	Visual	Installation state of connector and terminal			
		weidy unit	Inspection	Indicator should be free from crack and damage.			
	Recording Machine (RM)	lower	Visual	State of recording sysytem operation and indication	×	2	-All recorders are broken
		OVELAL	Inspection	Dust accumulation is not allowed in the recording machine and wiring.	×	т -	Dust accumulation
	Resistor Temperature Detector (RDT)	Overall	Visual Inspection	State of wire, terminal, and element etc.			
Control cable (Control Pane	and Wiring ()	Wiring	Visual	Installation state of internal wire	×	1~1	Dust accumulation
		Control Cable	Inspection	Terminal and cable	×	н . Т	Dust accumulation
(Remark)							
WATER LEVEL MEASURING	PANEL Manufactured	in 1985	No.1 GEN AUX	ILIARY RELAY PNEL Manudactured in 1985			
No.1 TURBINE GAUGE PANE	Ŀ	1985	No.2 GEN AUX	ILIARY RELAY PANEL 1985			
No.2 TURBINE GAUGE PANE	Ŀ	1985					
No.1 GEN GAUGE PANEL		1985					
No.2 GEN GAUGE PANEL		1985					

(Site F	Photo) Check List of Site Investig	ation		【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		ND 1 TURBINE GAUGE	Turbine Thermometer	Turbine gauge panel •Manufactured in 1985 (31 year-old) •Broken discharge meter •Broken water temperature recorder
RD 3	NO LIEN ANGE	Generator Thermometer 1	Generator Thermometer 2	Generator gauge panel •Manufactured in 1985 (31 year-old) •Broken generator thermometer 1 and 2
RD 4	AUXILIARY RELAY		Vibrometer	Generator auxiliary relay panel •Manufactured in 1985 (31 year-old) •Broken Vibrometer

A6 - 47

(4.Protect	tive Dev	ice) Ch	leck List	t of Site l	Investige	ation [0	ate】	O: Accepta	ole ×: Not Acceptable
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspec	tion	Inspection Point	Inspection Result	Photo (MPR)	Remarks
Machine Protection	Machine Prot (MPR)	ection Relay				Board installation state	×		
ketay (analogue, static type)						Installation state of connector and terminal	×		
						Mounting state of timer and auxiliary relays	×		Analog type relay unit
					Visual	Indicator, indicating lamp, and selector switch	×	1 - -	 Manutactured in 1985 (31 year-old) Dust accumulation No maintenance record of relay unit
				UVerall	Inspection	Test terminals	×	C∼I	• No spare part of relay unit • Aging degradation • Anabod true relay unit is budien and
						Electrolytic capacitor	×		- Antabug type ready unit is proven and standby relay is used.
						Cooling fan for power supply unit	×		
						Installation state of connector and terminal at power unit section	×		
						Board installation state	×		
						Installation state of connector and terminal	×		• Analog type relay unit • Manufactured in 1985 (31 year-old) • Dust accumulation
				Relay Unit	Visual Inspection	Indicator	×	$1\sim 5$	•Oil leakage from electrolyte capacitor •No maintenance record of relay unit •No snare nart of relay unit
						Electrolytic capacitor	×		-Aging degradation -Analog type relay unit is broken and
						Contact point	×		statituty telay is used.
	Control cable (Control Pan	e and wiring el)		Wiring	Visual	Installation state of internal wire	×	1 	Dust accumulation
				Control Cable	Inspection	Terminal and cable	×	c∼I	Dust accumulation
(Remark)									
GENERATOR TR	ANSFORMER	: PANEL 1 (2	panels) Man	uufactured in 1:	Relay Unit:	64F, 64R, 95FF, 86NE, 86E, 132kV51/64, 11kV51/64,	87GT、46		
GENERATOR TR	ANSFORMER	: PANEL 2 (2	panels)	19		59, 27, 64G, 40, 40V, 92GT, 87G, 51VR, 92G, 92C, 40T			
132kV MANDAL ⁴	VY FEEDER P	ANEL		19		67P(L1, L3), 67G, 21, 51×64			
33kV FEEDER P	ANEL			198		132kV51/64、33kV51/64、67G	*It is reques	ted that 33	cV feeder panel is removed.
132kV KYAUKPA	HTOE FEEDI	ER PANEL		19		67P(L1, L3), 67G, 21, 51×64			

(Site I	Photo) Check List of Site Investig	ation		【date】 26-23, Feb
Photo	(Protective Device) Overall	(Protective Device) Detail	(Protective Device) Detail	Remarks
MPR 1	GENERATOR TRANSFURMER 2			 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 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	132 KV MANDALAY FEEDER			 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	33.4V FEEDER			 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

【date】 16-23, Feb	Remarks	 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. 									
	(Protective Device) Detail										
ation	(Protective Device) Detail										
10to) Check List of Site Investige	(Protective Device) Overall	FREDERIE									
(Site P	Photo	MPR 5									

(5.Excitat	tion Syst	tem (AV	R)) Che	eck List (of Site In	ivestigation	-	【date】 6-24, Fé	D: Ac	ceptable ×:Not Acceptable X:Remarks
F		5	5		:		Inspec Resi	ction ult	Photo	-
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspe	ction	Inspection Fourt	Unit 1	Unit 2	(AVR)	Kemarks
Excitation System	Excitation System	Relay (Rv)				Board installation state	×	×		·Manufacturad in 1985 (31 voar-old)
(Control Panel)	(EX)			Control Panel	Visual Inspection	Installation state of connector and terminal	×	×	1	Analog type relay
					4	Electrolytic capacitor	×	×		•No spare part
		Thyristor (THY)		Arrestor, Thyristor, Rectifier,		Fouling, damage and errosion of elements; Looseness of terminat Overheat	×	×		•Fouling on thrystor •No spare part
				vitreous enamel resistor		Fouling and damage of elements; Looseness of terminal; Overheat	×	×	2	Dust accumulation
				, ÅJLズTr	Visual	Fouling and damage; Looseness of terminal; Overheat	×	×		Dust accumulation
				Fuse	mspection	Conduction; Looseness of terminal	×	×		Dust accumulation
				Grounding device		Grounding wire break; Removed grounding metal fitting	0	0	\setminus	
				Arrestor		Grounding wire break; Looseness of grounding metal fitting	0	0		
			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		Printed board		Fouling and damage; Overheat	×	×		
		Automatic	Voltage	90R and 70R Limit Switch		Operation state; Looseness of terminal	×	×		
		weguiator (F		Arrestor and		Fouling and damage of elements; Looseness of terminal: Overheat	×	×		Manufactured in 1985 (31 year-old)
		Automatic Regulator (A	Power Factor PFR)	Fuse		Conduction; Looseness of terminal; Overheat	×	×		 Analog type meters exceeding durable life Transistor type regulators exceeding
		Power Syst	em Stabilizer	Detective		Fouling and damage; Wire break of detection lamp	×	×	1, 3	durable life • Spring type field CB whose arc-
		(PSS)		Auxiliary relay	Visual	Operation state; Overheat; Looseness of terminal	×	×		extinguishing chamber is vitreous enamel resistor tyne
		Field Circui	t Breaker	Insuration Transformer	Inspection	Fouling and damage; Overheat	×	×		Dust accumulation
		(11)		Cooling Fan		Fouling and damage; Looseness of terminal; Overheat	×	×		
				Instrument		Operation state; damage; Looseness of terminal	×	×		
				Grounding		Grounding wire break; Removed grounding metal fitting	0	0	\setminus	
				device		Grounding wire break; Looseness of grounding metal fitting	0	0		
				Control, PT and CT Circuit		Fouling, overheat, deformation and looseness of terminal on control and PCT circuit.	×	×	$1 \sim 3$	Dust accumulation
	Control cable	and wiring		Wiring	Visual	Installation state of internal wire	×	×	19	Dust accumulation
		(r)		Control cable	Inspection	Terminal and cable	×	×	r~1	Dust accumulation
(Remark)	ł									
NO. I AVK FAL	VEL	Manuractured	1961 III 1		NO. 2 AVK FF					
No. 1 THYRIST	OR RECTIFIE	R PANEL	1985		No. 2 THYRIS	TOR RECTIFIER PANEL 1985				
No. 1 FIELD SV	VITCH CUBICI	E	1985		No. 2 FIELD S	SWITCH CUBICLE 1985				

【datte】 16-24,Feb	Remarks	AVR Panel • Manufactured in 1985 (31 year-old) • Analog type meters exceeding durable life • Removed cooling fan because of falure • No dust- prrof cover • No spare part	No.1 Thyristor Rectifier Manufactured in 1985 (31 year-old) • Thyristor exceeding the durable life • Black smoked auxiliary relays • No spare part	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	
	(AVR) Detail				
ation	(AVR) Detail				
hoto) Check List of Site Investig	(AVR) Overall	NG TAVR	entration in the second	NOT FIELD SWITCH	
(Site P	Photo	AVR 1	AVR 2	AVR 3	

(6.Speed	Governc	or (GOV)) Chec	k List of	Site Inv	estigation	16-2	late】	O: Accep	table ×: Not Acceptable X: Remarks
							Inspe Res	ction sult	Photo	
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspe	ction	Inspection Point	Unit 1	Unit 2	(Reg) (Act)	Remarks
Speed Governor (Control Panel)	Speed Governor	Regulator Pai (Red)	nel			Power unit, NFB	×	×		
	(GOV)	Barri				Control, detection and Regulation unit	×	×		
						Indicated value of meters	×	×		
						Motors for Regulator (77M, 65M)	×	×		•Manufactured in 1985 (31 year-old)
						hput/Output unit	×	×		•Llack of ability to adjust the speed
					Visual	Cable and terminal	×	×	Reg	· Replaced power unit
				Overall	Inspection	Indication panel/lamp	×	×	$1 \sim 3$	• Aging degradation on power unit • No spare part of power and detection
						Regulator	×	×		unit •All devices are analog type.
						Arrestor circuit and fuse	×	×		
						Installation state of prinnted board	×	×		
						Restoration unit	×	×		
						Grounding wire	×	×		
		Actuator (ACT)				Pilot Valve	×	×		
						Primary distribution valve	×	×		•Manufactured in 1985 (31 year-old)
						Secaondary distribution valve	×	×		•Grease adhering to the operation unit in
					Visual	Auxiliary servomotor	×	×	Act	Deterioration of operating oil
				Overall	Inspection	hydraulic booster	×	×	$1 \sim 3$	 Removed power meter because of ranke Incorrect value indicated by speed meter
						Coupling unit	×	×		at the position "0" •No maintenance record of coupling and
						Return unit	×	×		return units in actuator panel after COD
						Meters	×	×		
		Relay Unit				Board installation state	×	×		
						Installation state of connector and terminal	×	×	Dec	. Onometing curitchos timors and anyliany
				Overall	Visual Inspection	Indicator	×	×	n Ne	Operating switches, unless and auxiliary relays exceeding the durable life.
						Electrolytic capacitor	×	×	N	-Dust accumulation
						Contact point	×	×		
	Control cable (Control Pane	e and wiring		Wiring	Visual	Installation state of internal wire	×	×	Reg 3	 Dust accumulation on control cables
		6		Control Cable	Inspection	Terminal and cable	×	×	Act 4	•Oil adhering the cables
(Remark)										
GOV-Reg Panel:	No. 1 GOVEI	RNOR REGUL	ATOR PANEI	. Manufacture	d in 1985	GOV-Act PANEL: No. 1 GOVERNOR PANEL Manufactured i	in 1985			
	Vo. 2 GOVER	NOR REGULA	TOR PANEL	Manufactured	in 1985	GOV-Act PANEL: No.2 GOVERNOR PANEL Manufactured i	in 1985			

【date】 16-24, Feb	Remarks	Power unit • Manufactured in 1985 (31 year-old) • Aging degradation • No spare part of power unit • Dust accumulation	Regulator setting device Regulators of variable resistor, exceeding the durable life Operation switches, timers and auxiliary relays exceeding the durable life	Intermal wires and control cables • Dust accumulation		
	(GOV-Reg) Detail	No.2 Reg	No.2 Reg	No.2 Reg		
ation	(GOV-Reg) Detail	No.1 Reg	No.1 Reg	No.1 Reg		
hoto) Check List of Site Investig	(GOV-Reg) Overall					
(Site I	Photo	Reg 1	Roo 2	Reg 3		

【date】 16-24, Feb	Remarks	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"	Governor Actuator Panel Grease adhering to the operation unit in actuator panel Oil leakage Degraded operation oil	Return Unit •No maintenance record of coupling and return units in actuator panel after COD	Intermal wires and control cables • Dust accumulation
	(GOV-Act) Detail	No.2 Act		Servomotor Side	
gation	(GOV-Act) Detail	No.1 Act		Internal Actuator	
hoto) Check List of Site Investig	(GOV-Act) Overall				
(Site F	Photo	Act 1	Act 2	Act 3	Act 4

A6 - 55

(date)

(7.Turbine (Contro	l Cubic	le) Chec	sk List of	f Site Inv	vestigation	-	【date】 5-25, Feb	O: Accept	able ×:Not Acceptable X:Remarks
							Щ	pection Result	Photo	
Equipment M:	ajor Class	Sub-Class	1 Sub-Class 2	Inspe	sction	Inspection Point	Unit	1 Unit 2	(MAC)	Remarks
Automatic Au Turbine Control (Tu Founiment (W)	tomatic Tu urbine Con	rrbine Contro trol Cubicle)	ol Equipment			Terminal and wiring	×	×		
(Control Panel)					Visual	Meter	×	×		•Manufactured in 1985 (31 year-old) •Meters and auxiliary relays exceeding the
				OVERAL	Inspection	Distribution valve	×	×		durable life •No spare part of meters and switches
						Grounding wire	×	×	ע י ד	
		Solenoid Va (SOLE)	lve			Main body and coil	×	×	<u>[</u>	Dust accumulation
				Overall	Visual Inspection	Grounding fitting	×	×		
						Grounding wire	×	×		
		Strainer (STRA)		Overall	Visual Inspection	Dust accumulation and oil leakage	0	0		
		Relay (Ry)				Board installation state	×	×		
						Installation state of connector and terminal	×	×		. Manufactured in 1085 (21 voor old)
				Relay Unit	Visual Inspection	Indicator should be free from crack and damage.	×	×	1~3	Aging degradation of meters, protective relays and auxiliary relays
						Electrolytic capacitor	×	×		· No spare part
						Contact point	×	×		
<u>22</u>	ntrol cable ontrol Pane	t and wiring ()		Wiring	Visual	Installation state of internal wire	×	×	1 	•The result of visual inspection is not
				Control Cable	Inspection	Terminal and cable	×	×	°~1	acceptable.
(Remark)										
No.1 TURBINE GAI	JGE PANE.	L	Manufactured ii	n 1985		No.2 TURBINE GAUGE PANEL M.	anufactured in 196	5		
No.1 GEN GAUGE	PANEL			1985		No.2 GEN GAUGE PANEL	198	5		
No.1 ALARM AND	ANNUNCIA	TOR PANEL		1985		No.2 ALARM AND ANNUNCIATOR PANEL	19	85		
No.1 TURBINE AUX	ILIARY RI	JAY PANEL		1985		No.2 TURBINE AUXILIARY RELAY PANEL	19	85		
No.1 GEN AUXILIA	RY RELAY	PANEL		1985		No.2 GEN AUXILIARY RELAY PANEL	19	35		

(Site F	Photo) Check List of Site Investig	ation		【date】 16-25, Feb
Photo	(Turbine Control Cubicle) Overall	(Turbine Control Cubicle) Detail	(Turbine Control Cubicle) Detail	Remarks
WAC 1		NOT TURBINE GAUGE		 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		APP TEAN GALLER		 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		ATT A LANS W		 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		NUTINER PERINE		 Manufactured in 1985 (31 year-old) Meters and auxiliary relays exceeding the durable life No spare part on meters and switches Dust accumulation

【date】 16-25, Feb	Remarks	 Manufactured in 1985 (31 year-old) Broken vibrometer Meters and auxiliary relays exceeding the durable life exceeding the durable life exceeding the part on meters and Switches Dust accumulation 									
	(Turbine Control Cubicle) Detail										
ation	(Turbine Control Cubicle) Detail	AUXIL JARY RELVI									
hoto) Check List of Site Investig	(Turbine Control Cubicle) Overall										
(Site F	Photo	WAC 5	 	 	 		 	 		 	

(8.Auxiliary E	Guipmer	nt Coi	ntrol) C	theck list	t of site	investigation	【date】 17-24, Fé	eb O: Acc	eptable X:Not Acceptable X:Remarks	
Equipment Majo	r Class Sub-	Class 1	Sub-Class 2	İnspe	ction	Inspection Point	Inspection Result	Photo (C/C)	Remarks	
Auxiliary Auxil Equipment (Cont	liary Equipmen trol Center)	t Control				State of bus	×			1
(Control Panel)	ç					Installation state of teminal block	×			
						Mounting state of timer and auxiliary relays	×			
				ImonO	Visual	Indicator, indicating lamp, and selector switch	×	1~2	•Manutactured in 1985 (31 year-old) •No maintenace record after COD •Dust accumulation	
				OVERAIL	Inspection	Test terminals	×	C 2 1	 Mechanical meters and operation switches Action decoradation of MCCB and switche 	u
						Electrolytic capacitor	×			0
						Installation state of NFB and MCCB	×			
						NFB and MCCB should be free from operation failure.	×			
			1			Board installation state	×			
						Installation state of connector and terminal	×		-Manufactured in 1985 (31 year-old)	
				Relay Unit	Visual Inspection	Indicator	×	2	Aging degradation of meters, operation	
						Electrolytic capacitor	×		switches, protective relays, auxiliary relay and circuit breakers	Ś
						Contact point	×			
Cont. (Cont	rol cable and v trol Panel)	wiring		Wiring	Visual	Installation state of internal wire	×	6 	•Dust accumulation on internal wires and terminals	
				Control Cable	Inspection	Terminal and cable	×	1~3	Dust accumulation on control cables	
(Remark)										
Indoor Panel: 400V FI	EEDER-1	Ύ.	Manufactured	in 1985	400V FEEDER	R-7 Manufactured in 1985	Outdoor Pan	el: 400V FE	EDER-1 Manufactured in 1985	
400V FE	EDER-2	Μ	anufactured i	n 1985	400V FEEDEF	R-8 Manufactured in 1985				
EDG FEF	EDER-3	Ā	lanufactured i	in 1985						
No.1(11kV	V/400V) FEEI	DER-4 N	Aanufactured	in 1985						
Outdoor 5	S/S FEEDER-	-5	Manufactured	in 1985						
No.2 (11k	V/400V) FEE	DER-6	Aanufactured	in 1985						

to I	Photo) Check List of Site Investig: (C/C) Overall	(C/C) Detail	(C/C) Detail	【date】 17-24, Feb Remarks
		FEEDER-1 FEEDER-2 FEEDER-7 FEEDER-7 FEEDER-8	FEEDER-1 FEEDER-2 FEEDER-3 FEEDER-8	Auxiliary control center (C/C) •Manufactured in 1985 (31 year-old) •Aging degradation of MCCB, timer, switches and auxiliary relays •Dust accumulation
		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
	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 Ex	tinguishi	ing Syst	tem) Ch	eck List	of Site l	Investigation	【date】 17-24, Feb	O: Accep	table x:Not Acceptable X:Remarks	
Equipment	Major Class	Sub-Class 1	Sub-Class 2	Inspe	ction	Inspection Point	Inspection Result	Photo (FAL)	Remarks	
Fire Alarm System (Control Panel)	Fire Alarm Sy (Cenral Contr (FAL)	/stem ol Center)				Power Unit				· ·
					Visual	Installation state of board				
					Inspection	Mounting state of timer and auxiliary relays	\square			
						Indicator, indicating lamp, and selector switch,				
		Detector (Sensor)	Smoke Detector (Sensor)			Installation state of detector		\backslash		
						Free from malfunction				
			Heat Detector (Sensor)		Visual	Installation state of detector	$\overline{\ }$			
					Inspection	Free from malfunction	\square			
			Optical Detector (Sensor)			Installation state of detector				
						Free from malfunction	\square			
		Indivisual Ala (Indicator an	arm d buzzer)			Power Unit				
				Overall	Visual Inspection	Installation state of alarm indication				
						Operation state of alarm indication				
	Control cable (Control Pane	: and wiring ()		Wiring	Visual	Installation state of internal wire		\backslash		
				Control Cable	Inspection	Terminal and cable				
Fire Extinguisher Machila tyma)	Fire Extinguis (Mobile type)	her				Free from cracks, damage and leakage	0			
				Overall	Visual Inspection	Fire hose	×	1, 2	Aging degradation of hose	
						Periodic replacement of fire extinguishing compositions	0			
(Remark)		; ; ;								
FIRE EXTINGU	ISHER: KS2SE	3(B•E) M:	anufactured in	1987	FIRE EXTING	JISHER: Pr6G(A·B·C·E) Manufactured in 1987	FIRE EXTING	UISHER: KS	56SE(B・E) Manufactured in 1987	
FIRE EXTINGU.	ISHER: LW50(A-B) M	lanufactured in	1987	FIRE EXTING	JISHER: P50G(A·B·C·E) Manufactured in 1987	FIRE EXTING	UISHER: CO	02(B•60kg) Manufactured in 1987	

【date】 17-24, Feb	etail Remarks	Fire Extinguisher Manufactured in 1987 (29 year-old) • Replacement of extinguishing compositions 3years ago • Aging degradation of hose	 Z Fire Extinguisher Manufactured in 1987 (29 year-old) (only CO2 type is manufactured in 1987) Replacement of extinguishing compositions 4 years ago Aging degradation of hose 						
	(Fire Extinguishing System) De	KS6SE (B-E)	(B. 60						
gation	(Fire Extinguishing System) Detail	Ph6GE (A-B-C-E)	LW50 (A-B-C-E)						
hoto) Check List of Site Investig	(Fire Extinguishing System) Overall	KS2SB (B·E)	PEOG (A-B)						
(Site P	Photo	FAL 1	FAL 2						

(10. Ven)	tilation S	System)	Check I	List Site	Investig	ation	【date】 23-25, Feb	O: Accep	table ×:Not Acceptable X:Remarks
Equipment	Major Class	s Sub-Class 1	1 Sub-Class 2	Inspec	ction	Inspection Point	Inspection Result	Photo (DRS)	Remarks
Ventilation System	Ventilation System (DRS)	Suction System (DRS-IN)	Control Panel (CON)			Installation state of termianl	×		-Manufactured in 1985 (31 year-old)
		Exhaust		leron	Visual	Installation state of timer and auxiliary relay	×	6	· broken electrical components by lightening • Corrosion and dust accumulation on
		System (DRS-OUT)			Inspection	Indicator, indicating lamp, and selector switch,	×	4	wiring •All electrical elements are not in oneration
						Installation state of NFB and MCCB	×		It does not work as control panel.
			Relay (Ry)			Board installation state	×		-Manufactured in 1985 (31 year-old)
				Relay Unit	Visual Inspection	Indicator	×	2	•Broken electrical components by lightening •All electrical elements are not in
						Contact point	×		operation.
			FAN (FAN)			Installation state of motor	×		•Manufactured in 1985 (31 year-old)
				Overall	Visual Inspection	Installation state of fan	×	1	 Dust accumulation on the fan and wire Remote operation is not available from control panel.
						Power cable state	×		
			Suction Duct Exhaust			Installation state of duct	0		
			Duct Duct (DKT)	Overall	Visual Inspection	State of intake, outtake and filter	×	-	•Manufactured in 1985 (31 year-old) •Fouling on ventilation duct and filter
						State of flow regulating flow valve and switching lever	×	4	•Some part of regulating valve are brok
		Control cabl (Control Pan	le and wiring nel)	Wiring	Visual	Installation state of internal wire	×	1 - 0	•Dust accumulation on internal wires an terminals
			1	Control Cable	Inspection	Terminal and cable	×	I~3	•Dust accumulation on control cables
(Remark)		-		-					

VENTILATION CONTROL PANEL Manufactured in 1985

(Site I	Photo) Check List of Site Investig	ation		【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.
3 3 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 C	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-condit	ioning Sys	stem] C	heck Lis	it of Site	Investigation	【date】 23-25, Feb	O: Accep	table ×:Not Acceptable X:Remarks
Equipment Major Cla	ss Sub-Class 1	l Sub-Class 2	hispe	ction	Inspection Point	Inspection Result	Photo (AC)	Remarks
Air-Conditioning Air- System Conditioni System	Air- ng Conditioning System	Control Panel			Installation state of termianl	×		
(AC)	(AC)			Visual	Installation state of timer and auxiliary relay	×	c	•Manufactured in 1985 (31 year-old) •Broken air-conditioning system
			OVERAIL	Inspection	Indicator, indicating lamp, and selector switch,	×	4	Aging uegratuou of an electrical components in the cubicle . It does not work as control panel
					Installation state of NFB and MCCB	×		
		Water Cooling Modium		Visual	Installation state of each device	×	1	
		(WEET)	UVerall	Inspection	State of pipings			
		Dry Cooling Medium		Visual	Installation state of each device			
		(11177)	UVerall	Inspection	State of pipings			
		Compressor (COMP)			Installation state of motor	×		•Manufactured in 1985 (31 year-old) •Domoto coorreion is not available from
			Overall	Visual Inspection	hstallation state of fan	×	1	control panel control panel . Uses accumulation in the duct and on the
					State of power cable	×		cables
		Nozzle from Air-	-	Visual	Installation state of duct			*Duct is not able to check
		duct	UVerall	Inspection	State of duct and filter	×	3	Dust accumulation
	Control cabl (Control Pan	e and wiring nel)	Wiring	Visual	Installation state of internal wire	×	6	•Dust accumulation on internal wires and terminals
			Control Cable	Inspection	Terminal and cable	×	4	Dust accumulation on control cables
(Remark) Air-conditioning system in Air-conditioning system in	control room (2 rectifier room (1	units) M L unit) M	anufactured in lanufactured in					

【date】 23-25, Feb	ıg System) Detail Remarks	Air- conditioner (2 units) Manufactured in 1985 (31 year-old) - Dust accumulation - Both are broken.	Air-conditioning control panel Manufactured in 1985 (31 year-old) - 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.	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.	Air-conditioner in rectifier room (Lunit) - Manufactured in 1985 (31 year-old) - Broken machine - No air-conditioning equipment in rectifier room
ntion	(Air-conditioning System) Detail (Air-conditionir				
Photo) Check List of Site Investig	(Air-conditioning System) Overall	Air-conditioning System in Control Room	Control Panel	Nozzle on the Ceiling of Control Room	Air-conditioning System in Rectifier Room
(Site I	Photo	AC 1	AC 2	AC 3	AC 4

(12.Wateı	· Level C	auge) C	heck Li	st of Sit	e Investi	igation [da	te】 , Feb	O: Accepta	ble x:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1 S	ub-Class 2	İnspe	ction	Inspection Point	Inspectio Result	n Photo (WLVG)	Remarks
Water Level Gauge (Water Level	Water Level Gauge (WLVG)	Water Level Gauge (Main Bodv)				Float type			
Gauge Unit)	(6474)	(from more)			Visual	Pressure type	×	$1 \sim 2$	No data transmission from gauge
(Civil Equipment)				Delector	Inspection	Ultrasonic wave type			
						Breakwater pipe	0		
		Control Equipm (CON)	ent			Data Transmission Line			
						Power Unit			
				[]errort	Visual	Convertor, Inverter and Board			
				OVELAIL	Inspection	Rylay and Timer			
						Water Level Indicator			
						Grounding wire			
		Data Transmissio n Equipment		Data		Power Unit and NFB			
		ir Equipment (CDT) (VHF)		Transmission Equipment	Visual Inspection	Control Unit, Detective Unit and Data Transmission Un			
				(101)	-	Grounding wire			
		Frozenness and condensation p equipment	l dew revention	Overall	Visual Inspection	Heater Circuit			
	Control cable (Control Pan	e and wiring el)		Wiring	Visual	Installation state of internal wire			
				Control Cable	Inspection	Terminal and cable	×	1~2	·Dust accumulation on control cables
(Remark) Civi	l Equipment								
Water Level Ga	uge in Dam in	take (1unit)	Manufacture	d in 1985 *T	'his is maintain	ed by ministry of aggriculture and irrigation.			
Water Level Ga	uge in P/S (1	unit)	Manufacture	d in 1985 *7	lhis is maintain	led by ministry of electric power.			

【date】 23-25, Feb	Remarks	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.	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.							
	(Water Level Gauge) Detail									
ation	(Water Level Gauge) Detail									
hoto) Check List of Site Investig	(Water Level Gauge) Overall									
(Site I	Photo	1 1	WLVG 2			_	_	_	_	_

(13.Comm	unicatio	n Equip	ment) (Check Lis	t of Site) Investigation	【date】 17-24, Feb	O: Accept	able x:Not Acceptable X:Remarks
Equipment	Major Class	Sub-Class 1	t Sub-Class 2	hspec	tion	Inspection Point	Inspection Result	Photo (TC)	Remarks
Communication Equipment	Communicati on Fouriement	Data Transm Equipment	lission			Power Unit and NFB	×		•Communication equipment in control room is manufactured in 1963 and broken.
(Communication	(TC)	(VHF)		lloword	Visual	Control Unit, Detective Unit and Data Transmission Unit	×	11	 Communication equipment in power room is manufactured in 1964 and broken. All devices are aging degradation and do
Equipment)				Overall	Inspection	Indicator, indicating lamp, and selector switch	×	° 21	not work properly.
						Grounding wire	×		•Corrosion and rust are on both cables and grounding wire.
		Control Equi (TC-CON)	pment			Data Transmission Line	×		
					· · ·	Power Unit	×		•One unit is in control room and has been
					Visual	Convertor, Inverter and Board	×	10	not in operation since 2007 and maintained by ministry of electric power. •All devices are aging degradation and do
				OVERAIL	Inspection	Rylay and Timer	×	°≥1	not work properly.
					· · ·	Indicator, indicating lamp, and selector switch	×		1011
						Grounding wire	×		
		Utility Pole and Steel				Steel tower for communication system		\backslash	
		(TC-TW)		Overall	Visual Inspection	Utility pole for communication system	×	-	•There are corrosion, deformation and rust.
						lightning rod and grounding wire	×	1	•Melted lighting rod on utility pole
		Frozenness : condensation equipment	and dew n prevention	Overall	Visual Inspection	Heater Circuit		\square	
	Communicati Wiring	on, Control C	able and	Wiring	Visual	Installation state of internal wire	×	-	-
				Control Cable	Inspection	Terminal and cable	×	I~4	-Dust accumulation
(Remark) Comm Telenhone Svste	unication Sys	tem Room (1 unit)	Mai	mfactured in ur	nknown hv fore	ejon manufacturer *This is maintained hv ministry of elect	tric nower		
CARRER TELE	HONE TERMI	VAL EQUIPMI	ENT in Control	Room (1unit)	Manufac	tured in 1963 by HITACHI	*Communical electric powe	tion equipme or for all hyd Fold in Sod	ent is planned to set up by ministry of ropower plant in Myanmar and new
CARKIER TELEI Communication	HONE TEKMU Antenna in Da	MAL EQUIPM. Im Intake Obs	ENT IN POWER serving Station	Koom (2 units)	Manufactı Manufactı	ctured in 1964 by HILACHI ured in unknown by unknown	equipment is new equipme	neu m seu nt is unknov	awgyl r / S. nowever, we specification of m.

(Site I	Photo) Check List of Site Investige	ltion		【date】 17-24, Feb
Photo	(Communication Equipment) Overall	(Communication Equipment) Detail	(Communication Equipment) Detail	Remarks
1 1	Maintained by MOEP		New equipmnt provided by MOEP	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	No. 1 N.O. 2	No. 1	No. 2	Telephone System in Power Room (2 units) •Manufactured in 1964 by HITACHI •It does not work as communication tool •Dust accumulation
TC 4			HA	Antenna for transmission of dam water level •It does not work as communication tool •The result of visual inspection is not accepted.

(14.Contro	ol 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 Ph cables	loto No,	Remarks	
1 F Control Room	(ILI) (ILI) (ILI) (ILI) (ILI) (ILI) (ILIF)	(IIIL) (IIIIL) (IIIL) (IIIL) (IIIL) (IIIL) (IIIL) (IIIL) (IIIL) (IIIL) (IIIL)	Control Room and 小下) 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	1号cub盤 1号共通盤 2号cub盤 2号共通盤 1 1 0 0 1 NR 0 0	【 <u>(天井ケーブルラック)</u> (屋外S/Sへ) AVR 一所内 盤 盤 1 G	B2F NR 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	
B3F Turbin Pit	P 1 C C C C C C C C C C C C C		B3F B3F	1, 500	B3F	Governor Regulator/Actuator Panel: 30 cables, 1,500m	
B 4 F Draft Room	Db E E E E E	 (天井ケーブルラック) 1 (天井ケーブルラック) 1 (天井ケーブルラック) 1 (天井ケーブルラック) 1 1 G 1 G 1 G 1 G 1 日 	B4F N/A	•	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 contra Control cables (Total amount of 1. The number	ol cables are heavily degaraded such as corrosion, deformation and rus are manufactured in 1985 estimated cables to remove) : of removed cables: about 800 cables	st, the replacement is recommended.		-			

2. Total length of removed cables: about 56,000 m

(Site 1	Photo) Check List of Site Inve	stigation		【date】 17-26, Feb
Photo	(Control Cable) Overall	(Control Cable) Detail	(Control Cable) Detail	Remarks
1 1	to Outdoor S/S	Ottdoor	to Dam	
B1F	Under Distribution Panel	132/11kV Switchgear		
B2F (Generato r Room)	11kV Switchgear	No.2 AVR Panel		
B3F (Turbin Pit)	No.1 Governor Panel	No.1 Banel Panel		
B4F Draft Room)		Under No.1 Governor Panel	Under No.2 Penstock	
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)

Chec	k List of	Site Ins Name	pection of Powe	for Trar er Static	Isformers,132 kV Switchyard, Indooi In: Baluchaung No.1 Date: 3rd	· Swit Feb.	tchge to 5t	ar and Auxiliaries h 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	0	B-1	
				Operating	Voltage, current, loads, frequency, power factor, cooling water temmerature	0		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	0	B-2	
				Vibration	Confirmation of abnormal noise and vibration.	0	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	0	a L	
				Meter and relays	Visual inspection of operating conditions	0	+ ב	
			1	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	B-5, B- 6, B-7	Qust development has been occurred at oof of manin tank
		OLTC		Operating condition	Confirmation of normal operation and tap position	N/A	\setminus	
				Vibration	Confirmation of abnormal noise and vibration.	N/A		
				Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	N/A	$\overline{\ }$	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	N/A		
		Bushing		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	0	B-8	
			1	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	6-8	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.	0	B-10	
				Vibration	Confirmation of abnormal noise and vibration.	0	B-11	
				Radiator	Rust development, painting, peeling, deterioration, etc.	0	B-12	
				Cooling fan	Visual inspection of operating conditions	N/A	$\overline{\ }$	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	0	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	0	B-14	
			<u> </u>	Operating condition	Voltage, current, loads, frequency, power facto, etc.	0	\backslash	
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	0	B-15	
				Vibration	Confirmation of abnormal noise and vibration.	0	B-16	
			<u>ı </u>	Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	×		There is no oil temrature meter.
				Meter and relays	Visual inspection of operating conditions	0	B-17	Omly winding temperature meter
				Appearance check	Rust development, painting, peeling, deterioration, etc.	×	B-18	there is some deterioration at roof and duct of main tank.
		Cable duct		Appearance check	Rust development, painting, peeling, deterioration, etc.	0	B-19	
	11/0.4 kV Station	-		Rating	Confirmation of the rating of station service transformer by name plate	0	B-20	
			<u> </u>	Operating condition	Voltage, current, loads, frequency, power facto, etc.	0		
		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.	0		
			<u>ı </u>	Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	0	B-21	
				Meter and relays	Visual inspection of operating conditions	0	B-21	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	0	B-22	
		Insulators		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	A/N		Dry Type
				Appearance check	Rust development, painting, peeling, deterioration, etc.	0	B-23	
132 kV Switchyard	Circuit Breaker			Rating	Confirmation of the rating of 132 kV CB by name plate	0	B-24	
				Operating condition	Confirmation of trouble report for operation	×		Auxiliary relay was broken.
				Condition	Confirmation of abnormal noise and odor.	, ×		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.	0	B-25	
		Tank		Appearance check	Rust development, painting, peeling, deterioration, etc.	0	B-26	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	B-27	
		Terminal area		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	×	B-28	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	×	B-29	
		Foundation		Appearance check	Deterioration, etc.	0	B-30	
	Disconnector			Rating	Confirmation of the rating of 132 kV DS by name plate	0	B-31	
		Insulator		Appearance check	Pollution, deterioration, etc.	0	B-32	
		Blade		Appearance check	Rust development, painting, deterioration, etc.	0	B-33	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	×	B-34	
		Contact parts		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	×	B-35	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	×	B-36	
		Foundation		Appearance check	Deterioration, etc.	0	B-37	
	Current Fransformer			Rating	Confirmation of the rating of 132 kV CT by name plate	N/A		
		Insulator		Appearance check	Pollution, deterioration, etc.	N/A	\backslash	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	N/A	\backslash	
		Tank and termi.	nal area	Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	N/A	\backslash	
		Foundation		Appearance check	Deterioration, etc.	N/A		
0	Capacitor Volta	ige Transformer		Rating	Confirmation of the rating of 132 kV CVT by name plate	0	B-38	
		Insulator		Appearance check	Pollution, deterioration, etc.	0	B-39	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	B-40	
		Tank and termi.	nal area	Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	0	B-41	
		Foundation		Appearance check	Deterioration, etc.	0	B-42	
0	Surge Arrester			Rating	Confirmation of the rating of 132 kV SA by name plate	×		
		Insulator		Appearance check	Pollution, deterioration, etc.	0	B-43	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	B-44	

Remarks		Decrease of inlulation level	overload, loose connection, lack of capacity			loose connection	Pollution																			
Photo	B-45	B-46	B-47	B-48	B-49	B-50	B-51	B-52	B-53		B-54	B-55	B-56	B-57	B-58	B-59	B-60			B-61	B-62	B-63	B-64	B-65	B-66	B-67
Result	×	×	×	0	0	×	×	0	0	0	×	×	×	0	×	0	0	×	0	×	×	0	×	0	×	0
Inspection Contents (Check Point)	Deterioration, etc.	insufficient insulation, erosion, pollution, deterioration, etc.	Rust development, painting, deterioration, etc.	Tarnish by overhear, deterioration, etc.	Rust development, painting, deterioration, etc.	Size, pollution, deterioration, etc.	Pollution, deterioration, etc.	Deterioration, etc.	Confirmation of the rating of 11 kV generator switchgear by name plate	Confirmation of abnormal noise and odor.	Rust development, painting, peeling, deterioration, etc.	Tarnish by overheat, rust development, deterioration, etc.	Trace by corona discharge and tracking, deterioration, etc.	Abraision, pollution, deterioration, etc.	Erosion, pollusion and deterioration,etc.	Abraision, pollution, deterioration, etc.	Abraision, pollution, deterioration, etc.	Confirmation of the rating of LV switchgear by name plate	Confirmation of abnormal noise and odor.	Rust development, painting, peeling, deterioration, etc.	Tarnish by overheat, rust development, deterioration, etc.	Trace by corona discharge and tracking, deterioration, etc.	Erosion, pollusion and deterioration,etc.	Abraision, pollution, deterioration, etc.	Erosion, pollusion and deterioration,etc.	Abraision, pollution, deterioration, etc.
Inspection Items	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Rating	Condition	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Rating	Condition	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check
Sub-section 2					6	tor and clamps	fittings					Busbar	Insulators and support	Voltage Transformer	Cable and terminals	Circuit breaker	Current transformer				Busbar	Insulators and support	Cable and terminals	Circuit breaker	Cable and terminals	Circuit breaker
Sub-section 1	Foundation	11 kV cable	11 kV busbar	Cable head	Steel structure	Busbar conduc	Insulaters and	Foundation	- Switchgear		Cubicle	11 kV busbar			11 kV switchgear	I				Cubicle	400 V busbar		Transformer Feeder		400V Feeder	
Main Section		11 kV cable and bus			Gantry Structure				11kV Generator									Low voltage switchgear								
Facility									indoor Switchgear																	

Remarks																				
Photo	B-68		B-69	B-70	B-71	\backslash	B-72	B-73	B-74	B-75	B-76	B-77	B-78	B-79	B-80	B-81	B-82	B-83	B-84	
Result	0	0	×	×	0	0	×	×	×	0	×	×	×	0	×	×	×	×	×	
Inspection Contents (Check Point)	Confirmation of the rating of DC Panel by name plate	Confirmation of abnormal noise and odor.	Rust development, painting, peeling, deterioration, etc.	Abraision, pollution, deterioration, etc.	Confirmation of the rating of DC Panel by name plate	Confirmation of abnormal noise and odor.	Rust development, painting, peeling, deterioration, etc.	Erosion, pollusion and deterioration,etc.	Abraision, pollution, deterioration, etc.	Confirmation of the rating of DC battery and charger by name plate	Electric erosion, leakage deterioration, etc.	Rust development, painting, peeling, deterioration, etc.	Abraision, pollution, deterioration, etc.	Confirmation of the rating of EDG by name plate	Oil leak, tarnish by overheat, rust development, deterioration, etc.	Rust development, painting, peeling, deterioration, etc.	Oil leak, tarnish by overheat, rust development, deterioration, etc.	Rust development, painting, peeling, deterioration, etc.	Rust development, painting, peeling, deterioration, etc.	
Inspection Items	Rating	Condition	Appearance check	Appearance check	Rating	Condition	Appearance check	Appearance check	Appearance check	Rating	Appearance check	Appearance check	Appearance check	Rating	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check	
Sub-section 2		<u> </u>		Circuit breaker		1		Cable and terminals	Circuit breaker			Cubicle	Rectifier						Jel	
Sub-section 1			Cubicle				Cubicle	DC Feeder			DC battery	DC battery charger			Motor	Generator	Tank	Control Panel	Protection Pa	
Main Section	AC Panel				DC Panel					DC Battery and Charger				Emergency DG set				Transmission line protection	panel	
Facility	Auxiliaries																	Control Room		庫 睈



iaung No.1 Date : 3 rd Feb. to 5 th Fel	B-3	2/11kV	ain Tr.	ation and	se check	B-6	2/11kV	ain Tr.	earance	theck	B-9	2/11kV	ain Tr.	earance	theck	3-12	2/11kV	ain Tr.	earance	theck
Power Station : Baluch	Nº 1 M	13	M	Vibra	nois		13	Market and the second s	App			13	M	App	C		13	W	App	5
	B-2	132/11kV	Main Tr.	Oil leak check		B-5	132/11kV	Main Tr.	Appearance	check	B-8	132/11kV	Main Tr.	Bushing oil	leak check	B-11	132/11kV	Main Tr.	Radiator	noise check
aphy]					A TRUE TRANSPORT											Net	-		i i	
Site Photogr	B-1	132/11kV	Main Tr.	Name nate		B-4	132/11kV	Main Tr.	Temperature	meter	B-7	132/11kV	Main Tr.	Appearance	check	B-10	132/11kV	Main Tr.	Radiator oil	leak check

















Checl	< List of	Site Ins N	spection ame of F	for Tran ^S ower St	isformers,132 kV Switchyard, Indoor tation: Sedawgyi Date: 9th Feb.	Swit to 11	chgear and th Feb.	ł Auxiliaries
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	0	S-1	
			1	Operating condition	Voltage, current, loads, frequency, power factor, cooling water temeerature	0		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	×	S-2.S- I,S-4,S-	
				Vibration	Confirmation of abnormal noise and vibration.	0	S-6	
			<u> </u>	Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	0	S-7	
				Meter and relays	Visual inspection of operating conditions	×	S-8	
			1	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	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.	×	S-13	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-14	
		Oil Cooler		Oil leak	Visual inspection for oil leak of welded spot, gasket, etc.	×	S-15	
				Vibration	Confirmation of abnormal noise and vibration.	0	SS-6	
				Radiator	Rust development, painting, peeling, deterioration, etc.	×	S-16	
				Cooling fan	Visual inspection of operating conditions	N/A		
				Appearance check	Rust development, painting, peeling, deterioration, etc.	×	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	0	S-18	
				Operating condition	Voltage, current, loads, frequency, power facto, etc.	0		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	х	S-19,S- 20,S-21	
				Vibration	Confirmation of abnormal noise and vibration.	0		
			1	Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	×	\square	There is no oil temrature meter.
			<u> </u>	Meter and relays	Visual inspection of operating conditions	×	\backslash	
				Appearance check	Rust development, painting, peeling, deterioration, etc.	х	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.	×	S-23	
			1	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-24	
	11/0.4 kV Station			Rating	Confirmation of the rating of station service transformer by name plate	0	S-25	
			1	Operating condition	Voltage, current, loads, frequency, power facto, etc.	0		
		Main tank		Oil leak	Visual inspection for oil leak of welded spot, gasket, valves and connection point for auxiliaries.	×	S-27	
				Vibration	Confirmation of abnormal noise and vibration.	0		
			1	Temperature	Confirmation of dial temperature meter for insulation oil. Visual inspection for oil leak of dial plate, water leak, crack of protection cover	×	S-28	There is no oil temrature meter.
				Meter and relays	Visual inspection of operating conditions	×	S-28	There is no oil temrature meter.
			<u> </u>	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-29, S- 30	
		Insulators		Oil leak	Visual inspection for oil leak of welded spot and gasket, etc.	×	S-31	
			1	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-32	
132 kV Switchyard	Circuit Breaker		I	Rating	Confirmation of the rating of 132 kV CB by name plate	0	S-33, S- 34	
				Operating condition	Confirmation of trouble report for operation	×		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.	0		
		Insulator		Appearance check	Pollution, deterioration, etc.	0	S-35	
		Tank		Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-36	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	S-37	
		Terminal area		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	×	S-38	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	×	S-39	
		Foundation		Appearance check	Deterioration, etc.	×	S-40	
	Disconnector			Rating	Confirmation of the rating of 132 kV DS by name plate	0	S-41, S- 42	
		Insulator		Appearance check	Pollution, deterioration, etc.	0	S-43	
		Blade		Appearance check	Rust development, painting, deterioration, etc.	×	S-44	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	S-45	
		Contact parts		Appearance check	Tarnish by overheat, rust development, deterioration, etc.	×	S-46	
		Control Box		Appearance check	Rust development, painting, deterioration, etc.	0	S-47	
		Foundation		Appearance check	Deterioration, etc.	0	S-48	
	Current Fransformer			Rating	Confirmation of the rating of 132 kV CT by name plate	0	S-49	
		Insulator		Appearance check	Pollution, deterioration, etc.	0	S-50	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	S-51	
		Tank and termi	nal area	Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	×	S-52	
		Foundation		Appearance check	Deterioration, etc.	0	S-53	
	Capacitor Volta	ige Transformer		Rating	Confirmation of the rating of 132 kV CVT by name plate	0	S-54	Not operating
		Insulator		Appearance check	Pollution, deterioration, etc.	0	S-55	
		Ironware		Appearance check	Rust development, painting, deterioration, etc.	0	S-56	
		Tank and termi	nal area	Appearance check	Oil leak, tarnish by overheat, rust development, deterioration, etc.	×	S-57	Oil leak
		Foundation		Appearance check	Deterioration, etc.	0	S-58	
	Surge Arrester			Rating	Confirmation of the rating of 132 kV SA by name plate	0	S-59	
		Insulator		Appearance check	Pollution, deterioration, etc.	0	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.	0	S-61	
		Foundation		Appearance check	Deterioration, etc.	0	S-62	
	11 kV cable and bus	11 kV cable		Appearance check	insufficient insulation, erosion, pollution, deterioration, etc.	×	S-63	Decrease of inlulation level
		11 kV busbar		Appearance check	Rust development, painting, deterioration, etc.	×	S-64	insutator was repaired due to flash over
		Cable head		Appearance check	Tarnish by overhear, deterioration, etc.	0	S-64	
	Gantry Structure	Steel structure		Appearance check	Rust development, painting, deterioration, etc.	0	S-65	
		Busbar conduct	tor and clamps	Appearance check	Size, pollution, deterioration, etc.	0	S-66	
		Insulaters and f	ittings	Appearance check	Pollution, deterioration, etc.	0	S-67	
		Foundation		Appearance check	Deterioration, etc.	0	S-68	
Indoor Switchgear	11kV Generato	r Switchgear		Rating	Confirmation of the rating of 11 kV generator switchgear by name plate	0	\backslash	
				Condition	Confirmation of abnormal noise and odor.	0		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-69, S- 70	
		11 kV busbar	Busbar	Appearance check	Tarnish by overheat, rust development, deterioration, etc.	×		
			Insulators and support	Appearance check	Trace by corona discharge and tracking, deterioration, etc.	0	\setminus	
			Voltage Transformer	Appearance check	Abraision, pollution, deterioration, etc.	0	S-71	
		Unit 1 Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	0	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-74	
		Unit 2 Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,eto.	0	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-74	Not installed
		Station Transfomer 1	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,eto.	0	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-72	
		Station Transfomer 2	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	0	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-73	Not installed
		11/11 kV Tie Transformer in	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	0	S-70	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-75	
		11/11 kV Tie Transformer	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	0	S-70	

Facility	Main Section	Sub-section 1	Sub-section 2	Inspection Items	Inspection Contents (Check Point)	Result	Photo	Remarks
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-75	
		Irrication Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	0	\backslash	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	0	S-76	
			Current transformer	Appearance check	Abraision, pollution, deterioration, etc.	0	\backslash	
		Residential Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	×	$\left \right $	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-77	
			Current transformer	Appearance check	Abraision, pollution, deterioration, etc.	×	\backslash	not operating
	Low voltage switchgear			Rating	Confirmation of the rating of LV switchgear by name plate	×	$\left \right\rangle$	
			<u> </u>	Condition	Confirmation of abnormal noise and odor.	0		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-78	
		400 V busbar	Busbar	Appearance check	Tarnish by overheat, rust development, deterioration, etc.	×	S-79	
			Insulators and support	Appearance check	Trace by corona discharge and tracking, deterioration, etc.	×		
		LV Switchgear	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	×	S-79	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-80	
Auxiliaries	DC Panel			Rating	Confirmation of the rating of DC Panel by name plate	×		
			<u> </u>	Condition	Confirmation of abnormal noise and odor.	0		
		Cubicle		Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-81	
		DC Feeder	Cable and terminals	Appearance check	Erosion, pollusion and deterioration,etc.	×	S-82	
			Circuit breaker	Appearance check	Abraision, pollution, deterioration, etc.	×	S-83	
	DC Battery and Charger			Rating	Confirmation of the rating of DC battery and charger by name plate	×	\setminus	cannnot confirmed
			<u> </u>	Condition	Confirmation of abnormal noise and odor.	×		
		DC battery		Appearance check	Electric erosion, leakage deterioration, etc.	0	S-84	Replaced on 2009 and 2012
		DC battery charger	Cubicle	Appearance check	Rust development, painting, peeling, deterioration, etc.	×	S-85	
			Rectifier	Appearance check	Abraision, pollution, deterioration, etc.	×	S-86	
	Emergency DG set			Rating	Confirmation of the rating of EDG by name plate	0	S-87	Automatic operation system is not equipped

Remarks							
Photo	S-88	S-89	06-S	S-91	S-92		
Result	×	0	×	×	×		
Inspection Contents (Check Point)	Oil leak, tarnish by overheat, rust development, deterioration, etc.	Rust development, painting, peeling, deterioration, etc.	Oil leak, tarnish by overheat, rust development, deterioration, etc.	Rust development, painting, peeling, deterioration, etc.	Rust development, painting, peeling, deterioration, etc.		
Inspection Items	Appearance check	Appearance check	Appearance check	Appearance check	Appearance check		
Sub-section 2					او		
Sub-section 1	Motor	Generator	Tank	Control Panel	Protection Pane		
Main Section				Transmission line protection	panel		
Facility			_	Control Room		記事	









[Site Photogi	raphy]		Power Station : Se	<u>edawgyi</u>	Date : 9 th Feb. to 11 th Feb.
S-25	A Dig Very St Owneddam	S-26		S-27	
11/0.4 kV	1110 MORAN IN MORAN IN MIL	11/0.4 kV		11/0.4 kV	1-1
Station Tr.	Model and a second	Station Tr.	7	Station Tr.	
Name Plate		Oil leak check		Oil leak check	
S-28		S-29		S-30	Line
11/0.4 kV		11/0.4 kV		11/0.4 kV	
Station Tr.		Station Tr.	Im	Station Tr.	-
Temperature		Appearance		Appearance	
meter		check		check	
S-31	APP THE D	S-32		S-33	
11/0.4 kV	The second second	11/0.4 kV		132 kV Circuit	
Station Tr.		Station Tr.		breakers	
Cable		Insulators			A strategiest of the strategiest
connection	- A - A - A	check	Ì	Name plate 1	
S-34	TINIM CO	S-35		S-36	
132 kV Circuit	The BEOGRAD-TUGOSLAFIA	132 kV Circuit	•	132 kV Circuit	
breakers	Rated intuitikiter level (KN)	breakers		breakers	

3/8

Tank check

Insulator check

Name plate 2















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



Documents	
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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	N
	Inspection	Confirm the frequency and measure for the inspection and maintenance	

Intake Dam Spillway Gates

Facility	Item	Measure		Details	Photo
Gate, Frame	General	Visual Inspection	Ŋ	Cleanness	
	Frame	Visual Inspection	Ŋ	Major dimensions	
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
	Gate leaf	Visual Inspection		Deterioration of the paint	
		Visual Inspection	Ŋ	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	Ŋ	Damage, deformation, legibility and gap between actual gate position	
Installation	Installation	Visual Inspection	Ŋ	General arrangement	
		Visual Inspection	Ŋ	Major dimensions	
Hoist Installation Control		Visual Inspection	Ŋ	Dimensions of open mouth	
	Wiring, Piping	Confirm the route	Ŋ	Check the route of wiring and piping	
	Outside	Visual Inspection	Ŋ	General arrangement, space for crane and access	
Control	Control Panel	Visual Inspection	Ŋ	Damage, deformation or corrosion (outside)	
		Visual Inspection	Ŋ	Damage, deformation or corrosion (inside)	
		Visual Inspection	Ŋ	Plate, items	
	Meters	Visual Inspection	Ŋ	Damage, deformation and legibility	
	Lumps	Visual Inspection		Conditions of the light bulbs	

Intake Dam Spillway Stoplog

Facility	Item	Measure		Details	Photo
Gate, Frame	General	Visual Inspection		Cleanness	N
	Frame	Visual Inspection		Major dimensions	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
	Gate leaf	Visual Inspection	Ŋ	Deterioration of the paint	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion	Ø
Hoist	General	Visual Inspection	Ŋ	Viblation or noise	Ŋ
	Arrangement	Visual Inspection	Ŋ	General arrangement	Ŋ
	Structure	Visual Inspection	Ŋ	Damage, deformation or corrosion	Ŋ
	Power Output	Visual Inspection		Damage, deformation or corrosion	N
	Wire Rope	Visual Inspection		Damage, deformation or greasing condition	N

Intake Dam Intake Gate

Facility	Item	Measure		Details	Photo
Gate, Frame	General	Visual Inspection	Ŋ	Cleanness	
	Gate leaf	Visual Inspection	V	Deterioration of the paint	
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
Hoist	General	Visual Inspection	Ŋ	Viblation or noise	N
Gate, Frame Hoist Installation Control Raking System	Component	Visual Inspection	Ŋ	Plate	N
	Arrangement	Visual Inspection	Ŋ	General arrangement	N
	Structure	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Power Output	Visual Inspection	Ŋ	Damage, deformation or corrosion	Ŋ
	Wire Rope	Visual Inspection	Ŋ	Damage, deformation or greasing condition	Ŋ
	Position Indicator	Visual Inspection	Ŋ	Damage, deformation, legibility and gap between actual gate position	N
Installation	Installation	Visual Inspection	Ŋ	General arrangement	N
		Visual Inspection	Ŋ	Major dimensions	Ø
		Visual Inspection	Ŋ	Dimensions of open mouth	Ŋ
	Wiring, Piping	Confirm the route	Ŋ	Check the route of wiring and piping	Ŋ
	Outside	Visual Inspection	Ŋ	General arrangement, space for crane and access	Ŋ
Control	Control Panel	Visual Inspection	Ŋ	Damage, deformation or corrosion (outside)	Ŋ
		Visual Inspection	Ŋ	Damage, deformation or corrosion (inside)	
Control		Visual Inspection	Ŋ	Plate, items	
	Meters	Visual Inspection	Ŋ	Damage, deformation and legibility	Ŋ
	Lumps	Visual Inspection		Conditions of the light bulbs	
Raking System	Screen	Visual Inspection	Ŋ	Damage, deformation or corrosion	
		Visual Inspection	Ŋ	Deterioration of the paint	
	Raking System	Visual Inspection	Ŋ	Damage, deformation or corrosion	
		Visual Inspection	V	Operation	
		Visual Inspection	\mathbf{V}	0il leakage	

Intake Dam Intake Stoplog

Facility	Item	Measure		Details	Photo
Gate, Frame	General	Visual Inspection	Ŋ	Cleanness	Ŋ
	Frame	Visual Inspection	Ŋ	Major dimensions	Ŋ
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
	Gate leaf	Visual Inspection	Ŋ	Deterioration of the paint	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion	N

Head Pond Inlet Gate

Facility	Item	Measure		Details	Photo
Gate, Frame	General	Visual Inspection	Ŋ	Cleanness	N
	Frame	Visual Inspection	Ŋ	Major dimensions	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Gate leaf	Visual Inspection	Ŋ	Deterioration of the paint	Ŋ
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
		Measure the thickness	Ŋ	Measure the thickness of the skinplate	
Hoist	General	Visual Inspection	Ŋ	Viblation or noise	N
	Component	Visual Inspection	Ŋ	Plate	N
	Arrangement	Visual Inspection	\mathbf{N}	General arrangement	
	Structure	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Power Output	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Spindle	Visual Inspection	\mathbf{N}	Damage, deformation or greasing condition	
	Position Indicator	Visual Inspection	Ŋ	Damage, deformation, legibility and gap between actual gate position	
Installation	Installation	Visual Inspection	\mathbf{V}	General arrangement	
		Visual Inspection	\mathbf{V}	Major dimensions	
		Visual Inspection	\square	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	\mathbf{V}	Damage, deformation or corrosion (outside)	
		Visual Inspection	\mathbf{V}	Damage, deformation or corrosion (inside)	
		Visual Inspection		Plate, items	
	Meters	Visual Inspection		Damage, deformation and legibility	
	Lumps	Visual Inspection	Ŋ	Conditions of the light bulbs	
Raking System	Screen	Visual Inspection	\mathbf{V}	Damage, deformation or corrosion	N
		Visual Inspection	Ŋ	Deterioration of the paint	
	Raking System	Visual Inspection		Damage, deformation or corrosion	
		Visual Inspection		Operation	
		Visual Inspection	Ŋ	0il leakage	

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	Ŋ	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	Ŋ	Damage, deformation, legibility and gap between actual gate position	N
Installation	Installation	Visual Inspection		General arrangement	
		Visual Inspection	Ŋ	Major dimensions	
		Visual Inspection	Ŋ	Dimensions of open mouth	
	Operation Room	Visual Inspection		General arrangement, hooks on ceiling	
	Outside	Visual Inspection		General arrangement, space for crane and access	
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	Ŋ	Damage, deformation or corrosion	N
Hoist	General	Visual Inspection	Ŋ	Viblation or noise	N
	Arrangement	Visual Inspection	Ŋ	General arrangement	Ø
	Structure	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Power Output	Visual Inspection	Ŋ	Damage, deformation or corrosion	
	Spindle	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Position Indicator	Visual Inspection	Ŋ	Damage, deformation, legibility and gap between actual gate position	Ŋ
Installation	Installation	Visual Inspection	Ŋ	General arrangement	Ŋ
		Visual Inspection	Ŋ	Major dimensions	
		Visual Inspection	Ŋ	Dimensions of open mouth	Ø
	Operation Room	Visual Inspection	Ŋ	General arrangement, hooks on ceiling	N
	Outside	Visual Inspection	Ŋ	General arrangement, space for crane and access	N
Control	Control Panel	Visual Inspection	Ŋ	Damage, deformation or corrosion (outside)	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion (inside)	
		Visual Inspection	Ŋ	Plate, items	Ø
	Meters	Visual Inspection	N	Damage, deformation and legibility	
	Lumps	Visual Inspection		Conditions of the light bulbs	

Low Pressure Pipe Line

Facility	Item	Measure		Details	
Steel Pipe General Visual Inspection Damage, deformation or water leakage		Damage, deformation or water leakage			
	Surface	Visual Inspection Deterioration of the paint		Deterioration of the paint	
	Steel Pipe	Measure the thickness	Ŋ	Measure the thickness of the steel pipe	\square
Support	Support	Visual Inspection		Damage or deformation	
Access	Access	Visual Inspection		General arrangement, space for crane and access	

Penstocks

Facility	Item	Measure		Details	
Steel Pipe	General	Visual Inspection	Ŋ	Damage, deformation or water leakage	
	Surface	Visual Inspection	Ŋ	Deterioration of the paint	
	Steel Pipe	Measure the thickness	Ŋ	Measure the thickness of the steel pipe	
Support	Support	Visual Inspection	Ŋ	Damage or deformation	
Access	Access	Visual Inspection		General arrangement, space for crane and access	

Power	Station	Emergency	Discharge	Valve
		0 ,	0	

Facility	Item	Measure		Details	Photo
Valve	General	Visual Inspection	Ŋ	Cleanness	N
	Valve	Visual Inspection	Ŋ	Deterioration of the paint	
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
Hoist	General	Visual Inspection	Ŋ	Viblation or noise	N
	Arrangement	Visual Inspection	Ŋ	General arrangement	N
	Structure	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	0il Pressure Unit	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	0il Pressure Pipe	Visual Inspection	Ŋ	Damage, deformation or corrosion	N
	Position Indicator	Visual Inspection	Ŋ	Damage, deformation, legibility and gap between actual gate position	Ø
Installation	Installation	Visual Inspection	Ŋ	General arrangement	Ø
		Visual Inspection	Ŋ	Major dimensions	Ŋ
		Visual Inspection	Ŋ	Dimensions of open mouth	Ŋ
	Operation Room	Visual Inspection	Ŋ	General arrangement, hooks on ceiling	Ŋ
	Outside	Visual Inspection	Ŋ	General arrangement, space for crane and access	Ŋ
Control	Control Panel	Visual Inspection	\mathbf{N}	Damage, deformation or corrosion (outside)	
		Visual Inspection	\mathbf{N}	Damage, deformation or corrosion (inside)	
		Visual Inspection	\mathbf{N}	Plate, items	
	Meters	Visual Inspection	Ŋ	Damage, deformation and legibility	
	Lumps	Visual Inspection	N	Conditions of the light bulbs	Ŋ

Facility	Item	Measure	Ŋ	Details	Photo
Gate, Frame	General	Visual Inspection	Ŋ	Cleanness	Ø
	Frame	Visual Inspection	Ŋ	Major dimensions	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
	Gate leaf	Visual Inspection	Ŋ	Deterioration of the paint	N
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
Hoist	General	Visual Inspection	Ŋ	Damage, deformation or corrosion	

Baluchaung No.2 Headrace Channel Gate (Upstream and Downstream)

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

Object	Items	Detail	Photo
Documents	Calculation Sheet	Provision of calculation sheets	\square
	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	\square	Details	Photo
Gate, Frame	General Visual Inspection 🗹 Cleanness		Cleanness		
	Frame	Visual Inspection		Major dimensions	
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
	Gate leaf	Visual Inspection	Ŋ	Deterioration of the paint	
		Visual Inspection	Ŋ	Damage, deformation or corrosion	
		Measure the thickness	Ŋ	Measure the thickness of the skinplate	
Hoist	General	Visual Inspection	\mathbf{V}	Viblation or noise	
Gantry Crane	Component	Visual Inspection	Ŋ	Plate	
	Arrangement	Visual Inspection	Ŋ	General arrangement	
	Structure	Visual Inspection		Damage, deformation or corrosion	
	Power Output	Visual Inspection	\mathbf{V}	Damage, deformation or corrosion	
	Spindle	Visual Inspection	\mathbf{V}	Damage, deformation or greasing condition	
	Position Indicator	Visual Inspection	Ŋ	Damage, deformation, legibility and gap between actual gate position	
Control	Control Panel	Visual Inspection		Damage, deformation or corrosion (outside)	
		Visual Inspection	Ŋ	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 9

REHABILITATION OF CIVIL FACILITIES

- (1) Check List (Baluchaung No.1 Hydropower Plant)
- (2) Check List (Sedawgyi Hydropower Plant)

ltom		Methr	od for Checking	Dhoto No	Finding/Pomark	
		Item	from Record	at the Site	PHULU INU.	Finding/Remark
		Crack	None	Visual inspection (V.I.)		Not so serious
am	am	Deformation	None	V.I. or survey		Not so serious
	stre	Deterioration	None	V.I. and/or hammer blow	9.1-1 (L)	Not so serious
	Up	Joint opening	Not applicable	Visual inspection (V.I.)		
	 	Others				
		Crack	None	Visual inspection (V.I.)		Not so serious
	ا ا	Deformation	None	V.I. or survey		Not so serious
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious
am)	nstr	Joint opening	Not applicable	Visual inspection (V.I.)	9.1-1 (R)	
in D	Dow	Seepage water	None	V.I. and/or measurement		Not found
(Ma	-	Amount of leakage	None	Visual inspection (V.I.)		Not found
)am	 	Others				Security tower has been installed
ke [Crack	None	Visual inspection (V.I.)		Not so serious
Inta		Deformation	None	V.I. or survey		Not so serious
cha	est	Deterioration	None	V.I. and/or hammer blow		Not so serious
awta	ר ער	Abrasion	None	Visual inspection (V.I.)	9.1-1 (L)	Not so serious
i) Dî	Dar	Joint opening	Not applicable	Visual inspection (V.I.)		
1. (ĉ		Overtopping splay's impact on the surrounding	Not applicable			
	 	Others				
		Crack	Not applicable	Visual inspection (V.I.)		
	ery	Deformation	Not applicable	V.I. or survey		
	Gall	Deterioration	Not applicable	V.I. and/or hammer blow		
	tion	Joint opening	Not applicable	Visual inspection (V.I.)		
	pec	Abnormal leakage	Not applicable	☐	「	
	lns	Abnormal drain water	Not applicable			
	 	Others				
Desc	riptic	0n.				
Upst	ream	ı: [C]				
Dow	nstrea	am: [b2] * Security towe	er shall be relocate	ed to out of slope from the vi	iew point of	dam stability.
Dam	Cres	st: [C]	1			
Inspe Othe	ection	1 Gallery: ^ Not applicabl	е			
Unic	vate	er Level Gauge: [a2]				
	Rain	Gauge: [a2]				
	Com	munication System: [b1]				

Emergency Diesel Generator: [a2]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

		ltom	Metho	od for Checking	Dhoto No	Finding/Bomork
		item	from Record	at the Site	PHOLO NO.	Finding/Remark
		Design flood discharge	634 m ³ /s	Calculation by current criteria		
		Maximum flood discharge	-			Couldn't receive historical record
		Crack	None	Visual inspection (V.I.)		Not found
		Deformation	None	V.I. or survey		Not found
		Abrasion/ damage	None	Visual inspection (V.I.)		Not found
	Inlei	Deterioration	None	V.I. and/or hammer blow		Not so serious
		Joint opening	None	Visual inspection (V.I.)		Not found
		Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Some floating logs and garbage were found
ake		Others				
d Int		Crack	None	Visual inspection (V.I.)		Not found
anc		Deformation	None	V.I. or survey		Not found
vay	est	Deterioration	None	V.I. and/or hammer blow		Not found
pill	ũ	Abrasion	None	Visual inspection (V.I.)		Not so serious
n (S		Joint opening	None	Visual inspection (V.I.)		Not found
Dar		Others			9.1-2	
ake		Crack	None	Visual inspection (V.I.)		Not found
Int		Deformation	None	V.I. or survey		Not found
Icha	е	Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
awta	chut	Deterioration	None	V.I. and/or hammer blow		Not so serious
) Dâ	0	Joint opening	None	Visual inspection (V.I.)		Not found
d) .		Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Not found
~		Others				
		Crack	None	Visual inspection (V.I.)		Not found
	ator	Deformation	None	V.I. or survey		Not found
	sipa	Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
	Dis	Deterioration	None	V.I. and/or hammer blow		Not so serious
	ergy	Joint opening	None	Visual inspection (V.I.)		Not found
	Ene	Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Not found
		Others				
Desc	rintic	יייי <u>י</u> זורי				

Spillway Inlet: [c] Crest: [c] Chute: [c] Energy Dissipator: [c]

Intake

Inlet: [c] Crest: [c] Chute: [c] Energy Dissipator: [c]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

	ltem		Metho	od for Checking	Dhoto No	Finding/Remark
		item	from Record	at the Site	PHOLO NO.	Finding/Remark
		Crack	None	Visual inspection (V.I.)		Not so serious
Inel		Deformation	None	V.I. or survey		Not so serious
har		Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
ce C		Deterioration	None	V.I. and/or hammer blow	9.1-4	Not so serious
drac		Joint opening	None	Visual inspection (V.I.)		Not so serious
lea		Amount of leakage	None	Visual inspection (V.I.)		Not so serious
2. F		Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Not found
		Others			9.1-5	No serious probrem for side spillway
		Crack	None	Visual inspection (V.I.)		Not so serious
pu		Deformation	None	V.I. or survey		Not so serious
Po		Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
ting		Deterioration	None	V.I. and/or hammer blow	9.1-6	Not so serious
gula		Joint opening	None	Visual inspection (V.I.)		Not so serious
Re		Amount of leakage	None	Visual inspection (V.I.)		Not so serious
3.		Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Few garbage were found
		Others			9.1-7	No serious probrem for siphon spillway
ne		Crack	None	Visual inspection (V.I.)		Not so serious
oe Li		Deformation	None	V.I. or survey		Not so serious
e Pip		Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
ssur		Deterioration	None	V.I. and/or hammer blow	9.1-10	Not so serious
/ Pre		Joint opening	None	Visual inspection (V.I.)		For civil structure, not applicable
Low		Amount of leakage	None	Visual inspection (V.I.)		For civil structure, not found
4.		Others				
		Crack	None	Visual inspection (V.I.)		Not so serious
ank		Deformation	None	V.I. or survey		Not so serious
Je T		Abrasion/ damage	None	Visual inspection (V.I.)	0 1_11	Not so serious
Surc		Deterioration	None	V.I. and/or hammer blow	7.1-11	Not so serious
5.0		Amount of leakage	None	Visual inspection (V.I.)		For civil structure, not found
		Others				
Desc	riptic	on:				

Headrace Channel Waterway: [c] Side Spillway: [c]

Regulation Pondage Pondage: [c] Siphon Spillway: [c] Others: Water Level Gauge: [a1] Communication System: [a1] Fence around the Pondage: [a1] Low Pressure Pipe Line: [c] Surge Tank: [c]

[Classification] a1: Emergency countermeasure is required due to decrease in function. a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

ltom		Metho	od for Checking	Dhoto No	Einding/Remark	
		Item	from Record	at the Site	PHOLO INO.	Finding/Remark
		Crack	None	Visual inspection (V.I.)		Not so serious
		Deformation	None	V.I. or survey		Not so serious
	lers	Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
	dle F	Deterioration	None	V.I. and/or hammer blow	9.1-12 (L)	Not so serious
	Sade	Joint opening	None	Visual inspection (V.I.)		For civil structure, not applicable
×		Amount of leakage	None	Visual inspection (V.I.)		For civil structure, not found
Istoc		Others				
Per		Crack	None	Visual inspection (V.I.)	9.1-12 (R)	Not so serious
6.	locks	Deformation	None	V.I. or survey		Not so serious
		Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
	or B	Deterioration	None	V.I. and/or hammer blow		Not so serious
	nch	Joint opening	None	Visual inspection (V.I.)		For civil structure, not applicable
	A	Amount of leakage	None	Visual inspection (V.I.)		For civil structure, not found
		Others				
е		Crack	None	Visual inspection (V.I.)		Not so serious
snou		Deformation	None	V.I. or survey	0 1 12 (1)	Not so serious
verh		Deterioration	None	V.I. and/or hammer blow	9.1-13 (L)	Not so serious
. Po		Amount of leakage	None	Visual inspection (V.I.)		Not so serious
7.		Others			9.1-13 (R)	Steel rolling door was deteriorated

Description:

Penstock Saddle Piers: [c] Anchor Blocks: [c] Powerhouse

Building: [c] Tailrace: [c] Others: Water Level Gauge: [a2] Steel Rolling Door: [a2] Emergency Diesel Generator: [a2]

[Classification] a1:

a1: Emergency countermeasure is required due to decrease in function.a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

		ltom	Metho	od for Checking	Dhoto No	Finding/Pomork
			from Record	at the Site	PHULO ING.	Finding/Remark
	 	Crack	None	Visual inspection (V.I.)		Not so serious
	am	Deformation	None	V.I. or survey		Not so serious
	stre	Deterioration	None	V.I. and/or hammer blow	9.1-15 (L)	Not so serious
	ЧD	Joint opening	Not applicable	Visual inspection (V.I.)		
		Others				
	 	Crack	None	Visual inspection (V.I.)		Not so serious
		Deformation	None	V.I. or survey		Not so serious
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious
	Instr	Joint opening	Not applicable	Visual inspection (V.I.)	9.1-15 (R)	
(m	Dow	Seepage water	None	V.I. and/or measurement		Not found
n Da		Amount of leakage	None	Visual inspection (V.I.)		Not found
Mai		Others				
am (Crack	None	Visual inspection (V.I.)		Not so serious
le Dä		Deformation	None	V.I. or survey		Not so serious
loby	est	Deterioration	None	V.I. and/or hammer blow		Not so serious
(a) N	n Cr	Abrasion	None	Visual inspection (V.I.)	9.1-15 (R)	Not so serious
8. (Dar	Joint opening	Not applicable	Visual inspection (V.I.)		
		Overtopping splay's impact on the surrounding	Not applicable			
		Others				
	 	Crack	Not applicable	Visual inspection (V.I.)	「 <u> </u>	
	ery	Deformation	Not applicable	V.I. or survey		
	Gall	Deterioration	Not applicable	V.I. and/or hammer blow	「	
	tion	Joint opening	Not applicable	Visual inspection (V.I.)		
	pect	Abnormal leakage	Not applicable			
	lns	Abnormal drain water	Not applicable			
		Others				
Desc	criptic	 on:				
Upst	ream	.: [C]				
Dow	nstrea	am: [c]				
Dam	Cres	it: [C] 2 Callony: * Not applicable	^			
Othe	PCtion	I Gallery. Not applicable				
0110	Wate	er Level Gauge [,] [a2]				

r Level Gauge: [a2] Rain Gauge: [a2] Communication System: [b1]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

		ltom	Metho	od for Checking	Dhoto No	Finding/Pomark
		Item	from Record	at the Site	PHOLO NO.	Finding/Remark
		Design flood discharge	668 m ³ /s	Calculation by current criteria		
		Maximum flood discharge	-			Couldn't receive historical record
		Crack	None	Visual inspection (V.I.)		Not found
		Deformation	None	V.I. or survey		Not found
		Abrasion/ damage	None	Visual inspection (V.I.)		Not found
	Inlei	Deterioration	None	V.I. and/or hammer blow		In progress, but still OK
		Joint opening	None	Visual inspection (V.I.)		Not found
		Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Few floating logs and garbage were found
ock		Others				
on L		Crack	None	Visual inspection (V.I.)		Not found
gatic		Deformation	None	V.I. or survey		Not found
lavi	est	Deterioration	None	V.I. and/or hammer blow		In progress, but still OK
√ pι	S	Abrasion	None	Visual inspection (V.I.)		Not so serious
y ar		Joint opening	None	Visual inspection (V.I.)		Not found
llwa		Others			9.1-16	
Spi		Crack	None	Visual inspection (V.I.)		Not found
am (Deformation	None	V.I. or survey		Not found
βDi	e	Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
oby	Chut	Deterioration	None	V.I. and/or hammer blow		In progress, but still OK
) M(0	Joint opening	None	Visual inspection (V.I.)		Not found
3. (b		Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Not found
		Others				
		Crack	None	Visual inspection (V.I.)		Not found
	ator	Deformation	None	V.I. or survey		Not found
	sipa	Abrasion/ damage	None	Visual inspection (V.I.)		Not so serious
	Dis	Deterioration	None	V.I. and/or hammer blow		In progress, but still OK
	ergy	Joint opening	None	Visual inspection (V.I.)		Not found
	En€	Clogging (e.g., floating log)	None	Visual inspection (V.I.)		Not found
		Others				

Description:

Spillway Inlet: [c] Crest: [c] Chute: [c] Energy Dissipator: [c] Navigation Lock Concrete Structure: [c]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

Check List for Civil Facilities

- Sedawgyi Hydropower Plant -

		ltom	Metho	od for Checking	Dhoto No	Finding/Pomark		
		item	from Record	at the Site		Finding/Remark		
		Crack	Referred	Visual inspection (V.I.)		Not so serious		
	am	Deformation	Referred	V.I. or survey		Not found		
	stre	Deterioration	None	V.I. and/or hammer blow		Not so serious		
	Up	Joint opening	None	Visual inspection (V.I.)		Not found		
		Others	Referred		9.1-19	Intake towers have a leakage problem		
		Crack	Referred	Visual inspection (V.I.)		Not so serious		
		Deformation	Referred	V.I. or survey		Not found		
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious		
	nstr	Joint opening	None	Visual inspection (V.I.)	9.1-21 (L)	Not found		
	Dow	Seepage water	None	V.I. and/or measurement		Not found		
_		Amount of leakage	None	Visual inspection (V.I.)		Not found		
Jam		Others						
ete I		Crack	Referred	Visual inspection (V.I.)		Not so serious		
oncr		Deformation	Referred	V.I. or survey		Not found		
I. C(est	Deterioration	None	V.I. and/or hammer blow		Not so serious		
`	n Cr	Abrasion	Referred	Visual inspection (V.I.)	9.1-21 (R)	Not so serious		
	Dar	Joint opening	None	Visual inspection (V.I.)		Not found		
		Overtopping splay's impact on the surrounding	Not applicable					
		Others						
		Crack	None	Visual inspection (V.I.)		Not so serious		
	ery	Deformation	None	V.I. or survey		Not found		
	Galle	Deterioration	None	V.I. and/or hammer blow		Not so serious		
	ion (Joint opening	None	Visual inspection (V.I.)		Not found		
	pect	Abnormal leakage	None			55.04 liter/min (Estimation from the interview)		
	lns	Abnormal drain water	None					
		Others			9.1-20	Observation instruments were deteriorated		
Desc Upst Dow Dam Insp Othe	Description: Upstream: [c] Downstream: [c] Dam Crest: [c] Inspection Gallery: [b2] * Obervation instruments and drainage pump were deteriorated. Others: Intake Tower (Unit 1) Intake Tower (Unit 2) Breast Wall: [a1] Breast Wall: [c] Stoplog Groove: [c] Stoplog Groove: [c]							
	Gate Groove: [b1] Gate Groove: [b1]							

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

		ltom	Metho	od for Checking	Dhoto No	Finding/Pomark
		nem	from Record	at the Site		Finding/Remark
		Crack	Referred	Visual inspection (V.I.)		Not found
	am	Deformation	Referred	V.I. or survey	9.1-25 (L)	Minor slope failures were found
	stre	Deterioration	None	V.I. and/or hammer blow		Not so serious
	Пр	Joint opening	Not applicable	Visual inspection (V.I.)		
		Others				
		Crack	Referred	Visual inspection (V.I.)		Not found
	_	Deformation	Referred	V.I. or survey	9.1-22	Partly gullies were found
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious
	nstr	Joint opening	Not applicable	Visual inspection (V.I.)		
	Dow	Seepage water	Referred	V.I. and/or measurement		57.20 liter/min (at observation point)
		Amount of leakage	Referred	Visual inspection (V.I.)	9.1-23	Not found (at measurement weir)
am		Others			9.1-24	Erosion probrem at the obserbasion house
fill D		Crack	Referred	Visual inspection (V.I.)		Not found
arth		Deformation	Referred	V.I. or survey		Not so serious
2. E	est	Deterioration	None	V.I. and/or hammer blow		Not so serious
	n Cr	Abrasion	Referred	Visual inspection (V.I.)	9.1-25 (R)	Not so serious
	Dar	Joint opening	Not applicable	Visual inspection (V.I.)		
		Overtopping splay's impact on the surrounding	Not applicable			
		Others				
		Crack	Not applicable	Visual inspection (V.I.)		
	ery	Deformation	Not applicable	V.I. or survey		
	Gall	Deterioration	Not applicable	V.I. and/or hammer blow		
	ion (Joint opening	Not applicable	Visual inspection (V.I.)		
	pect	Abnormal leakage	Not applicable			
	lns	Abnormal drain water	Not applicable			
		Others				

Description:

Upstream: [b2]

Downstream: [b1] * Spilled water at the observation house shall be bypassed to the downstream toe by appropriate way not to erode the downstream slope and eroded slope shall be backfilled according to the original design.

Dam Crest: [c]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

		ltom	Metho	od for Checking	Dhoto No	Einding/Remark
		Item	from Record	at the Site	FIIOLO NO.	T inding/itemark
		Crack	Referred	Visual inspection (V.I.)		Not found
	am	Deformation	Referred	V.I. or survey	9.1-26	Minor slope failures were found
	stre	Deterioration	None	V.I. and/or hammer blow		Not so serious
	ЧD	Joint opening	Not applicable	Visual inspection (V.I.)		
		Others				
		Crack	Referred	Visual inspection (V.I.)		Not found
		Deformation	Referred	V.I. or survey		Not so serious
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious
	nstr	Joint opening	Not applicable	Visual inspection (V.I.)	9.1-27 (L)	
	Dow	Seepage water	Referred	V.I. and/or measurement		7.20 liter/min (at observation point)
		Amount of leakage	Referred	Visual inspection (V.I.)		Not found
am		Others				
fill D		Crack	Referred	Visual inspection (V.I.)		Not found
Rock		Deformation	Referred	V.I. or survey		Not so serious
З. F	est	Deterioration	None	V.I. and/or hammer blow		Not so serious
	n Cr	Abrasion	Referred	Visual inspection (V.I.)	9.1-27 (R)	Not so serious
	Dar	Joint opening	Not applicable	Visual inspection (V.I.)		
		Overtopping splay's impact on the surrounding	Not applicable			
		Others				
		Crack	Not applicable	Visual inspection (V.I.)		
	ery	Deformation	Not applicable	V.I. or survey		
	Gall	Deterioration	Not applicable	V.I. and/or hammer blow		
	ion	Joint opening	Not applicable	Visual inspection (V.I.)		
	pect	Abnormal leakage	Not applicable			
	lns	Abnormal drain water	Not applicable			
		Others				

Description: Upstream: [b2] Downstream: [c] Dam Crest: [c]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

Itom			Metho	od for Checking	Dhoto No	Finding/Pomork
		Item	from Record	at the Site	PHOLO INO.	Finding/Remark
		Design flood discharge	6,668.62 m ³ /s	Calculation by current criteria		
		Maximum flood discharge	2,568.90 m ³ /s			Record as of August 15, 1992
		Crack	Referred	Visual inspection (V.I.)		Not so serious
		Deformation	Referred	V.I. or survey		Not so serious
		Abrasion/ damage	Referred	Visual inspection (V.I.)		Not so serious
	Inlei	Deterioration	Referred	V.I. and/or hammer blow		Not so serious
	_	Joint opening	Referred	Visual inspection (V.I.)		Not so serious
		Clogging (e.g., floating log)	Referred	Visual inspection (V.I.)		Some floating logs and garbage were found
		Others				
		Crack	Referred	Visual inspection (V.I.)		Not so serious
	Crest	Deformation	Referred	V.I. or survey		Not so serious
		Deterioration	Referred	V.I. and/or hammer blow		Not so serious
		Abrasion	Referred	Visual inspection (V.I.)		Not so serious
vay		Joint opening	Referred	Visual inspection (V.I.)		Not so serious
pill		Others				
4. S		Crack	Referred	Visual inspection (V.I.)	9.1-28	Not so serious
		Deformation	Referred	V.I. or survey		Not so serious
	е	Abrasion/ damage	Referred	Visual inspection (V.I.)		Not so serious
	hut	Deterioration	Referred	V.I. and/or hammer blow		Not so serious
	0	Joint opening	Referred	Visual inspection (V.I.)		Not so serious
		Clogging (e.g., floating log)	Referred	Visual inspection (V.I.)		Not found
		Others				
		Crack	Referred	Visual inspection (V.I.)		Not so serious
	ator	Deformation	Referred	V.I. or survey		Not so serious
	sipa	Abrasion/ damage	Referred	Visual inspection (V.I.)		Not so serious
	Dis	Deterioration	Referred	V.I. and/or hammer blow		Not so serious
	ergy	Joint opening	Referred	Visual inspection (V.I.)		Not so serious
	En€	Clogging (e.g., floating log)	Referred	Visual inspection (V.I.)		Not found
		Others				

Description:

Spillway Inlet: [c] Crest: [c] Chute: [c] Energy Dissipator: [c]

[Remark]

- Spillway gate No.1 and No.7 have a gate opening problem.

- Further investigation will be necessary if ID and HPGE would like to add the repair work of spillway gates to future rehabilitation project.

- Based on the above-mentioned investigation, screening result will possibly be changed.

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

		ltom	Metho	od for Checking	Dhoto No	Finding/Pomork
		nem	from Record	at the Site	Pholo No.	Finding/Remark
		Crack	Not applicable	Visual inspection (V.I.)		
		Deformation	Not applicable	V.I. or survey		
	lers	Abrasion/ damage	Not applicable	Visual inspection (V.I.)		
	dle F	Deterioration	Not applicable	V.I. and/or hammer blow		
	Sade	Joint opening	Not applicable	Visual inspection (V.I.)		
×	• •	Amount of leakage	Not applicable	Visual inspection (V.I.)		
Istoc		Others				
Per		Crack	None	Visual inspection (V.I.)		Not so serious
<u>ъ</u> .	locks	Deformation	None	V.I. or survey		Not so serious
		Abrasion/ damage	None	Visual inspection (V.I.)	9.1-29, 30	Repair works was completed
	or B	Deterioration	None	V.I. and/or hammer blow		Not so serious
	nch	Joint opening	None	Visual inspection (V.I.)		Not found
	A	Amount of leakage	None	Visual inspection (V.I.)		Not found
		Others				
е		Crack	None	Visual inspection (V.I.)	9.1-31	Some cracks were found around the penstock
snou		Deformation	None	V.I. or survey		Not so serious
verh		Deterioration	None	V.I. and/or hammer blow		Not so serious
Po		Amount of leakage	None	Visual inspection (V.I.)		Not so serious
6.		Others				

Description:

Penstock Saddle Piers:

Saddle Piers: * Not applicable Anchor Blocks: [c] Powerhouse

Building: [c] Tailrace: [c] Others: Water Level Gauge: [a2]

[Classification] a1: E

a1: Emergency countermeasure is required due to decrease in function.a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the hear future.)
b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

	ltem		Metho	od for Checking	Dhoto No	Finding/Pomark
		item	from Record	at the Site	FIIOLO NO.	Tinding/Remark
		Crack	None	Visual inspection (V.I.)		Not found
	am	Deformation	None	V.I. or survey		Not so serious
	stre	Deterioration	None	V.I. and/or hammer blow		Not so serious
	ЧD	Joint opening	Not applicable	Visual inspection (V.I.)		
		Others				
		Crack	None	Visual inspection (V.I.)		Not found
		Deformation	None	V.I. or survey		Not so serious
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious
	nstr	Joint opening	Not applicable	Visual inspection (V.I.)		
	Dow	Seepage water	None	V.I. and/or measurement		Not found
Ľ		Amount of leakage	None	Visual inspection (V.I.)		Not found
Dai		Others				
ddle		Crack	None	Visual inspection (V.I.)		Not found
t Sa		Deformation	None	V.I. or survey	9.1-33	Eroded spot was found
. Lef	est	Deterioration	None	V.I. and/or hammer blow		Not so serious
7.	л С	Abrasion	None	Visual inspection (V.I.)		Not so serious
	Dar	Joint opening	Not applicable	Visual inspection (V.I.)		
		Overtopping splay's impact on the surrounding	None			
		Others				
		Crack	Not applicable	Visual inspection (V.I.)		
	ery	Deformation	Not applicable	V.I. or survey		
	Gall	Deterioration	Not applicable	V.I. and/or hammer blow		
	ion	Joint opening	Not applicable	Visual inspection (V.I.)		
	pect	Abnormal leakage	Not applicable			
	lns	Abnormal drain water	Not applicable			
	-	Others				

Description: Upstream: [c] Downstream: [b2] Dam Crest: [c]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

Check List for Civil Facilities

- Sedawgyi Hydropower Plant -

		ltom	Metho	od for Checking	Photo No	Finding/Pomark
		Item	from Record	at the Site	FIIOLO NO.	T mulig/Remark
		Crack	None	Visual inspection (V.I.)		Not found
	am	Deformation	None	V.I. or survey		Not so serious
	stre	Deterioration	None	V.I. and/or hammer blow		Not so serious
	ЧD	Joint opening	Not applicable	Visual inspection (V.I.)		
		Others			9.1-34 (L)	Villagers reclaimed and took riprap stones away
		Crack	None	Visual inspection (V.I.)		Not found
		Deformation	None	V.I. or survey		Not so serious
	eam	Deterioration	None	V.I. and/or hammer blow		Not so serious
	nstr	Joint opening	Not applicable	Visual inspection (V.I.)		
	Dow	Seepage water	None	V.I. and/or measurement		Not found
E		Amount of leakage	None	Visual inspection (V.I.)		Not found
e Da		Others				
addle		Crack	None	Visual inspection (V.I.)		Not found
nt Sá		Deformation	None	V.I. or survey	9.1-34 (R)	Scraped away caused by 3-point turn of automobile
Rigł	est	Deterioration	None	V.I. and/or hammer blow		Not so serious
8.	n Cr	Abrasion	None	Visual inspection (V.I.)		Not so serious
	Dar	Joint opening	Not applicable	Visual inspection (V.I.)		
		Overtopping splay's impact on the surrounding	None			
		Others				
		Crack	Not applicable	Visual inspection (V.I.)		
	ЭŊ	Deformation	Not applicable	V.I. or survey		
	Galle	Deterioration	Not applicable	V.I. and/or hammer blow		
	ion (Joint opening	Not applicable	Visual inspection (V.I.)		
	pect	Abnormal leakage	Not applicable			
	sul	Abnormal drain water	Not applicable			
		Others				

Description: Upstream: [b2] Downstream: [c] Dam Crest: [b2]

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

Item			Method for Checking		Dhoto No	Finding/Domork
			from Record	at the Site	PHOLO NO.	Finding/Remark
ervoir	Dam Foundation	Leakage from dam sorrounding	Not applicable	V.I. or hearing		
		Swelling out of rock mass	Not applicable	V.I. or survey		
		Settlement	Not applicable	V.I. or survey		
		Weathering	Not applicable	Visual inspection (V.I.)		
		Fault	Not applicable	V.I. or survey		
		Landslide/ collapse	Not applicable	Visual inspection (V.I.)		
		Grouting	Not applicable			
		Others				
	Watershed	Swelling out of rock mass	Referred	V.I. or survey		Not found
Res		Settlement	Referred	V.I. or survey		Not found
9.		Weathering	None	Visual inspection (V.I.)		Not so serious
		Fault	None	V.I. or survey		Not found
		Landslide/ collapse	Referred	Visual inspection (V.I.)	9.1-35, 36	2 bank failures were observed
		Others				
	Sedimentation	Sediment yield	Referred	V.I. or survey		1,474 m ³ /km ² /year
		Effective storage capacity	Referred	V.I. or survey		378.68 million m ³ (ID Report, Aug. 2013)
		Land use (upstream)	Referred	V.I. or hearing		Deforestation was not confirmed
		Others			9.1-34 (L)	Sandbar was seen at around Japan Gon Village

Description:

Dam Foundation: * Not applicable

* Remarkable deforestation and/or land slide were not found.

Watershed: [c]

Sedimentationt: [c] * ID doesn't have any plan for sedimentation countermeasures based on the conclusion of their report.

[Classification] a1: Emergency countermeasure is required due to decrease in function.

a2: Function is decreased by deterioration and/or damage, thus possible countermeasure is required.

b1: Function is carried on even though deterioration and/or damage is found. (Countermeasure will be required in the near future.)

b2: Function is carried on even though deterioration and/or damage is found. (Probably long-term stability and safety is not secured.)

ANNEX 11

POWER SYSTEM ANALYSIS FOR REQUIRED EXPANSION OF TRANSMISSION LINE





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%)





Thermal capacity of transmission line

500kV	I	I	458MW
230kV	I	179MW	211MW
132kV	79MW	121MW	142MW
Ampere	407A	530A	622A
MCM	397.5	605	795
Conductor Type	lbis	Duck	Drake

*PF:0.85 **Maximum thermal temperature :75°C

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

	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	+++	++	+

 Table 11.2-1
 Tykyit P/S Generation Power Limitation in the case of 132kV T/L Fault

(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

		Exi	sting	Scenario A	Scenario B	Scenario C	Scenario C'	Scenario C"
Power System Diagram		Shwemyo PL UPL Pinmana Thephyu Taungoo Thartargone	Baluchaung No.1 Baluchaung No.2 Baluchaung No.3	Shwemyo S/S Kalaw S/S Tykyit P/S (0) Loikaw S/S BJC. No.2 P/S Taungoo S/S (NEW) (0) BLC. No.1 BLC. No.2 BLC. No.3 (NEW) (0)	Taungoo S/S Si Si Si Si Si Si Si Si Si Si Si Si Si	Shwemyo S/S Tykyit P/S Loikaw S/S Tykyit P/S BJC. No.2 P/S BLC. No.1 BLC. No.2 BLC. No.2 BLC. No.3 (NEW)	Shwemyo S/S Kalaw S/S Tykyit P/S BJC. No.2 P/S Loikaw S/S Loikaw S/S Loikaw S/S Taungoo S/S (NEW) BJC. No.1 BLC. No.2 BJC. No.2 P/S Comparison BJC. No.2 P/S Comparison BJC. No.2 P/S Comparison BJC. No.2 P/S Comparison Compariso	Shwemyo S/S Kalaw S/S Tykyit P/S Loikaw S/S Loikaw S/S BJC. No.2 P/S BJC. No.2 P/S
	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
Transmission Line (T/L)	Conductor type	795MCM (Drake)	605MCM (Duck)	795MCM (Drake)	605MCM (Duck)	795MCM (Drake)	795MCM (Drake) 397.5MCM(Ibis)	
opecification	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)
_	Load Flow			+++	+++	+++	++ (System operation restriction)	+(System operation restriction)
Power System Analysis	Power Loss			++++	+++	++	++	++
, many ore	Transient Stability			+++	+++	+++	+++	+++
Transmission L Feasibility	ine (T/L) Route			+ (Land mine issue)	++	+++	+++	+++
Substation Fee Feasibility	eder Facility (S/S F.F.)			+++	+++	+++	+	++
	Construction of T/L (USD)			++	++	++++	+++++	+++++
Cost	Construction of S/S F.F. (USD)			++	++	++	+++	+++
	Total around constructic cost (USD) (Subject to change)			36 million USD	45 million USD	15 million USD	6 miilion USD	1 million USD

 Table 11.2-2
 Power System Expansion Scenarios Study for Baluchaung Hydropower Station No.1



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.11.3-4 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.

		Existing	Scenario A	Scenario B	Scenario C
Total transmission	(MW)	144.4	134.7	142.6	143.5
loss	(%)	(100)	93.3	98.8	99.4

Table 11.3-1Transmission Line Loss



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
 - 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)

စီမံကိန္းလုပ္ငန္းအက်ဥ္း 🔲 အမ်ိဳြးသားေရးဆိုင္ရာ လွ်ပ္စစ္ဓာတ္**အားရရွိေရး စီမံခ်က္**အရ ေရအားလွ်ပ္စစ္**အရင္းအျမစ္မ်ားအား အရည္**အေသြး ေလ့လာတိုင္းတာရာတြင္ စက္ကိရိယာမ်ား၏ အဓိကအစိတ္အစိုင္းမ်ားသည္ အရည္အေသြးက်ဆင္းလာခဲ့ပါသည္။ လက္ရွိလည္ပတ္ေနေသာ ဘီလူးေခ်ာင္းအမွတ္(၁)ေရအား လွ်ပ္စစ္စက္၏အဓိက စက္ပစ**ြည္း အစိတ္**အပိုင္း မ်ားအားအစားထိုးလဲလွည္ရန္ လိုအပ္လာပါသည္။ အစားထိုးလဲလွည္ျခင္းလုပ္ငန္း ေဆာင္ရြက္ရန္ ေလ့လာမ ြမ်ား ျပ**ြလုပ္ရာတြင္ ြ**ိုင္ငံ၏ စီပြားေရးဖြံြဖိြ**းတိုးတက္မ**ြအား အေထာက္အအကူျပ**ြမ**ါ၊ လူမ သဘာလ ပတ္၀န္းက်င္ ထိခိုက္မူ မရွိေစေရေး၊ တိုးခ်ဲဲြမ ြျပ**ြလုပ္ဘဲေဆာင္ရြက္နိုင္ေရးတို**ြအားထည့္သြင္းစဥ္းစဥ္းစားခဲ့ပါသည္။

္ လွ်ပ္စစ္ဓါတ္အားထုတ္လုပ္ေရးလုပ္ငန္း ႏွင့္ပူးေပါင္းကာ အရြယ္အေစားတိုးခ်ဲါမ ျမပ ြလုပ္ဘဲ ႏွင့္ စက္ပစ ြည္းမ်ဴား အစားထိုးလဲလွယ္ျခင္း၊

ျပန္လည္ျပ ြျပင္ျခင္းတိုြျဖင့္စီမံကိန္းအားေဆာင္ရြက္ရန္ထည့္သြင္းစဉ္းစားခဲ့ပါသည္။

 လုပ္ငန္းအေကာင္အထည္ေဖာ္ေဆာင္ရြက္မည့္အာစီအစဥ္အရ စီမံကိန္းေဆာင္ရြက္ရာတြင္

 စီမံကိန္းအ ြကံေပးး ေြစြးခ်ယ္ျခင္း၊ စီမံကိန္းပံုစံေရးစြဲခ်မွတ္ျခင္း၊

 စီမံကိန္းအတြက္တင္ခါေေျခင္း၊
 စီမံကိန္းလုပ္ငန္း အေကာင္အထည္

 ေဖာ္ေဆာင္ရြက္ျခင္းစသည္ကို ြျဖင့္ ေဆာင္ရြက္သြားမည္ ျဖစ္ပါသည္။ စီမံကိန္းလုပ္ငန္း
 အေကာင္အဆည္

 ေဖာ္ေဆာင္ရြက္ျခင္းစသည္ကို ြျဖင့္ ေဆာင္ရြက္သြားမည္ ျဖစ္ပါသည္။ စီမံကိန္းလုပ္ငန္း
 အကာင္အည္ေဖာ္

 ေဆာင္လြက္ျခင္း လုပ္ငန္းကို ၂၀၁၈
 ခု ႏွစ္ေႏွာင္းပိုင္းတြင္ေဆာင္ရြက္မည္ျဖစ္ပါသည္။
 စီမံကိန္းအား(၂)ႏွစ္ ြကာ

 ေဆာင္ရြက္မည္ျဖစ္ပါသည္။
 လွ်ပ္စစ္ဓါတ္အအား ထုတ္လုပ္ေရးလုပ္ငန္းႏွင့္ ပူးေပါင္းကာ
 အရြယ္အစားတိုးခ်ဲျမဲ။ မျပ ူလုပ္တဲ ႏွင့္ စက္မစ ည္းမ်ား အစားထိုး လဲလွယ္ျခင္း၊

 ျပန္လည္ျပ ျပင္ျခင္းတို ျဖင့္စီမံကိန္းအားေဆာင္ရြက္ရန္ထည့္သသြင္းစဥ္းစားခဲ့ပါသည္။
 ေမိကိန္းသည့္သလြင္ျမစ္၏ ျမစ္လက္တက္တခုျဖစ္ေသာနန္ ။ ပြန္ျမစ္မွ ျမစ္မ်ားခံလာေသာဘီလူးေခ်ာင္းေပ

 တြင္ တည္ရွိ သည္။
 ၁၉၉၂
 ခု ႏွစ္

 ကပ္နင္းဆက္ရာဆညိဳျဖင့္စစတင္ေဆာင္ရြက္ခဲ့ေသာေရအားလွ်ပ္စစ္စီမံကိန္းျဖစ္ပါသည္။
 တင္သြင္ စခင္စစ္

 ဂ်ပန္ ေတာအားသယံတတ ႏုပ္ သဘာပပတ္ပ္က္ေသားက်င္ ထိန္းသိမ္းေရးပန္ ေက်းဌာနမွ ေကာ္မ္ရရ ျစ္
 စေဆေဆာင္စရာနားသယံတတ ႏွင့္ သဘာပပတ္ေန္းက်င္ ထိန္းသိမ္းေရးပန္ ေက်းဌာနမွ ေကာည္ရရ ျ

 စစ္ေဆာင္စုပါသည္။
 သဘာ၀ ပတ္ပ္က္ေ စီမံာန္းက်င္ စီမံခန္းစြဲေန ေစြာေခ အစီအစဥ္ေအာင္ေျနာရန္းခဲ့ေရာင္တာ ေနာင္စာေနာင္စာေနာက္ခေေနာက္ခ်ားလင္းက်င္ စီမံခန္းစိုေနာ္ ေနာက္ခေေနာက္ခေေနာက္ခ်ာေနာက္ခ်ားေနာက္ခေေနာက္ခ်ားလင္းခဲ့ေနာက္ခေေနာက္ခ်ားလွာ လွာ စေေနာက္ခေေနာက္ခ်ေနာက္ခေေနာက္ခေေနာက္ခေေနာက္ခေေနာက္ခေေနာက္ခေနးကို အေနာက္ခေေနာက္ခေေနာက္ခေေနာက္ခ

ေအာက္ေဖာ္ျပပါအခ်က္ခ်ားအားထည့္သြင္းေရးဆြဲခဲ့ပါသည္။ ၁. ျဖစ္ေပ □ ြိုင္ေသာ သက္ေရာက္မ ြမ်ားအား သတ္မွတ္ျခင္း၊ သက္ေရာက္မ ြမ်ားအား တခုျခင္းစီအလိုက္ အဆင့္ခြဲျခား ျခင္း ေဆာင္ရြက္ရာတြင္(၃၈)မ်ိြ း ပါ၀င္ခဲ့ပါသည္။ လူမ ြ ေရး အမွတ္(၁၇)၊ သဘာ၀ပတ္၀န္းက်င္ အေျခအေန အမွတ္(၁၀) ြွင့္ သဘာ၀ပတ္၀န္းက်င္ညစ္ညမ္းမ၊ အမွတ္(၁၁) တိုါျဖစ္ပါသည္။ ၂. သတ္ေရာက္မ ြမ်ားအား အဆင့္ခြဲျခား သတ္မွတ္ရာတြင္ (A-) သည္ ပတ္၀န္းက်င္ ထိခိုက္မ ြမရွိျခင္း (B-) သည္ ပတ္၀န္းက်င္ ထိခိုက္မ ၊ အနည္းငယ္သာရွိျခင္း၊ (D) သည္ ပတ္၀န္းထိခိုက္မ ၊ မရွိျခင္း စသည္ကိုြျဖင့္ ခြဲျခား သတ္မွတ္ ထားပါသည္။

၃. သဘာဂပတ္ဂဂန္းက်င္စီမံခန္ ြစ္ပဲမ 🗆 အစီအစဥ္ အားေရးဆြဲရာတြင္ လုပ္ငန္း အေကာင္အအထည္ေဖာ္ ေဆာင္ရြက္ျခင္း အဆင့္တြင္ ျဖစ္ေပ ြလာ ြိုင္ေသာ ထိခိုက္မွ ြမ်ဴားအတြက္ ေလွ်ာ့ခ်ဲေရးအစီအစဥ္၊ အေကာင္အထည္ေဖာ္ ေဆာင္ရြက္ မည့္အဖြဲြအစည္း၊ တာဂန္ရွိေသာ အဖြဲါအစည္း ႏုိင့္ ေက်ိဳး ေကပ္ေရးအဖြဲါအစည္းတိုါကို ေအာက္ပါအတိုင္း ထည့္သည္ပြင္း ေရးဆြဲပါသည္။ (၁) အစီအစဥ္ေရးဆြဲျခင္းအဆင့္ (၂) လုပ္ငန္းအေကာင္အထည္ေဖာ္ျခင္း -(၁) လူမ ြသဘာဂပတ္ဂပန္းက်င္- လက္ရွိလူမ ြပတ္ဂပန္းက်င္အေျခအေန၊ က်မ္းမာေရး ေစာင့္ေရွာက္မ အေျခ အေန၊ အလုပ္အကိုင္ အခြင့္အလမ္း၊ ေဘးအ 🗆 ရာယ္မ်ွား (၂) သဘာ၀ပတ္ဂဂန္းက်င္-ကမ ြာေျမပူေြြးလာမါ (၃) သဘာဂပတ္ဂဂန္းက်င္သစ္ညမ္းမါ- ေလထုညစ္ညမ္းမါ၊ ေရထုညစ္ညမ္းမါ၊ ေျမထုညစ္ညမ္းမ။၊ ဆူညံသံ မ်ဴား၊ တုန္ခါမ ြမ်ဴား ၃. စီမံကိန္းအေကာင္အထည္ေဖာ္ေဆာင္ရြက္မူ ၄. လုပ္ငန္းအဆင့္မ်ဴား (၁)လူမ □သဘာဂပတ္ဂ၀န္းက်င္- ေျမယာအသံုးခ်မပါ ြင့္ ေဒသတြင္းေျမယာ အသံုးျပ □ပံုမ်ား၊ ေဘးဒုက □သည္မ်ား၊ တိုင္းရင္းသားမ်ိိ □း □ြယ္မ်ား၊ လိင္၊ ကေလးသူငယ္အအခြင့္အေရး၊ ခြဲေဂမ 🗌 ြွင့္အသံုးခ်မ 🛛 မ်ဴား၊ ေဒသတြင္းျပ 🗆 နာမ်ဴား ၄.သဘာဂပတ္၀န္းက်င္ ေစာင့္ 🗆ကည့္တိုင္းတာျခင္း အစီအစဥ္ကိုလည္း သဘာဂပတ္၀န္းက်င္ စီမံခန္ ြခြဲမ] အစီအစဉ္ အတိုင္းေရ းဆြဲပါမည္။ ေရးဆြဲရာတြင္ စံ 🗆 ြန္းမ်ဴား၊ ေနရာမ်ဴား၊ ေဆာင္ရြက္မည့္အဖြဲါအစည္း၊ 🛛 ကီး ြကပ္မည့္အဖြဲါအစည္း၊ အ ြကိမ္အေရအတြက္၊

တာ၀န္ခံအဖြဲြအစည္းတိုြပါ၀င္မည္ျဖစ္ပါသည္။

ງ∙

ေဒသခံမ်ား ြွင့္ေတြါဆံုေဆြးေြြး၍သတင္းအခ်က္အအလက္မ်ားရယူျခင္းကို(၂)ြကိမ္ျပ လုပ္ခဲ့ပါသည္။ ပထမအ ြကိမ္ေတြါဆံု ေဆြးေြြးပြဲတြင္ စီမံကိန္းအခ်က္အအလက္မ်ား၊ လူမ ြရေး ြွင့္သဘာဂပတ္ဂ၀န္းက်င္ ေလ့လာဆန္းစစ္ျခင္း ျပ ြလုပ္မည့္ ပံုစံမ်ား အားရွင္းလင္း တင္ျပခဲ့ပါသည္။ ဒုတိယအ ြကိမ္ေတြါဆံုေွဆြးေြြးပြဲတြင္ျပ ြ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.

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.

 Table 1
 Necessity of Rehabilitation (Replacement, Repair or Addition)

 with Major Facilities/Equipment of Existing Hydropower Plant

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.

	Subject		2016				2017		2018			2019				2020				2021					
			П	Ш	IV	Ι	П	Ш	IV	Ι	П	Ш	IV	Ι	П	Ш	IV	Ι	П	Ш	IV	Ι	Π	Ш	IV
1	JICA Preparatory Study	ł			↑																				
2	Loan Agreement																								1
3	Consulting Services for Rehabilitation of Hydropower Stations Project (selction of Consultant, Detailed Design Study, Tender for Constructors)						ŧ					•													
4	Implementation of Constrcution Work for Rehabilitation																			♦					
5	Power Plant Operation after Rehabilitation																				¢				

Table 2 Implementation Schedule for Rehabilitation Project of Hydropower Plant

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 1 and 2.



Source: Land Records Department (2000) S

Source: Land Records Department



Figure 3 Location Map of Baluchaung No.1 HPP along Baluchaung River



Photo 1 Existing 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

Table 3 Major Parameters of Baluchaung No.1 HPP

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.

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							

Table 4Major Laws and Regulations relevant to Environment

(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.

Type of Economic Activity	Criteria for IEE Type Economic Activities	Criteria for EIA Type Economic Activities				
(a) Energy Sector Development	·					
	a) Installed capacity ≥ 1 MW but < 15 MW	a) Installed capacity $\geq 15 \text{ MW}$				
Hydro Power Plants	b) Reservoir volume (full supply level) < 20,000,000 m ³	b) Reservoir volume (full supply level) \geq 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 (\geq 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	\geq 4 ha	All activities where the Ministry requires that the Project shall undergo EIA				

Table 5 Categorization of Hydropower Development Schemes

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
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Stage	Anticipated Activities							
T	Securing land/space for hydropower plant and related facilities							
Planning Stage (Pre-construction	Securing construction yard including storage of construction materials							
Stage)	Change in land use and utilization of local resources							
	Procurement of construction materials and securing water supply							
	arth moving work such as excavation, cutting and mounting							
II Construction	Work for exchange/renewal of dilapidated facilities /equipment and/or parts/devices to new ones							
Stage (Rehabilitation Work)	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 of hydropower plant and related facilities/equipment							
Operation Stage	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) $\vec{A}(+/-)$ 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.

E*		Scop	ing	Aft	er	Descare
	Environmental Items *	1/II	III	I/II	Ш	Keasons
(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	С	С	B-	В-	(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

Table 7 Identification and Evaluation of Possible Impacts due to Hydropower Plants RehabilitationProject

,	*	Scop	ing	Aft	er	Desser					
	Environmental items *	1/II	III	I/II	Ш	Keasons					
						informed to relevant community peoples and community based organizations.					
5	Existing social infrastructures and services (Traffic condition)	С	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	С	С	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	С	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	С	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	С	С	B-	В-	(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	С	С	B-	В-	(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	С	С	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	С	С	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	С	С	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					
		Scoping After				D					
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	Environmental Items *	1/II	III	I/II	III	Reasons					
						such as HIV/AIDS is not anticipated.					
15	Working condition	С	С	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-	С	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-	С	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	С	С	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	С	С	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	С	С	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.)	С	С	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)	С	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)	С	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	С	С	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	С	С	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-	С	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-	С	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					

		Scop	ing	Aft	er	Doctore					
l	Environmental Items *	1/II	III	I/II	ш	Keasons					
						plant operation.					
29	Water Pollution	B-	С	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-	С	В-	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-	В-	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-	С	В-	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	С	С	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	С	С	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	С	С	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.
- Mitigation measures (1) To consider and to carry out possible preventive b) 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							
РСВ	Not c	ontained						
	Generator Rotor	Phase to phase insulator						
		Field circuit switch						
Asbestos	Excitation system	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 O & 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.

Environmental Items Mitigation Measures		Implementation organization*, ***	Responsible and/or supervising organization**	
(I / I	I) Planning Stage/ Con	struction Stage		
(1) S	ocial 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.		
15	Working condition	 In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). Preparation of safety management plan and enlighten occupational safety to construction workers. Tangible safety considerations should be prepared for individuals involved in the project. The installation of safety equipment and management of hazardous materials. Any worker and personnel who enter into construction sites have to bear safety shoes, hats and earplugs for construction works. Monitoring health condition and occupational safety of workers. 	Contractor, EPGE	Local government (State, District or Township),
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.		ECD, MOEE
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) N	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) E	Environmental pollutio	n		
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,	Local government
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.	EPGE	(State, District or Township), ECD, MOEE
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		

Table 9 Environmental Management Plan (EMP)

E	invironmental Items	Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**				
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 1	tem							
(1)	Land use and	Before the 2^{nd} stakeholder meeting it was confirmed by hearing						
3	utilization of local resources	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						

E	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.

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	 To get Environmental Compliance Certificate (ECC) from MONREC 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.	 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 Environmer	nt	r	r	r			
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 Pollu	ition						
Air pollution	 Visual observation, 2) Complaints from residents 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		

Table 10Environmental Monitoring Plan

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.	 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) Physical observation. (2)		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	1	1	1	1		
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	 Collect complains, (2) Consultation with relevant chief of villages and representatives of community organizations 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
- 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



(10) Question and Comment by Participant - 2



(8) Participants at the meeting



(11) Question and Comment by Participant - 3



(9) Question and Comment by Participant - 1



(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



4) Question and Comment by Participant - 1



5) Question and Comment by Participant – 2



3) Presentation by the Local Consultant



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 25th and 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)

စီမံကိန္းလုပ္ငန္းအက်ဥ္း 🗌 အမ်ိိြးသားေရးးဆိုင္ရာလွ်ပ္စစ္ဓာတ္အားရရွိေရးစီမံခ်က္အရေရအားလွ်ပ္စစ္အအရင္းအျမစ္မ်ဴားအားအရည္ အေသြ္း ေလ့လာတိုင္းတာရာတြင္စက္ကိရိယာမ်ဴား၏အဓိကအစိတ္အအပိုင္းမ်ဴားသည္အရည္အေအသြ္းက်ဆင္းလာခဲ့ပါ သည္။ ____ လက္ရွိလည္ပတ္ေနေသာဘီလူးေခ်ာင္းအမွတ္(၁)ေရအားလွ်ပ္စစ္စက္၏အဓိကစက္ပစ ြည္းအစိတ္အရပိုင္းမ် ാഃങ്ങ အစားထိုးလဲလွည္ရန္လိုအပ္လာပါသည္။အစားထိုးလဲလွည္ျခင္းလုပ္ငန္းေဆာင္ရြက္ရန္ေလ့လာမ ြမ်ားျပ ြလုပ္ရာ တြှင ____ □ိုင္ငံ၏စီပြားေရးဖြံ ြဖိ □းတိုးတက္မ ြအားအေထာက္အကူျပ ြမ ြ၊လူမ ြသဘာဂပတ္၀န္းက်င္ထိခိုက္မ ြမ ရွိေစေရး၊ တိုးခ်ဲ်မြ မျပ ြလုပ္ထဲေဆာင္ရြက္နိုင္ေရးတိုြအားထည့္သြင္းစဥ္းစားခဲ့ပါသည္။ □ လွ်ပ္စစ္ဓါတ္အားထုတ္လုပ္ေရးလုပ္ငန္း ြွင့္ပူးေပါင္းကာ အရြယ္အစားတိုးခ်ဲဲြမ ြမျပ ြလုပ္တဲ့ြွင့္ စက္စစ ြည္းမ်ဲ္ား အစားထိုးလဲလွယ္ျခင္း၊ ျပန္လည္ျပ ြျပင္ျခင္းတိုြျဖင့္စီမံကိန္းအားေဆာင္ရြက္ရန္ထည့္သြင္းစဉ္းစားခဲ့ပါသည္။ 🔲 လုပ္ငန္းအေကာင္အထည္ေဖာ္ေဆာင္ရြက္မည့္အစီအစဉ္အရ စီမံကိန္းအ 🗆 ကံေပး ေရြးခ်ယ္ျခင္း၊ စီမံကိန္ စီမံကိန္းေဆာင္ရြက္ရာတြင္ စီမံကိန္းပံုစံေရးစြဲခ်မွတ္ျခင္း၊ စီမံကိန္းအတြက္တင္ဒါေခ ြျခင္း၊ စီမံကိန္းလုပ္ငန္း အေကာင္အထည္ ေဖာ္ေဆာင္ရြက္ျခင္းစသည္တို^{႐ု}ျဖင့္ ေဆာင္ရြက္သြားမည္ ျဖစ္ပါသည္။ စီမံကိန္းလုပ္ငန္း ျခင္း လုပ္ငန္းကို ၂၀၁၈ ၁ည္။ စီမံကိန္းအား(၂)ြွစ္ြကာ လွ်ပ္စစ္ဓါတ္အားထုတ္လုပ္ေရးလုပ္ငန္းြင့္ပူးေပါင္းကာ ေဆာင္ရြက္ျခင္း အေကာင္လည္ေဖာ္ ခ္ ြစ္ေ ြွာင္းပိုင္းတြင္ေဆာင္ရြက္မည္ျဖစ္ပါသည္။ ေဆာင္ရြက္သည္ျဖစ္ပါသည္။ အရြယ္အစားတိုးခ်ဲ်ါမ ြမျပ ြလုပ္ဆဲြွွင့္ စက္ပစ ြည္းမ််ား အစားထိုးလဲလွယ္ျခင္း၊ ျပန္လည္ျပ ြျပင္ျခင္းတိုြျဖင့္ စီမံကိန္းအားေဆာင္ရြက္ရန္ထည့္သြင္းစဉ္းစားခဲ့ပါသည္။ စီမံကိန္းသည့္ဧရာဂတီျမစ္္မွံျမစ္ဖ်ွံားခံလာေသာ ေခ််ာင္းမ ြကီးေခ်ာင္းေပ ြတြင္ တည္ရွိသည္။ မ ြ ေလးတိုင္းေဒသ ြကီး၊ မတ ြရာ ြမိြ ြနယ္တြင္တည္ရွိပါသည္။ တြင္သြင္းခဲ့ေသာ အစီအရင္ခံစာအားသယံဇာတ ြင့္ သဘာဂပတ္ဂဂန္းက်င္ ထိန္းသိမ္းေရးးဂန္ ြကီးဌာနမွ ြကည့္ရျ စစ္ေဆ်း ြပီးေနာက္တြင္ စီမံကိန္းသည္ သဘာဂပတ္ဂ၀န္းက်င္စီမံခန္ြခဲ့မဲ ြအစီအစဉ္အားေရးဆြဲရန္ ည ြန္ ြကားခဲ့ပါသည္။ 🔲 သဘာဂပတ္ဂဂန္းက်င္ စီမံခန္ 🛛ခြဲမ 🗌 အစီအစဥ့္တင္ဖြ

ေအာက္ေဖာ္ျပပါအခ်က္ရွိားအားထည့္ရသြင္းေရးဆြဲခဲ့ပါသည္။ ၁. ျဖစ္ေပ 🗆 🗠 ိုင္ေသာ သက္ေရာက္မ ြမ်ဴားအား သတ္မွတ္ျခင္း၊ သက္ေရာက္မ ြမ်ဴားအား တခုျခင္းစီအလိုက္ အဆင့္ခြဲျခ**ား** ျခင္း ေဆာင္ရြက္ရာတြင္(၃၈)မိိ ြး ပါ၀င္ရွဲပါသည္။ လူမ ြေရႊ အမွတ္(၁၇)၊ သဘာဂပတ္၀န္းက်င္ အေျခအေန အမွတ္(၁၀) 🛛 ္ရင့္ သဘာဂပတ္ဂဂန္းက်င္သစ္သမ္းမ၊ အမွတ္(၁၁) တိုြျဖစ္ပါသည္။ ١. သတ္ေရာက္မွ ြမ်ဴားအား အဆင့္ခြဲျခ္း သတ္မွတ္ရာတြင္ (A-) သည္ ပတ္ဂဂန္းက်င္ ထိခိုက္မ ြမရွိျခင္း (B-) သည္ ပတ္ဂဂန္းက်င္ ထိခိုက္မ[®] အနည္းငယ္သာရွိျခင္း၊ (D) သည္ ပတ္ဂဂန္းထိခိုက္မ[®] မရွိျခင္း စသည္ကို ြုဖင့္ သတ္မွတ္ထားပါသည္။ ခြဲျခင္း သဘာဂပတ္ဂ၀န္းက်င္စီမံခန္ ြခြဲမ ြအစီအစဥ္ုအားေရးဆြဲရာတြင္ လုပ္ငန္း အေကာင့အထည္ေဖာ္ ေဆာင္ရြက္ျခင္း အဆင့္တြင္ ျဖစ္ေပ 🛛 လာ 🗋 ိုင္ေသာ ထိခိုက္စ ြမ်္ားအတြက္ ေလွ််ာ့ခ်ဲေရးအစီအစဉ္၊ အေကာင္အထည္ေဖာ္ ေဆာင္ရြက္ မည့္အဖြဲါ့အစည္း၊ တာဂန္ရွိေသာ အဖြဲါအစည္း 🛛 ွင့္ 🗆 က်ီး 🗆 ကပ္ေရးအဖြဲါအစည္းတိုါကို ေအာက္ပါအတိုင္း ထည့္ခ်ဳသြင္း ေရးဆြဲပါသည္။ (၁) အစီအစဥ္ေရးဆြဲျခင္းအဆင့္ (၂) လုပ္ငန္းအေကာင္အထည္ေဖာ္ျခင္း -(၁) လူမ□သဘာဂပတ္ဂဂန္းက်င္- လက္ရွိလူမ□ပတ္ဂဂန္းက်င္အေျခအေန၊ က်မ္းမာေရး ေစာင္္ေရွာက္ပါ အေျခအေန၊ အလုပ္အကိုင္ အခြင့္အာလမ္း၊ ေဘးအ 🗆 ြရာယ္ရွိဘး

(၂) သဘာဂပတ္ဝန္းက်င္- ကမ ြာေျမပူေြြးလာမဲါ (၃) သဘာဂပတ္ဝန္းက်င္သစ္ညမ္းမ ေလထုညစ္ညမ္းမါ၊ ေရထုညစ္ညမ္းမါ၊ ေျမထုညစ္ညမ္းမါ၊ ဆူညံသံ မ်ား၊ တုန္ခါမ ြမ်ား ၃. စီမံကိန္းအေကာင့အထည္ေဖာ္ေဆာင္ရြက္မ ၄. လုပ္ငန္းအဆင့္မ်ား (၁)လူမ သဘာဂပတ္ဝန္းက်င္-ေျမယာအသံုးခ်မ ြ ွင့္ ေဒသတြင္းေျမယာ အသံုးျပ ြပံုမ်ား၊ ေဘးဒုက သည္မ်ား၊ တိုင္းရင္းသားမိိ ြ ႏြယ္ခ်ြား၊ လိင္၊ ကေလးသူငယ္အခြင့္အေရေး၊ ခြဲေဝမ ြ ွင့္အသံုးခ်မ ြမ်ား၊ ေဒသတြင္းျပ ြနာမ်ား

၄.သဘာဂပတ္ဂဂန္းက်င္ ေစာင့္ ြကည့္တိုင္းတာျခင္း အစီအစဥ္ကိုုလည္း သဘာဂပတ္ဂဂန္းက်င္ စီမံခန္ ြစ္ပြဲမဲ အစီအစဥ္ အတိုင္းေရးဆြဲပါမည္။ ေရးဆြဲရာတြင္ စံ ြန္းမ်ား၊ ေနရာမ်ား၊ အ ြကိမအေရအတြက္၊ ေဆာင္ရြက္မည့္အဖြဲြအစည္း၊ ြကီး ြကပ္မည့္အဖြဲြအစည္း၊ တာ၀န္ခံအဖြဲြအစည္းတိုြပါ၀င္မည္ျဖစ္ပါသည္။ ၅. ေဒသခံမ်ား ြင့္ေတြြဆံုေဆြးေြး၍သတင္းအခ်က္အအလက္မ်ားရယူျခင္းကို(၂)ြကိမ္ျပ လုပ္ခဲ့ပါသည္။ ပထမအ ြကိမ္ေတြြဆံု ေဆြးေြြးပြဲတြင္ စီမံကိန္းအခ်က္အအလက္မ်ား၊ လူမ ေရးႏြွင့္သသဘာ၀ပတ္ဂဂန္းက်င္ ေလ့လာဆန္းစစ္ျခင္း ျပ ြလုပ္မည့္ ပံုစံမ်ား အားရွင္းလင္း တင္ျပခဲ့ပါသည္။ ဒုတိယအ ြကိမ္ေတြြဆံုေွဆြးေြြးပြဲတြင္ျပ ြလုပ္ ေဆာင္ရြက္ခဲ့ေသာ အေြကာင္းအရာမ်ား 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.								
	No changes in space, capacity and dimension from the existing hydropower plant								
2) Change in	are not expected for following facilities and structures:								
External of	(1) No raising / expansion of existing body of dam,								
Existing Facilities	2) No changes in amount of length, and dimension and route of flow channel due								
or Civil Structures	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 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.

	Subject		2016			2017			2018			2019				2020				2021					
	Subject	Ι	П	Ш	IV	Ι	Π	Ш	IV	Ι	П	Ш	IV	Ι	П	Ш	IV	Ι	Π	Ш	IV	Ι	Π	Ш	IV
1	JICA Preparatory Study	Ŧ			♠																				
2	Loan Agreement																								
3	Consulting Services for Rehabilitation of Hydropower Stations Project (selction of Consultant, Detailed Design Study, Tender for Constructors)						Į					1													
4	Implementation of Constrcution Work for Rehabilitation											•								1					
5	Power Plant Operation after Rehabilitation																				¢				

 Table 2 Implementation Schedule for Rehabilitation Project of Hydropower Plant

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

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

Table 3	Maior	Parameters	of	Sedawgvi	HPP
			~J		

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.

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

Table 4Major Laws and Regulations relevant to Environment

(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.

Type of Economic Activity	Activities	Criteria for EIA Type Economic Activities			
(a) Energy Sector Development					
	a) Installed capacity \geq 1 MW but $<$ 15 MW	a) Installed capacity \geq 15 MW			
Undra Damar Dianta	b) Reservoir volume (full supply	b) Reservoir volume (full supply level)			
Hydro Power Plants	level) <20,000,000 m ³	≥20,000,000 m ³			
	c) Reservoir area (full supply	c) Reservoir area (full supply level) ≥ 400			
	level) < 400 ha	ha			
Electrical Power Transmission	> 50 Jrm	All activities where the Ministry requires			
Lines ($\geq 115 \text{ kV}$ but $< 230 \text{ kV}$)	\geq 50 km	that the Project shall undergo EIA			
Electrical Power Transmission		All activities where the Ministry requires			
Lines ($\geq 230 \text{ kV}$)	All sizes	that the Project shall undergo EIA			
High Voltage (230 kV and 500	> 1 ha	All activities where the Ministry requires			
kV) Transformer Substations	≥ 4 na	that the Project shall undergo EIA			

 Table 5
 Categorization of Hydropower Development Schemes

Critorio for IEE Type Economia

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.

Stage	Anticipated Activities
I	Securing land/space for hydropower plant and related facilities
Planning Stage (Pre-construction	Securing construction yard including storage of construction materials
Stage)	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

 Table 6
 Anticipated Activities due to the Rehabilitation of Existing Hydropower Plants

(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.
Environmental Items *		Scop	ing	A	fter	Descons	
E	aivironmentai items *	1/II	III	I/II	III	Reasons	
(1) §	Social Environment			-	-	- -	
1	Involuntary Resettle- ment (land acquisition/ resettlement etc.), migra- tion 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	С	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)	С	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	С	С	В-	В-	(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	С	С	В-	В-	(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	С	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	С	C	В-	В-	(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	С	C	В-	В-	(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	

Table 7 Identification and Evaluation of Possible Impacts due to Hydropower Plants RehabilitationProject

F	nvironmontal Itoms *	Scop	ing	g After		Passans
E		1/II	III	I/II	III	Reasons
11	Cultural property and heritage	С	С	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	С	С	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	С	С	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	С	С	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	С	С	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-	С	В-	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-	С	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	С	С	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	С	С	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	С	С	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.)	С	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)	С	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.

F	nuinonmontol Itoma *	Scop	ing	A	fter	Daggong
E	nvironmentai items *	1/II	III	I/II	III	Reasons
24	Flora, Fauna, Ecosystem and Biodiversity (Aquatic)	С	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	С	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	С	С	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) H	Environmental pollution		T	1		
28	Air pollution	B-	C	В-	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-	С	В-	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	В-	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	С	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		Baagong	
		1/II	III	I/II	III	Reasons	
						public facilities nearby the plant site. Thus, impact on sunshine inhibition is not anticipated.	
37	Electromagnetic interference	С	С	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.

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

Mitigation measures - (1) To consider and to carry out possible preventive **b**) 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.

Environmental Items		Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
(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.		
15	Working condition	 In the construction work contractor/ EPGE should comply with requirement of Labor Law and Labor Safety Law (draft). Preparation of safety management plan and enlighten occupational safety to construction workers. 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. 	Contractor, EPGE	Local government (State, District or Township), ECD_MOEE
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.		ECD, MOEE
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) I	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 pollutio	n		
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

 Table 9
 Environmental Management Plan (EMP)

E	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 i	tem			
(T) '	Whole stages	(1) Information dialog as and a life of the transformed		
4	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		

10 communities charge of public communication and complaints from peoples. 6 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 arefully 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 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 benefits and damage Consultation with stakeholders includ	E	environmental Items	Mitigation Measures	Implementation organization*, ***	Responsible and/or supervising organization**
6 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 gender issues 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 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 stakeho		communities	charge of public communication and complaints from peoples.		
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 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 stage holotain understanding and consent among the stage holotain understanding and consent among the stage to obtain understanding of public communication and complaints from peoples. <td>6</td> <td>The poor, refugees, indigenous of ethnic minority people</td> <td>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</td> <td></td> <td></td>	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		
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) 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 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) 10 Local conflict of interests obtain understanding and consent among the stakeholders in order to avoid local conflict of interests. (2) 10 Local conflict of in charge of public communication and complaints from peoples.	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.		
9Misdistribution benefit and damageConsultation 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.10Local 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.	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.		
10 Local conflict of interests of 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.	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 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.

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 Environmen	nt	1		1	
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 Pollu	ıtion				
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

Table 10Environmental Monitoring Plan

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	r	r	r	r	1
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 disturd avecously 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



d) Presentation by Station Manager



b) Most of Village Peoples using by Motorbikes



c) Pre-meeting with GAD Officer



e) Photos of Sedawgyi Hydropower Plant



f) Presentation by Local Consultant



g) Presentation by Village Chief-1



j) Participants - 2



h) Presentation by Village Chief-2





i) Participants - 1



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
- 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

7) Presentation by attendant -2



5) Presentation by Local Consultant



8) Attendants of the Meeting

Photo 3 Scenes of Second Stake



6) Presentation by attendant -1



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

Annex 16.2 Official letter from MONREC Regarding Project Proposal Screening to obtain ECC

ပြညဲထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန ရုံးအမှတ်(၅၃)၊နေပြည်တော်

စာအမှတ် ၊ အီးအိုင်အေ - ၂ / ၂ (၈၂၇^{၉ခ်)}/၂၀၁၆) ရက်စွဲ၊၂၀၁၆ ခုနှစ် အောက်တိုဘာလ 🌱 ရက်

ဦးဆောင်ညွှန်ကြားရေးမှူး လျှပ်စစ်ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်း လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန

အကြောင်းအရာ။

ာင္ခဲ့လိုလေဦလာဦးထုခ္ပံလေဒ

သိုးကြား

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ဘီလူးချောင်းအမှတ်(၁)ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံနှင့် ဆည်တော်ကြီး ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံတို့အား အကြီးစား မွမ်းမံပြင်ဆင်ခြင်း လုပ်ငန်းများ ပြုလုပ်ရန်အတွက် အဆိုပြုတင်ပြလာခြင်းအပေါ် သဘောထား မှတ်ချက်ပြန်ကြားခြင်း

ရည်ညွှန်**း**ချက်။

- (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၊ လျှပ်စစ် ဓာတ်အားထုတ်လုပ်ရေးလုပ်ငန်းနှင့် ဂျပန်အပြည်ပြည်ဆိုင်ရာပူးပေါင်းဆောင်ရွက်ရေးအေဂျင်စီ (JICA) တို့သည် ဘီလူးချောင်းအမှတ်(၁) ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံနှင့် ဆည်တော်ကြီးရေအား လျှပ်စစ်ဓာတ်အားပေးစက်ရုံတို့ကို အကြီးစားမွမ်းမံပြင်ဆင်ခြင်း (Rehabilitation) လုပ်ငန်းများ ပြုလုပ်ရန်အတွက် JICA survey team မှ ပြုစုထားသော စီမံကိန်းအဆိုပြုလွှာကို စိစစ်၍ သဘောထားမှတ်ချက်ပြန်ကြားပေးရန် ရည်ညွှန်းစာများဖြင့် အကြောင်းကြားလာပါသည်။

၂[။] ပူးတွဲပေးပို့လာသည့် စီမံကိန်းအဆိုပြုလွှာတွင် ဘီလူးချောင်းအမှတ်(၁) ရေအားလျှပ်စစ် ဓာတ်အားပေးစက်ရုံသည် နမ်ပေါ်မြစ်လက်တက်ဖြစ်သည့် ဘီလူးချောင်းပေါ်တွင် တည်ရှိ၍ ကယားပြည်နယ်၊ လွိုင်ကော်မြို့မှ ၂၀ ကီလိုမီတာခန့်ကွာဝေးပြီး ၁၉၉၂ ခုနှစ် သြဂုတ်လမှ စတင်တည်ထောင်လုပ်ကိုင်ခဲ့ကြောင်း၊ ဆည်တော်ကြီးရေအားလျှပ်စစ် ဓာတ်အားပေးစက်ရုံသည် ဧရာဝတီမြစ်လက်တက်ဖြစ်သည့် ဆည်တော်ကြီးမြစ်ပေါ်တွင်**တ**ည်ရှိ၍ မန္တလေးမြို့ နှင့် ၆၀ ကီလိုမီတာခန့် ကွာဝေးပြီး ၁၉၈၉ ခုနှစ် မေလမှ စတင်တည်ထောင် လုပ်ကိုင်ခဲ့ကြောင်း စိစစ်တွေ့ရှိရပါသည်။ ၃။ အဆိုပြု ရေအားလျှပ်စစ်ဓာက်အားပေးစက်ရုံ (၂) စုကို အကြီးစားမွမ်းမံပြင်ဆင်ရန်အတွက် (၂) နှစ်စီကြာမြင့်မည်ဖြစ်ပြီး ဓာတ်အားပေးစက်ရုံများနှင့် ဆည်များ၏ တည်နေရာအရွယ်အစားများ၊ စက်အင်အားနှင့် ဓာတ်အားထုတ်လွှတ်မှုပမာဏတို့ကို တိုးရဲ့ပြောင်းလဲခြင်းမရှိဘဲ ယိုယွင်းနေသော စက်ပစ္စည်းကိရိယာများကို ပြင်ဆင်ခြင်း နှင့် အသစ်လဲလှယ်ခြင်းတို့ကိုသာ ပြုလုပ်မည်ဖြစ်ကြောင်း စာမျက်နှာ (၂) အပိုဒ် (၂) နှင့် ဖယား (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 ပတ်ဝန်းကျင်ဆိုင်ရာစိစစ်မှု ပြုလုပ်၍ အောက်ပါအချက်အလက်များပါဝင်သည့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (Environmental Management Plan-EMP) ကို ကျွမ်းကျင် ပညာရှင်များဖြင့် ရေအားလျှပ်စစ်ဓာတ်အားပေးစက်ရုံ (၁) ခုချင်းအလိုက်ရေးဆွဲ၍ သယံစာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တင်ပြရမည်ဖြစ်ကြောင်း ပြန်ကြားအပ်ပါသည်။

- (က) အကြိုတည်ဆောက်ခြင်း၊ တည်ဆောက်ခြင်း၊ လုပ်ငန်းလည်ပတ် ဆောင်ရွက်ခြင်း၊ ရပ်ဆိုင်းခြင်း၊ ပိတ်သိမ်းခြင်းနှင့် ပိတ်သိမ်းပြီးကာလစသည့် စီမံကိန်းလုပ်ငန်း အဆင့် အလိုက် အကြောင်းအရာဖော်ပြချက်၊
- (ခ) စီမံကိန်း၏ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် လူမှုစီးပွားရေးဆိုင်ရာနှင့် လိုအပ်ပါက ကျန်းမာရေးဆိုင်ရာ မူဝါဒ၊ ကတိကဝတ်၊ ဥပဒေဆိုင်ရာလိုအပ်ချက်နှင့် ဖွဲ့စည်းမှု ဆိုင်ရာစီစဉ်ဆောင်ရွက်မှုများ၊
- (ဂ) ပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုများနှင့် လျော့နည်းစေရန် ဆောင်ရွက်မည့် လုပ်ငန်းများအကျဉ်းချုပ်၊
- (ဃ) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အား အကောင်အထည်ဖော်ဆောင်ရွက်ရန် ယေဘုယျ အသုံးစရိတ်၊
- (င) အကြိုတည်ဆောက်ခြင်း၊ တည်ဆောက်ခြင်း၊ လုပ်ငန်းလည်ပတ်ဆောင်ရွက်ခြင်း၊ ရပ်ဆိုင်းခြင်း၊ ပိတ်သိမ်းခြင်းနှင့် ပိတ်သိမ်းပြီးကာလစသည့် စီမံကိန်းလုပ်ငန်းအဆင့် အလိုက် စီမံခန့်ခွဲမှုနှင့် စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးမှုအစီအစဉ်ခွဲများနှင့် စပ်လျဉ်း၍ ဆူညံမှု၊ တုန်ခါမှု၊ စွန့်ပစ်ပစ္စည်း၊ စွန့်ပစ်ရေနှင့်ရေဆိုးများ၊ လေအရည်အသွေး၊ အနံ့၊ ဓာတုပစ္စည်း၊ ရေအရည်အသွေး၊ တိုက်စားမှုနှင့်နုန်းအနည်ကျမှု၊ ဇီဝမျိုးစုံမျိုးကွဲ၊ လုပ်ငန်းခွင်ဆိုင်ရာနှင့် လူမှုအဖွဲ့အစည်းဆိုင်ရာ ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး၊ ယဉ်ကျေးမှုအမွေအနှစ်၊ အလုပ်အကိုင်နှင့် လေ့ကျင့်သင်ကြားမှုနှင့်

မိတ္တူကို

ပြည်ထောင်စုဝန်ကြီးရုံး၊

သယံဓာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၊ ရုံးအမှတ်(၂၈) ရုံးလက်ခံ၊ မျှောစာတွဲ၊ အမှုတွဲချုပ်

(လှမောင်သိန်း)

- (j)

- (၄) ဆက်လက်ဆောင်ရွက်မည့်တိုင်ပင်ဆွေးနွေးမှုများ၊ (၅)
 - သတင်းအချက်အလက်ထုတ်ဖော်ချက်။

- (၃) ဆွေးနွေးညှိနှိုင်းမှုများ၏ ရလဒ်များ၊
- ဆွေးနွေးညှိနှိုင်းမှုအကျဉ်းချုပ်နှင့်ဆောင်ရွက်သည့်လှုပ်ရှားဆောင်ရွက်မှုများ၊
- အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက်များ ထုတ်ဖော် (ဆ) တင်ပြခြင်**း**၊ နည်းလမ်းသတ်မှတ်မှုနှင့် ချဉ်းကပ်မှု၊ (c)
- စီမံခန့်ခွဲမှုဆောင်ရွက်ချက်များ၊ စောင့်ကြပ်ကြည့်ရှုမည့် အစီအစဉ်များ၊ (ઉ) ရန်ပုံငွေလျာထားချက်နှင့် တာဝန်များ။ (၇)
- ကောင်းကင်ဓာတ်ပုံများ၊ ဂြိုလ်တုဓာတ်ပုံများ၊
- လွှမ်းခြုံမြေပုံကြီးများ၊ လုပ်ငန်းခွင်အလိုက် မြေပုံများ၊ ဓာတ်ပုံများ၊
- (၃)
- <u>ဥပဒေဆိုင်ရာလိုအပ်ချက်များ၊</u> **(**)
- ရည်ရွယ်ရျက်များ၊ (c)
- အစီအစဉ်ခွဲအလိုက် ပါဝင်ရမည့် အကြောင်းအရာများ၊ (o)

အရေးပေါ် တုန့်ပြန်မှုစသည့် သက်ဆိုင်ရာပက်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ စီမံခန့်ခွဲ မှုနှင့် စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးမှုကိ**စ္စရ**ပ်များ ဖော်ပြချက်၊

(ç) အကောင်အထည်ဖော်ဆောင်ရွက်မည့် အစီအစဉ်၊

(၅)

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) Office File, Floating File