

Environmental and Socio-economic Impact Assessment (ESIA) Report (FINAL)

Prepared for: GEP (Myanmar) Co Ltd

Conducted by:



SUBMISSION OF DOCUMENTATION

We, Myanmar Survey Research Co., Ltd. (MSR) submit this Environmental and Social Impact Assessment Study report, for the Implementing Solar Power Plant Project, in Minbu (Saku) Township, Magwe Region.

To our knowledge all information contained in this report is accurate and truthful representation of all findings as relating to the project.

Signed at YANGON on 20th Day of October, 2016

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သို့/ ညွှန်ကြားရေးမှူးချူပ် ပတ်ဂန်းကျင်ထိမ်းသိမ်းရေးဦးစီးဌာန သယံဇာတနှင့်ပတ်ဂန်းကျင်ထိမ်းသိမ်းရေးဂန်ကြီးဌာန။

နေ့စွဲ ။ ။ ၂၀၁၇ခုနှစ်၊ဇန်နုဂါရီလ (၁၉)ရက်

အကြောင်းအရာ။ ပန်ခံကတိပြုခြင်း

အထက်ဖော်ပြပါကိစ္စနှင့်ပတ်သက်၍ GEP (Myanmar) Co., Ltd. သည် လျှပ်စစ်နှင့် စွမ်းအင်ဂန်ကြီးဌာန၊ လျှပ်စစ်ဓါတ်အားထုတ်လုပ်ရေးလုပ်ငန်း၏ ခွင့်ပြုချက်ရယူကာ မြန်မာနိုင်ငံ၏ပထမဦးဆုံး နေရောင်ခြည်စွမ်း အင်သုံးလျှပ်စစ်ထုတ်လုပ်ရေးစက်ရုံအား မကွေးတိုင်းဒေသကြီး၊ မင်းဘူးခရိုင်၊ စကုမြို့နယ်တွင် တည်ဆောက် ဆောက်အကောင်အထည်ဖော် ဆောင်ရွက်လျှက်ရှိပါသည်။

အဆိုပါနေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ်ထုတ်လုပ်ရေးစက်ရုံစီမံကိန်း အတွက် GEP (Myanmar) Co., Ltd. အနေဖြင့် လူမှုပတ်ပန်းကျင်သက်ရောက်မှုအစီရင်ခံစာ (Environmental and Social Impact Assessment/ EISA Report) အား Thirparty ဖြစ်သည့် Myanmar Survey Research (MSR) အားကွင်းဆင်းလေ့လာပြုစုခဲ့ပါသည်။ MSR အနေဖြင့် လည်း အဆိုပါ EISA report အား ရေးသားပြုစုရာတွင်သက်ဆိုင်ရာပန်ကြီးဌာနများ၏ လမ်းညွှန်မှု၊ ပတ်ပန်းကျင်ဆိုင်ရာဥပဒေ နှင့် အရြားသေားဒေသဆိုင်ရာနည်းဥပဒေတွေများနှင့်အညီပြူစုခဲ့ပါသည်။

GEP (Myanmar) Co., Ltd. အနေဖြင့် MSR မှ ပြုစုရေးသားခဲ့သည့် EISA Report သည် အောက်ဖော်ပြပါအချက်လက်များနှင့်ပြည့်စုံတိကျစွာပါရှိသည်-

(၁) လူမှုပတ်ပန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းတို့အတွက် တိကျမှုနှင့် ပြည့်စုံမှုရှိကြောင်း၊

(၂)လူမှုပတ်ဂန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းကို သက်ဆိုင်ရာလုပ်ထုံးလုပ်နည်းများ အပါအဂင် နည်း ဥပဒေများ၊ ပတ်ဂန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း ပြုလုပ်ရန် လုပ်ငန်းတာဂန်များနှင့်အညီ တိကျ စွာ လိုက်နာဆောင်ရွက်ပြုစုကြောင်း စသည့်အချက်တို့အားတွေရှိရပါသည်

ထိုအပြင် GEP (Myanmar) Co., Ltd. အနေဖြင့် စီမံကိန်းအတွက်လေ့လာပြုစုထားသည့်လူမှုပတ်ပန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ) EISA Report) ပါ ပတ်ပန်းကျင်ထိခိုက်မှု လျှော့ချရေးလုပ်ငန်းများနှင့် အစီအစဉ်များကို အပြည့်အပ အစဉ်အမြဲ လိုက်နာ ဆောင်ရွက်မည်ဖြစ်ကြောင်းပန်ခံဂတိပြုပါသည်။

လေးစားစွာဖြင့်

အောင်သီဟ အုပ်ချုပ်မှုဒါရိုက်တာ

GEP (Myanmar) Co., Ltd.

MSR al

1 EXECUTIVE SUMMARY

1.1 EXECUTIVE SUMMARY (MYANMAR VERSION)

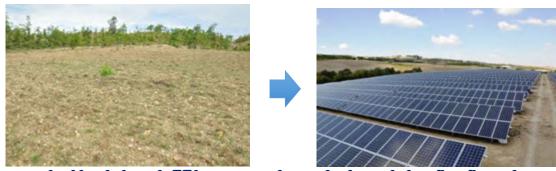
စီမံကိန်းအကြောင်းအရာဖေါ်ပြချက် (Project Description)

GEP (Myanmar) ကုမ္ပကီလိမိတက်သည် နေရာင်ခြည်စွမ်းအင်သုံး လျှပ်စစ်ဓါတ်အားပေးစနစ် စီမံကိန်း တစ်ခုကို ရန်ကုန်မြို့မှ အနောက်မြောက်ဘက် ၅ဝဝ ကီလိုမီတာနှင့်နေပြည်တော်မှ အရှေ့ဘက်၂ဝဝ ကီလိုမီတာအကွာအဝေးရှိ မင်ဘူးမြို့နယ်အတွင်း အကောင်အထည် ဖေါ်လျှက်ရှိပါသည်။ ၈၃၆ ဧကရို တောင်ကုန်းငယ်များ ထူထပ်စွာတည်ရှိသော အထက်ပါလုပ်ငန်းခွင် မြေနေရာသည် မင်းဘူးမြို့နှင့် ၁၆ မိုင်ကွာဝေးပြီး မင်းဘူး-ပဒန်း-အမ်းလမ်းမကြီးပေါ်တွင် တည်ရှိပါသည်။ အထက်ပါ လုပ်ငန်းစီမံကိန်း သည် လတ္တိကျူ့ N ၂၂၁ဝဝဝဝ နှင့် N ၂၂၂ဝဝဝဝ ကြားတွင်၄င်း၊ လောင်ဂျီကျူ့ E ၆၇၄၁ဝဝ နှင့် E ၆၇၅ဝဝဝ ကြားတွင်၄င်း တည်ရှိပါသည်။

ဤစီမံကိန်းသည် DC လျှပ်စစ်စွမ်းအား ၂၂ဝ.၆ မဂ္ဂါဝပ် ကိုထုပ်လုပ်နိုင်စွမ်းရှိပြီး တစ်နှစ်ပတ်လုံး ၃၅၂၃ဝဝ MWh ထုပ်လုပ်ပေးမည်ဖြစ်ပါသည်။ ထုပ်လုပ်ရရှိသော DC လျှပ်စစ်စွမ်းအားကို AC လျှပ်စစ်စွမ်းအားအဖြစ်ပြောင်းလဲရာတွင် ၁၇ဝ MW(AC) မဂ္ဂါဝပ် ရရှိမည်ဖြစ်ပြီး ထုပ်လုပ်ရရှိသည့် လျှပ်စစ်ကို မြန်မာ့လျှပ်စစ်ဓါတ်အားလုပ်ငန်းသို့ ရောင်ချမည်ဖြစ်ပြီး လုပ်ငန်းခွင်၏ တောင်ဘက်အရပ်ရှိ ၁မိုင် (၁.၈ ကီလိုမီတာ) ခန့် ကွာဝေးသော မဟာဓါတ်အားလိုင်းသို့ ပို့လွှတ်မည်ဖြစ်ပါသည်။ အထက်ပါ မဟာဓါတ်အားလိုင်းမှာ ၂၃ဝ KV (ကေဗွီ) လိုင်းဖြစ်၍ မင်းဘူးခွဲရုံသို့ ၁၅ မိုင်နှင့် အမ်းခွဲရုံသို့ ၅၂ မိုင် အသီးသီး ပို့လွှတ်မည်ဖြစ်ပါသည်။

လုပ်ငန်းစီမံကိန်းကို အပိုင်း ၁၊ အပိုင်း ၂၊ အပိုင်း ၃ နှင့် အပိုင်း ၄ ဟူ၍ အပိုင်း ၄ ပိုင်းခဲခြား၍ အကောင်အ ထည်ဖေါ်ဆောင်ရွက်မည်ဖြစ်ရာ အပိုင်း ၁သည် မြေအကျယ်အဝန်း ၁၆ဝဧကပေါ်တွင်ဆောက်လုပ်အ ကောင်အထည်မည်ဖြစ်ပြီး ထုပ်လုပ်နိုင်စွမ်းမှာ ၅ဝ MW မဂ္ဂါဝပ်၊ အပိုင်း ၂ သည် မြေအကျယ်အဝန်း ၁၆ဝ ဧက ပေါ်တွင် လုပ်ဆောင်မည်ဖြစ်ပြီး ထုပ်လုပ်နိုင်စွမ်းမှာ ၅ဝ MW မဂ္ဂါဝပ်၊ အပိုင်း ၃ သည် မြေအကျယ်အဝန်း ၁၆ဝ ဧက ပေါ်တွင်ဆောက်လုပ်ဆောင်မည်ဖြစ်ပြီး ထုပ်လုပ်နိုင်စွမ်းမှာ ၅ဝ MW မဂ္ဂါဝပ်၊ အပိုင်း ၄ သည် မြေအကျယ်အဝန်း ၃၅၆ ဧက ပေါ်တွင် ဆောက်လုပ်မည် ဖြစ်ပြီး ထုပ်လုပ်နိုင်စွမ်းမှာ ၇ဝ MW မဂ္ဂါဝပ် အသီးသီးဖြစ်ကာ တဆင့်ချင်းစီတည်ဆောက်အကောင်အ ထည်ဖေါ်ဆောင်ရွက်သွားရန်ရည်ရွယ်ပါသည်။

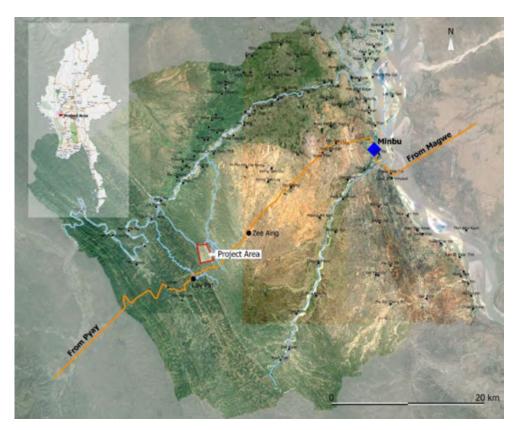
စီမံကိန်းတစ်ခုလုံးပြီးမြောက်သည့်အခါတွင် ၂၂၀.၆ MW (DC) မဂ္ဂါဝပ်မှ တဆင့် ၁၇၀ MW (AC) မဂ္ဂါဝပ်သို့ ပြောင်းလဲပြီး ၂၃၀ KV မဟာဓါတ်အားလိုင်းအတွင်းသို့ပို့လွှတ်ရန် ၅၀ MVA ထရန် စဖေါ် မာ (၃)လုံးနှင့် ၇၀ MVA ထရန်စဖေါ်မာ(၁)လုံး တို့ကိုအသုံးပြုမည်ဖြစ်ပါသည်။ စီမံကိန်းကြီး တစ်ခုလုံးကို အပိုင်းလိုက်ခွဲခြားဆောင်ရွက်ရန် လျာထားလျက်ရှိပြီးဖြစ်ရာ ၂၀၁၅ ခုနှစ် မတ်လ တွင် လုပ်ငန်းစတင်၍ ၂၀၂၀ မတ်လတွင် စီမံကိန်းတစ်ခုလုံး ပြီးစီးမည် ဖြစ်ပါသည်။



စီမံကိန်းလုပ်ငန်းမစခင်မြေပြင်အနေအထားနှင့် ဆောက်လုပ်ရေးလုပ်ငန်းများပြီးဆုံးပြီးနောက်တွေ့ ရှိရမည့်အခြေအနေ

စီမံကိန်းတည်နေရာ၏ ပတ်ဝန်းကျင်အနေအထား (Surrounding environment)

GEP (Myanmar) ကုမ္ပကီလီမိတက်၏ နေရောင်ခြည်စွမ်းအင်သုံး ဓါတ်အားပေးစက်ရုံတည်ဆောက် မည့်နေရာသည် မင်းဘူး(စကု)မြို့နယ် အတွင်းရှိ လေးပင်-အိုင်မ အဆိုပြု ကြိုးပြင်ကာကွယ်တော အတွင်း မင်းဘူးမြို့မှ (၁၅ မိုင် ၆ ဖါလုံ) ခန့် အကွာ မင်းဘူး-အမ်း ကားလမ်း၏မြောက်ဘက် (၅ ဖါလုံ) ခန့်အကွာ ပင်းတလဲချောင်း၏ အနောက်ဖက်တွင်တည်ရှိသည်။ မြေဇရိယာအကျယ်အဝန်းမှာ (၈၃၆) ဧကဖြစ်၏။ ဤနေရာသည် ရန်ကုန်မြို့မှအနောက်မြောက် ကီလိုမီတာ (၅၀၀) ကွာဝေးပြီး၊ နေပြည်တော် မှ အရှေ့ဘက် ကီလိုမီတာ (၂၀၀)ကွာဝေးသည်။ ဤနေရာသည် တောင်ကုန်း အနည်းငယ် မ တ်စောက်ပြီး ပင်လယ်ရေ မျက်နှာပြင် အမြင့် (၅၆၆)ပေတွင် တည်ရှိပါသည်။ မြေအမျိုးအစားမှာ ဂဝံ ဆန်သော ကျောက်စရစ်မြေ အမျိုးအစား ဖြစ်ပြီး ချောင်း၊ မြောင်းအနီးတွင် သဲဆန်သော မြေနီများ တွေ ရှိရပါသည်။ စီမံကိန်းနေရာ၌ သစ်ပင်ကြီးများမရှိဘဲ အရွယ်ငယ်၊ အရွယ်လတ်သစ်ပင်များ စပ်ကြဲကြဲ ပေါက်ရောက်နေလျက်ရှိသည်။ မြေမျက်နှာပြင်မှာ ညီညာပြန့်ပြူးသည့် အနေအထား မဟုတ်ပဲ၊ တောင်ကုန်း၊ ဂမူငယ်များပြည့်နှက်လျက် ချိုင့်များ၊ ချောက်များပြည့်နက်နေ၏။ အနီးဆုံးလူနေ ရပ်ကွက်မှာ လေးပင်နှင့် ဇီးအိုင်ရွာတို့ဖြစ်ကြသည်။ လေးပင် ရွာတွင် အိမ်ခြေ (၄၃၅)အိမ် ရှိပြီး စီမံကိန်း နေရာမှ အနောက်တောင် ဘက်သို့ (၁.၂၇) မိုင်ကွာဝေးသည်။ ဇီးအိုင်ရွာသည် အိမ်ခြေ(၁၉၀) ရှိပြီး အရှေ့ မြောက်ဘက် (၃.၃၄) မိုင်အကွာတွင်တည်ရှိ၏။



စီမံကိန်းလုပ်ငန်းခွင်နေရာနှင့် မင်းဘူးမြို့နယ်မြေပုံ

သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှုဖြစ်နိုင်ရေများ (Potential Environment Impacts)

မြန်မာ ဆာဗေးသုတေသန ကုမ္ပကီ (MSR Co Ltd) သည် အဆိုပါစီမံကိန်းကြီး အကောင်အ ထည်ဖော် ဆောင်ရွက်ရန်အလို့ငှာ လုပ်ငန်းခွင်ပြင်ဆင်ခြင်း၊ လုပ်ငန်းခွင်တည်ဆောက် အကောင်အထည် ဖော်ခြင်း၊ လုပ်ငန်းလည်ပတ်ခြင်းနှင့် လုပ်ငန်းကြီးတစ်ခုလုံး ဖျက်သိမ်းခြင်း စသည့် လုပ်ငန်း အဆင့်ဆင့် တွင်သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှု ဖြစ်နိုင်ခြေများကို လေ့လာ သုံးသပ်ရန်အတွက် ရုပ်ပိုင်း ဆိုင်ရာ ပတ်ဝန်းကျင်လေ့လာရေးအဖွဲ့၊ သစ်ပင်၊ပန်းမန်နှင့် သတ္တဝါများ ဆိုင်ရာ ပတ်ဝန်းကျင်လေ့လာရေး ဖွဲ့နှင့် လူမှုပတ်ဝန်းကျင်ဆိုင်ရာလေ့လာရေး ကျွမ်းကျင်သည့် ပညာရှင်များဖြင့် ဖွဲ့စည်း၍ ဆောင်ရွက်မည်ဖြစ်ပါသည်။

ရုပ်ပိုင်းဆိုင်ရာသဘာဝပတ်ဝန်းကျင်ထိခိုက်မှုဖြစ်နိုင်ချေများ (Impact on Physical Environment)

ရုပ်ပိုင်းဆိုင်ရာသဘာဝပတ်ဝန်းကျင်ထိခိုက်မှု ဖြစ်နိုင်ချေများကို လေ့လာသည့် ပညာရှင်အဖွဲ့သည် GEP (Myanmar) Co Ltd မှ ပေးအပ်ထားသော ကွန်ဒိုမြေပုံ၊ လုပ်ငန်းခွင်အခြေပြမြေပုံ၊ ရေစီး ရေလာနှင့် ချောင်းများမြောင်းများ၊ထွက်ပေါက်များလေ့လာထားရှိသည့် အစီအရင်ခံစာ၊ စီမံ ကိန်းဆောင်ရွက်မည့် အထောက်အထား ပုံစံဒီဖိုင်းများကို လေ့လာခဲ့ပါသည်။ အထက်ပါ ပုံစံများဒီဖိုင်းများ၊ အစီအရင်ခံစာများ ကို လေ့လာသုံးသပ်ပြီးနောက်လုပ်ငန်းခွင်နေရာသို့ လှည့်လည်ကြည့်ရှုခဲ့ပြီးလိုအပ်သောနမှုနာ များ ကောက်ယူရန်အတွက်တည်နေရာများသတ်မှတ်ခဲ့ပါသည်။ အထက်ပါအတိုင်းလေ့လာခဲ့ရာ သဘာ ဝမြေဆီလွှာထိခိုက်မှုဖြစ်နိုင်ခြေများကိုတွေ့ ရှိရပါသဖြင့် သဘာဝမြေဆီလွှာရှိ မြေဩဇာဓာတ် နှင့် ဘေးဖြစ်စေနိုင်သောဒြပ်ထုများကို စစ်ဆေးမှတ်တမ်းတင်ရန် နမူနာများကိုနေရာ အသီးသီးခွဲခြား၍ ကောက်ယူခဲ့ပါသည်။

အလားတူစက်ယန္တ ရားကြီးများမှထုတ်လွှတ်သည့် ဒီဇယ်ဆီလောင်ကျွမ်းခြင်းကြောင့် ဖြစ်ပေါ်စေမည့် သဘာဝပတ်ဝန်းကျင် လေထုညစ်ညမ်းခြင်းကို မှတ်တမ်းတင်ရန် အလို့ငှာ လေထုညစ်ညမ်းမှုတိုင်း ကိရိယာတစ်ခုကို လုပ်ငန်းခွင်၏ အလယ်ဗဟိုနှင့် ဝန်ထမ်းနှင့်အရာရှိအဆောင်များ ဆောက်လုပ်ရန် မြေနေရာအနီးတွင်တပ်ဆင်၍တိုင်းတာမှတ်တမ်းတင်ခဲ့ပါသည်။

လုပ်ငန်းခွင်တွင်ပစ္စည်းများစုပုံခြင်း၊ စွန့်ပစ်ပစ္စည်းများစုပုံထားရှိခြင်းတို့ကြောင့် မိုးရာသီတွင်မိုးရေနှင့် အတူပါဝင်၍ မိုးရေကိုလည်းကောင်း၊ မြေအောက်ရေကိုလည်းကောင်း ထိခိုက်ပျက်စီးမှုဖြစ် ပေါ်နိုင်ကြောင်းကို လေ့လာတွေ့ရှိရပါသဖြင့်လုပ်ငန်းခွင် အနီးတစ်ဝိုက်ရှိ သဘာဝမြစ်ချောင်းများ မှတွေ့ရှိသော ရေနမူနာများကိုကောက်ယူကာ ဓာတ်ခွဲ မှတ်းတမ်းတင်ထားရှိခဲ့ပြီးလည်းဖြစ်ပါသည်။

သက်ရှိ**ဇီဝပတ်ဝန်းကျင်၌ဖြစ်ပေါ်နိုင်သည့်သက်ရောက်မှုများ (Impact on Biological Environment)** စီမံကိန်းနေရာပတ်ဝန်းကျင်၏ကုန်းမြေဂေဟစနစ်သည် အထက်ရွက်ပြတ်ရောနောသော တောခြောက် အင်တိုင်းတောများဖုံးလွှမ်းထားသည့် ခြောက်သွေ့တောရှိရာ အပူပိုင်းဒေသဖြစ်၏။ အရွယ်ငယ် အရွယ်လတ်သစ်ပင်များကျိုးတို့ကျဲတဲပေါက်ရောက်ပြီး ခြုံများလွှမ်းမိုးထားသည့် ဖုန်းဆိုးတောများ ရှိကြ၏။ အရွယ်ကြီးနို့တိုက်သတ္တဝါများ နေထိုင်ကျက်စားမှု မရှိတော့ဘဲ ခွေးအများနှင့် တောယုန်များ သာ မှီတင်းလျက်ရှိပြီး၊ ဖြူကောင်၊ တောကြောင်နှင့် ချေတို့လာရောက်လေ့ရှိကြသည်။

စီမံကိန်းတည်ရှိရာ မြေ ၈၃၆ဧက အကျယ်အဝန်းမှ သစ်ပင်၊ ခြုံပင်၊ မြက်ပင်များအား ဖယ်ရှားပစ်ရမည် ဖြစ်ရာ ဤဒေသ၏ဂေဟစနစ်ပုံမှန်လည်ပတ်မှုကို ထိခိုက်နိုင်သကဲ့သို့ မှီတင်းနေထိုင်ကြသော သတ္တဝါများ ရွှေ့ပြောင်းသွားခြင်း၊ သေဆုံးသွားခြင်းဖြစ်ကြပေမည်။ မြေလွှာသဘာဝ အရည်အသွေး ပျက်ယွင်းသွားမည်။ ရေကန်အင်းအိုင်၊ ချောင်းမြောင်းတို့ နွေရာသီတွင်ရေမရှိဘဲ မိုးရာသီ၌ ပုံမှန်စီးဆင်း နေကျ ရေမြောင်းများမှာလည်း စီမံကိန်းကြောင့်ပြောင်းလဲသွားပေမည်။

လူမှုပတ်ဝန်းကျင်အပေါ်အကျိုးသက်ရောက်မှု (Impact on Social Environment)

မင်းဘူးမြို့ နေရောင်ခြည်စွမ်းအင်သုံး လှူစ်စစ်ဓာတ်အားပေးစက်ရုံနေရာနှင့် အနီးဆုံး ရွာနှစ်ရွာမှာ လေးပင်နှင့် ဇီးအိုင်ရွာများဖြစ်သည်။ ဒေသ၏အဓိက စီပွားရေးလုပ်ငန်းမှာ ပဲအမျိုးမျိုးနှင့် နှမ်းများ စိုက်ပျိုးခြင်းအပြင် နွားနှင့်ဆိတ်မွေးမြူသူများလဲရှိကြသည်။ ထိုနှစ်ရွာလုံးတွင် ဆန်စပါး စိုက်ပျိုးခြင်း မရှိပါ။ ထိုရွာနှစ်ရွာလုံးတွင် အဓိကစိုက်ပျိုးသော သီးနှံမှာ ပဲအမျိုးမျိုးနှင့် နှမ်းဖြစ်သည်။

စီမံကိန်းနေရာသည် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာ ဝန်ကြီးဌာနလက်အောက်တွင် တည်ရှိပြီး ဤစီမံကိန်း တည်ရှိခြင်းကြောင့် ဤမြေနေရာပေါ်ရှိ မြေဧကအနည်းငယ်ဖြင့် စိုက်ပျိုး စားသောက်နေကြသူများမှလွဲ၍ အခြားကျေးရွာနေ ပြည်သူများအပေါ် တိုက်ရိုက်အကျိုးသက်ရောက် မှုအများအပြားမရှိပါ။ စီမံကိန်းမြေနေရာပေါ်တွင် တည်ရှိနေသော စိုက်ပျိုးမြေဧကစုစုပေါင်းမှာ ၉.၅၅ ဧက ဖြစ်သည်။

လယ်သမားများနှင့် ကျေးရွာနေပြည်သူများသည် ဤစီမံကိန်းကုမ္ပကီထံမှ သူတို့၏လယ်ယာမြေအ တွက်သာမက စိုက်ပျိုးသီးနှံအတွက် လျော်ကြေးငွေပါ လိုချင်ကြသည့်အလျှောက်။ စီမံကိန်း အကောင်အထည် ဖော်သူအနေဖြင့် (ပုံစံ - ၇ အရ) လယ်ယာ မြေပိုင်ဆိုင်မှု စာချုပ်မ ရှိသော်လည်း ဤစီမံကိန်းကြောင့် လယ်ယာမြေဆုံးရှုံးသွားသူများကို မြို့နယ်လယ်ယာ မြေစီမံခန့်ခွဲမှုကော်မတီ၏ ဆုံးဖြတ်ချက်နှင့်အညီ လျော်ကြေးငွေများကို ၂ဝ၁၆ခုနှစ်၊မတ်လတွင် သက်ဆိုင်သူများသို့ ပေးချေခဲ့ပြီး

ဖြစ်ပါသည်။ (နောက်ဆက်တွဲ(က))

ဘေးအနွယ်ရှိသည့်ထိခိုက်နိုင်မှုကိုဆန်းစစ်ခြင်း (Risk Assessment)

ဘေးအန္တယ်ရှိသည့်ထိခိုက်နိုင်မှုကို ဖြစ်ပေါ်နိုင်ခြေရှိသည့်အကြောင်းချင်းရာတစ်ခုနှင့် ထိုအကြောင်း ချင်းရာဖြစ်ပေါ်ခြင်း၏ အကျိုးဆက်သို့မဟုတ် သက်ရောက်မှု၏ ဖြစ်တန်စွမ်းကို ခန့်မှန်း တွက်ဆလျက် ဆန်းစစ်ခြင်းပြုလုပ်သည်။

စီမံကိန်းတစ်ခု၏ တည်ဆောက်ခြင်းအဆင့်၊ လုပ်ငန်းလည်ပတ်ဆောင်ရွက်ခြင်းအဆင့်၊ နှင့်လုပ်ငန်း ရပ်စဲခြင်းအဆင့်တိုတွင်ဖြစ်ပေါ် တတ်သည့်သက်ရောက်မှု အကျိုးဆက်များ၊ သိသာထင်ရှားမှုပမာက အတိုင်းအဆတို့ကို ခန့်မှန်းဆန်းစစ်လျက် အောက်ပါဇယားတွင် ဖော်ပြထားခြင်းဖြစ်သည်။

Impact	Construction Phase	Operation Phase	Decommissioning Phase
Soil	Significant Risk	Low Risk	Moderate Risk
Dust Emission	Significant Risk	Low Risk	Moderate Risk
Water	Significant Risk	Low Risk	Moderate Risk
Air pollution	Significant Risk	Low Risk	Moderate Risk
Noise & Vibration	Significant Risk	Low Risk	Moderate Risk
Solid waste	Significant Risk	Low Risk	Significant Risk
Traffic Flow	Significant Risk	Low Risk	Moderate Risk
Risk of Accident	Significant Risk	Low Risk	Significant Risk
Visual Quality	Significant Risk	High Risk	Moderate Risk
Social Impact	Significant Risk	Significant Risk	Moderate Risk
Flora	Significant Risk	Significant Risk	Moderate Risk
Fauna	Significant Risk	Significant Risk	Moderate Risk

သဘာဝပတ်ဝန်းကျင်ထိရိက်ယုတ်လျော့စေသောနည်းလမ်းများနှင့် စောင့်ကြပ်ကြည့်ရှမှု မှတ်တမ်းတင်အစီအစဉ် (Mitigation Measurse and Monitoring Plan)

ဆိုလာဓာတ်အားပေးစနစ်စီမံကိန်း၏ လုပ်ငန်းခွင်ပြင်ဆင်ခြင်း၊ တည်ဆောက်ခြင်း၊ ထုတ်လုပ်ခြင်း၊ ဖျက်သိမ်းခြင်းအစရှိသော လုပ်ငန်းအပိုင်းလိုက်တို့တွင် ဖြစ်ပေါ် လာမည့် သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှု များကိုယုတ်လျော့စောနည်းလမ်းများနှင့် ဖြစ်နိုင်ခြေများအပေါ် စောင့်ကြပ်ကြည့်ရှုသည့် လုပ်ငန်း အစီအစဉ်များကို ဤအခန်းတွင်ဖော်ပြထားမည်ဖြစ်ပါသည်။

ရုပ်ပိုင်းဆိုင်ရာ (ရေထု၊ မြေထု၊ လေထု စသည့်များနှင့်ပတ်သက်၍ သဘာဝပတ်ဝန်းကျင်ထိခိုက်မှု ဖြစ်နိုင်ရေများအပေါ် စောင့်ကြပ်ကြည့်ရှု မှတ်တမ်းတင်ခြင်းနှင့် လျော့ကျစေသောနည်းလမ်းများ (Physical Mitigation Measure)

Soil Erosion (မြေဆီလွှာတိုက်စားပျက်စီးခြင်း)

စီမံကိန်းကာလတလျှောက်လုံး မိုးရာသီတွင်ရွာသွန်းသည့်မိုးရေကြောင့် မြေဆီလွှာတိုက်စားပျက် စီးခြင်းများကို စီမံကိန်းနယ်မြေရေထွက်ပေါက်များတွင် တွေ့ကြုံရဖွယ်ရှိပါသည်။ အထက်ပါ မြေဆီလွှာ များပျက်စီးခြင်းများမရှိစေရန် သဲထိန်းနံရံများ၊ ရေစုကန်များ၊ ချောင်းနံရံထိန်းသိမ်းခြင်း လုပ်ငန်းများ ဆောင်ရွက်ခြင်းဖြင့်လည်း မြေသားရေမြောင်းများနှင့်ကွန်ကရစ်ရေမြောင်းများကိုပြုပြင် ထိန်းသိမ်းခြင်း ဖြင့်လည်းကောင်းထားရှိသင့်ပါသည်။





မြေဆီလွှာတိုက်စားပျက်စီးခြင်းပုံများ

ဖုန်များထုတ်လွှတ်ခြင်း (Dust Emission)

စီမံကိန်းကာလတလျှောက်လုံး စက်ယွန္တရားများ၊ မော်တော်ယာဉ်များသွားလာခြင်းကြောင့် ဖုန်မှုန့်များ ထုတ်လွှတ်ခြင်းကိုတွေ့ ကြုံရမည်မှာမှချပင်ဖြစ်ပါသည်။လမ်းများပေါ် တွင်ရေဖြန်းခြင် ဖြင့်လည်းကောင်း၊ ဆောက်လုပ်ရေးပစ္စည်များသယ်ယူရာတွင် အဖုံးအကာထားရှိခြင်းဖြင့်လည်းကောင်း၊ မော်တော် ယာဉ်တာယာများအား ဆေးကြောသန့်စင်စေခြင်းဖြင့်လည်းကောင်း သဘာဝပတ်ဝန်းကျင်နှင့် အနီး တဝိုက်ဖုန်မှုန့်များ ထုတ်လွှတ်ခြင်း (ဖုန်ထခြင်း)များကို ကာကွယ်လျော့ချစေနိုင်ပါသည်။



မြေညိခြင်းလုပ်ငန်းခွင်အတွင်းရေဖြန်းနေသည့်ပုံ လေထုညစ်ညမ်းခြင်း (Air Pollution)

လုပ်ငန်းခွင်တွင် ဆောက်ရွက်လုပ်ကိုင်လျက်ရှိသော စက်ယွန္တရားကြီးများနှင့် သယ်ယူပို့ဆောင်ရေး ယာဉ်များအားလုံးနီးပါး ဒီဇယ်လောင်စာသုံးအင်ဂျင်များဖြင့် လည်ပတ်လျက်ရှိကြောင်းတွေ့ ရှိခဲ့ရ ပါသည်။ ဒီဇယ်လောင်ကျွမ်းမှုကြောင့်ဖြစ်ပေါ်လာသည့်အမှုန့် ငယ်များ (PM_{2.5})၊ ဆာဖာဒိုင် အောက်ဆိုဒ်၊ နိုက်တြိုဂျင်အောက်ဆိုဒ်များ (SO₂, NO₂)ကိုလည်း သတ်မှတ်ချက်ထက်ကျော်လွန်စွာ ရှိနေကြောင်း လေထုညစ်ညမ်းမှု တိုင်းတာသည့်စက်ကိရိယာမှ ညွှန်းပြလျက်ရှိပါသည်။ အထက်ပါ ညစ်ညမ်းမှုများ ကြောင့် လုပ်ငန်းခွင်အတွင်းရှိလုပ်သားများ၊ ယာဉ်မောင်းများတို့တွင် အဆုတ်ရောဂါ ဝေဒနာကိုလည်း ကောင်း၊ နှလုံးရောဂါဝေဒနာများကိုလည်းကောင်း ခံစားရဖွယ်ရှိနေပါသည်။ လေးပင်ရွာနှင့် ဇီးအိုင်ရွာ များသည် အတော်အတန်အလှမ်း ကွာဝေးလျက်ရှိနေသဖြင့် ၄င်းရွာများတွင် နေထိုင်ကြ သူများအတွက် စိုးရိမ်ဖွယ်ရာ မရှိသော်လည်း လုပ်ငန်းခွင်အတွင်းရှိ ဝန်ထမ်းများ၊ ယာဉ်မောင်းများ၊ လုပ်သားများတို့တွင် ခံစားရနိုင်ဖွယ် တွေ့ ရှိရပါသည်။





လေအရည်အသွေးတိုင်းတာရန်နမူနာကောက်ယူပုံ

စက်ယွန္တရားကြီးများလုပ်ငန်းခွင်အတွင်းအလုပ်လုပ်နေပုံ

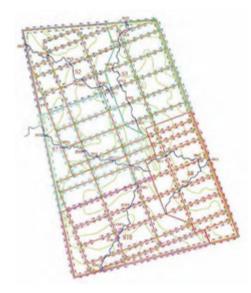
လေ့လာရေးအဖွဲ့ များ၏ လေ့လာစိစစ်ချက်များအရ တစ်ရက်လျှင် ဒီဇယ်ဆီဂါလံ ၈၂ဝဝ ခန့်ကို ၂၄နာရီ အတွင်း အသုံးပြုနေကြောင်းကိုလည်း စစ်ဆေးတွေ့ ရှိခဲ့ရပါသည်။ ဤလေထုညစ်ညမ်းမှုမှာ မြေသား ပြုပြင်ခြင်းနှင့် မြေသားသိပ်သည်းစေသည့် လုပ်ငန်းအချိန်ကာလများတွင်သာ ဖြစ်ပေါ်မည်ဖြစ်ပြီး ဆိုလာပြားများတပ်ဆင်ခြင်းနှင့် အခြားတည်ဆောက်ရေးလုပ်ငန်းများ ဆောင်ရွက်သည့်အခါ မရှိနိုင် တော့ပါကြောင်းတွေ့ ရှိခဲ့ရပါသည်။

အထက်ပါလေထုညစ်ညမ်းမှုကြောင့် သဘာဝပတ်ဝန်းကျင်ပျက်စီးစေခြင်းနှင့် လုပ်ငန်းခွင်အန္တရာယ် ရှိခြင်းများကို ကာကွယ်ရန်အတွက် လုပ်ငန်းခွင်ရှိလုပ်သားများ၊ ယာဉ်မောင်းများ၊ ဝန်ထမ်း များအားလုံး ကို လိုအပ်သည့်အကာအကွယ်ပစ္စည်းများဝတ်ဆင်စေခြင်းဖြင့်လည်းကောင်း၊ စက်ယန္တရား ကြီးများ၏ အင်ဂျင်များကို ပုံမှန်စစ်ဆေးကြည့်ရှုပြုပြင်ခြင်း ဖြင့်လည်းကောင်း၊ ဆေးလိပ်သောက်ခြင်းမှ တားမြစ်ခြင်းဖြင့်လည်းကောင်း၊ လုပ်သားများ၊ ယာဉ်မောင်းများ၊ ဝန်ထမ်းများကို လေထုညစ်ညမ်းမှု ရှိနေသော လုပ်ငန်းခွင်တွင် ပါဝင်ဆောင်ရွက်လျက်ရှိနေကြောင်း အသိပညာပေးခြင်းဖြင့်လျော့ချကာ ကွယ်နိုင်ပါသည်။ စီမံကိန်းအကောင်အထည်ဖော်သည့် အဖွဲ့အစည်းအနေနှင့်လည်း တစ်လတစ်ကြိမ် လေထု အရည်အသွေးကို စမ်းသပ်စစ်ဆေးမှတ်တမ်း တင်ထားရှိသင့်ပါသည်။

အသံနှင့်တုန်ခါမှု (Noise and Vibration)

ကွန်ကရစ်ဖျော်စက်များ၊ အင်ဂျင်များ၊ သတ္တုဖြတ်စက်များမှထွက်ရှိသည့် အသံနှင့်တုန်ခါမှုများကို ကာကွယ်လျော့ချရန်အလို့ငှာအင်ဂျင်များကိုပုံမှန်ထိန်းသိမ်းပြုပြင်ခြင်း၊ ညပိုင်း လုပ်ငန်းခွင်ဆောင်ရွက် ခြင်းကိုတားမြစ်ခြင်း၊ အလုပ်ချိန်ကန့်သတ်ခြင်းတို့ဖြင့် ကာကွယ်လျော့ချနိုင်ပါသည်။ ဤထိရိုက်မှု ဖြစ်နိုင်ခြေသည် တည်ဆောက်ရေးကာလ တစ်ခုတည်းအတွင်းသာရှိနိုင်မည်ဖြစ်ပြီး လုပ်ငန်းလည်ပတ် ထုတ်လုပ်သောကာလတွင် ရှိနိုင်လိမ့်မည်မဟုတ်ပါ။

ရွာသွန်းသောမိုးရေနင့်မြေအောက်ရေညစ်ညမ်းခြင်း (Surface water/Groundwater Contamination)

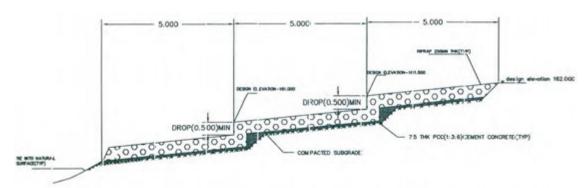


230 kV တာဝါတိုင်များစိုက်ထူရန်အတွက်အောက်ခြေခံ အုတ်မြစ်လုပ်ငန်းများ၊ ရုံးခန်းနှင့်ဝန်ထမ်း အိမ်ရာ အဆောက်အဦးများဆောက်လုပ်ခြင်းနှင့် ဓါတ်အားခွဲရုံ ဆောက်လုပ်ရန် အုတ်မြစ်ချခြင်းလုပ်ငန်းများအတွက် မြေတူးခြင်း လုပ်ငန်းများ ဆောင်ရွက်ရာတွင်လည်းကောင်း၊ ကွန်ကရစ်လုပ်ငန်းများကို ဆောင်ရွက်ရာတွင်လည်းကောင်း၊ မြေအောက်ရေထုကိုလုပ်ငန်းဆောင်ရွက်ရာတွင်လည်း ကောင်း၊ မြေအောက်ရေထုကိုလုပ်ငန်းဆောင်ရွက်စဉ်ကာ လအတွင်း ယာယီညစ်ညမ်းမှုများဖြစ်ပေါ် စေပါသည်။ လုပ်ငန်းခွင်အတွင်း ပစ္စည်းများ စုပုံထားရှိခြင်းနှင့် အမှိုက် သရိုက်များ၊ ပုံးခွံများ၊ ထုပ်ပိုးခွံများနှင့် ဆေးပုံးများ၊ ဓါတု ပစ္စည်းများစုပုံထားရှိခြင်း တို့ကြောင့်လည်း မိုးရွာစဉ်ကာလ အတွင်း မြေအောက်ရေထု ညစ်ညမ်းမှုကိုဖြစ် ပေါ်နိုင်

စေပါသည်။ ဆိုလာပြားများထားရှိစဉ်နှင့် ကိုင်တွယ်တည်ဆောက်စဉ် မကွဲမရှမပျက်စီးစေရန် သတိကြီးစွာလုပ်ကိုင် ဆောင်ရွက်စေ၍လည်းကောင်း၊ စွန့်ပစ်ပစ္စည်းများ စနစ်တကျစုပုံထား ရှိစေခြင်း ဖြင့်လည်းကောင်း ညစ်ညမ်းမှုကို လျော့ချစေနိုင်ပါသည်။

ရေစီးရေလာကောင်းမွန်စေရြင်း (Hydrology and Minimization of rain water flow)

မိုးရာသီကာလအတွင်း မြေဆီလွှာတိုက်စားမှုကို ကာကွယ်ရန်အတွက်လည်းကောင်း၊ ရေစီးရေလာ ကောင်းမွန်စေရန်အတွက်လည်းကောင်း၊ရေစီးနှုန်းကိုထိန်း သိမ်းတည်တံ့စေရန်အတွက်လည်းကောင်း၊ ရေမြောင်းများ၏အဆိုင်းများကို ထိန်းသိမ်းထားရှိခြင်း၊ အမှိုက်သရိုက်များ မရှိစေခြင်းဖြင့် ကြိုတင်စီမံ ထားရှိသင့်ပါသည်။ အနည်ထိုင်ကန်များ၊ သဲထိန်းတမံများ၊ ရေကြောင်းထိန်းလုပ်ငန်း များဆောင်ရွက် ခြင်းဖြင့်လည်း အထက်ပါဆိုးကျိုးမှကာကွယ်နိုင်ကြောင်း တွေ့ရှိရပါသည်။



မြေဆီလွှာတိုက်စားမှုကာကွယ်ရန်သဲထိန်းတမံများ (Typical drain over slopes)

ဆိုလာပြားများကိုင်တွယ်တပ်ဆင်းခြင်း (Handling of PV Solar Panels)

သံဟင်ဂလန်များကို မြေကြီးအတွင်းသို့ ၂ မီတာမှ ၃ မီတာအနက်ပိုင်အဖြစ်ရိုက်သွင်းပြီးနောက်၄င်း သံငုတ်များပေါ်တွင် ဆိုလာပြားများ တပ်ဆင်ရန် အတွက်အလူမီနီယမ် ဘောင်များကိုဦးစွာ ထုတ်လုပ် တပ်ဆင်မည်ဖြစ်ပါသည်။ အဆိုပါအလူမီနီယမ်ဘောင်များပေါ်တွင် ဆိုလာပြား များကိုတပ် ဆင်မည်ဖြစ်ပါသည်။ လုပ်ငန်းအကောင်အထည်ဖော်သူသည် အဆိုပါ ဆိုလာပြားများကို လုပ်ငန်းခွင်အရောက်သယ်ယူ လာပြီးနောက် ပုံတွင် ပြထားသော S1, S2 နှင့် S3 စသည့် စုပုံထားရှိသည့် နေရာများတွင် စနစ်တကျစုပုံ ထားရှိပြီးနောက် တပ်ဆင်ရန် အချိန်ကျရောက်သော အခါ တပ်ဆင်ခြင်း လုပ်ငန်းကိုဆောင်ရွက် မည်ဖြစ်ပါသည်။ ထိုသို့ဆိုလာပြားများ ကိုစီမံကိုင်တွ



ယ်တပ်ဆင်ရာတွင် ပျက်စီးမှုများဖြစ်ပေါ်နိုင်ပါသည်။ တည်ဆောက် ရေးကာလနှင့် လုပ်ငန်း လည်ပတ်ဆောင်ရွက်စဉ်ကာလရှိ ပြုပြင်ထိန်းသိမ်းခြင်း လုပ်ငန်းများတွင် အထက်ပါဆိုလာ ပျက်စီးမှုများကို စနစ်တကျထုပ်ပိုး၍ Recycle ပြုလုပ်ရန် ပြန်လည်ပေးပို့မည်ဖြစ် ကြောင်းဖော် ပြထားပါသည်။ လုပ်ငန်းခွင်နှင့် စီမံကိန်းဧရိယာအတွင်း အထက်ပါ ဆိုလာအပျက်အစီးများကို ထားသိုရန် ဂိုဒေါင်များ ဆောက်လုပ်မည်မဟုတ်ပါကြောင်းလည်း ဖော်ပြထားရှိ ပါသည်။

ယာဉ်လမ်းကြောင်းအန္တရာယ်ကင်းရှင်းရေး (Traffic Flow)

စက်ယန္တရားကြီးများကို လုပ်ငန်းခွင်သို့သယ်ယူပို့ဆောင်ရာတွင်လည်းကောင်း၊ ဆောက်လုပ်ရေး လုပ်ငန်းသုံးပစ္စည်းများလုပ်ငန်းခွင်သို့သယ်ယူပို့ဆောင်ရာတွင်လည်းကောင်း၊ ဘိလပ်မြေ၊ အုတ်သဲ ကျောက်၊ ဒီဇယ်နှင့်အခြား စက်ကိရိယာတန်ဆာပလာများကို သယ်ယူပို့ဆောင်ရာ တွင်လည်းကောင်း၊ မင်းဘူး-ပဒါန်း-အမ်းလမ်းတလျှောက်တွင်စနစ်တကျရှိစေရန် စီမံခန့်ခွဲခြင်း၊ ဆိုင်းဘုတ်များ ရေးဆွဲထား ရှိခြင်း၊ မီးဆလိုက်နှင့် အချက်ပြမီးများတပ်ဆင်ခြင်း၊ လုပ်ငန်းခွင်မှ တာဝန်ရှိသူတဦးအား တာဝန်ချ ထားခြင်းဖြင့် ယာဉ်အန္တရာယ်နှင့် ယာဉ်လမ်းကြောင်းသိပ်သည်းမှုကို ဖြေလျော့ ထိန်းသိမ်းနိုင်ပါသည်။ အထူးသဖြင့် မန်းရွှေစက်တော်ဘုရားပွဲတော်ကာလအတွင်း ခရီးသွားလုပ်သားပြည်သူများအား အနောက်အယှက်မဖြစ်စေရန်အလို့ငှာ၊ စီမံကိန်းအဝင်အထွက်ပေါက်နေရာတွင် အထူးကြပ်မတ် တာဝန်ချထားသင့်ပါကြောင်းတွေ့ ရှိရပါသည်။ ပုံစံတွင်ဖော်ပြထားသကဲ့သို့ တည်ဆောက်ရေးကာလ အတွင်းနှင့် လုပ်ငန်းလည်ပတ်စဉ်ကာလအတွင်း ယာဉ်ရပ်နားရန်နေရာများကို လုံလောက်စွာ ထည့်သွင်းတည်ဆောက်ပါက လုပ်ငန်းခွင်အတွင်း အဆင်ပြေချောမွေ့စွာယာဉ်များဝင်ထွက်လာနိုင် ကြောင်းတွေ့ရှိရပါသည်။

သက်ရှိဖီဝပတ်ဝန်းကျင်ထိခိုက်မှုလျော့ချရေးလုပ်ငန်းများ (Biological Mitigation Measure)

စီမံကိန်းနေရာတခုလုံးရှိ အင်တိုင်းတောခြောက်နှင့် ရွက်ပြတ်ရောနောတောခြောက်မှ သစ်ပင်ခြုံနွယ် အားလုံးအပြင် အပေါ် ယံမြေလွှာကိုပါ ဖယ်ရှားပစ်ရသည်ဖြစ်ရာ ဤထိနိက်မှုကို လျော့ချသည့်လုပ်ငန်း တွင် အောက်ပါလုပ်ထုံးလုပ်နည်းများကို အသုံးပြုရမည်ဖြစ်သည်။



စီမံကိန္းပတ္ဝန္းက်င္အနီးႀကိႏဳိျပင္ကာကြယ္ေတာ

- စီမံကိန်းအနီးအနားဝန်းကျင်ရှိ ဖုန်းဆိုးမြေနှင့်သစ်တောထူထပ်မှုမရှိသည့် နေရာများတွင် မူရင်းဒေသပေါက်သစ်ပင်မျိုးများ စိုက်ပျိုးပေးခြင်း။
- ကျေးလက်နေပြည်သူတို့ပါဝင်လုပ်ဆောင်သည့် Community Forestry ဖြစ်ထွန်းအောင် ကူညီ ပေးခြင်း။
- ပြည်သူလူထုကို ဂေဟစနစ်တန်ဘိုးနှင့် ပတ်သက်သည့်ဖွံ့ဖြိုးရေးဆိုင်ရာ ရေရှည်တည်တံ့မှု အကြောင်း အသိပညာမြင့်မားလာစေရေးလုပ်ငန်းကို ကျောင်းပညာရေးနှင့်တွဲဖက်၍ (Environmental Education) စီမံကိန်းလုပ်ဆောင်ထောက်ပံ့ပေးခြင်းနှင့်
- နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ်ဓာတ်အားပေး (Large-scale solar power) စီမံကိန်း ဖြစ်သည်နှင့်အညီ ပတ်ဝန်းကျင်ထိခိုက်မှုလျော့ချရေးအတွက် လူမှုစီပွားအကျိုးပြုမှု ဆိုင်ရာ လုပ်ငန်းများ (CSR) လုပ်ငန်းနှင့်အတူသုံးစွဲမည့် ငွေကြေးလျာထားချက်ကို စီမံခန့်ခွဲရေး လုပ်ငန်း၌ အကောင်အထည်ဖော်ဆောင်ရွက်ရန် သတ်မှတ်ထား ရခြင်းတို့ဖြစ်သည်။

လူမှုဝန်းကျင်ပေါ်ထိခိုက်မှုလျော့ချရေးလုပ်ငန်းများ(Social Mitigation Measure)

ဤစီမံကိန်းကြောင့် လူမှုဝန်းကျင်ပေါ်ထိခိုက်နစ်နာစေသော အကျိုးသက်ရောက်မှုများကို တိုင်းတာ ရန် အောက်ပါ အချက်များကို အကြံပြုဆွေးနွေးတင်ပြပါသည်။

• နေရောင်ခြည်စွမ်းအင်သုံး ဤစီမံကိန်းသည် မြန်မာနိုင်ငံအနေဖြင့် ပထမဆုံး စီမံကိန်းကြီးဖြစ် သောကြောင့်အဖွဲ့ရှိတာဝန်ရှိသူများသည် ကျေးရွာသူပြည်သူများနှင့် တွေ့ဆုံပြီး ဤစီမံကိန်း

- ကြောင့် ပတ်ဝန်းကျင်အပေါ် ဆိုးကျိုးသက်ရောက်မှု အနည်းဆုံးဖြစ်မည် ဆိုသော ကြောင့် မစိုးရိမ်ကြရန်ကျေးရွာနေပြည်သူများအားပညာပေးဟောပြောပွဲများ လုပ်သင့်ပါသည်။
- လေးပင်ရွာသားများကို စီမံကိန်းနေရာနှင့်အနီဆုံးဖြစ်သောကြောင့် အလုပ်အကိုင် အခွင့် အလမ်းများ ပေးခြင်းနည်းလမ်းဖြင့် ကူညီသင့်ပါသည်။ ထိုသို့ ကျေးရွာသူကျေးရွာသားများ အလုပ်အကိုင်အခွင့်အလမ်းရရှိရေးနှင့်ပတ်သက်ပြီးဆွေးနွေးတိုင်ပန်ကျေးရွာစီမံအု ပ်ချုပ်သူနှင့် ကျေးရွာရှိလူကြီးသူမများစုပေါင်းပြီး အဖွဲ့တစ်ဖွဲ့ဖွဲ့၍ ဤစီမံကိန်းကုမ္ပကီနှင့် ဆွေးနွေးသင့် ပါသည်။
- စီမံကိန်းအကောင်အထည်ဖော်လုပ်ဆောင်စဉ်ကာလအတွင် ကုမ္ပဏီအနေနှင့် လေးပင်နှင့် ဇီးအိုင်ကျေးရွာသူ/ကျေးရွာသားများနှင့် ဆက်ဆံရေးကောင်းကောင်းမွန်မွန် ပြေပြေပြ စ်ပြစ် ရှိရန် နည်းစနစ်ကျကျစီစဉ် ဆောင်ရွက်သင့်ပါသည်။
- လေးပင်ကျေးရွာရှိမြေရာများအတွက် လျော်ကြေးငွေပေးရာတွင် မြေပိုင်ဆိုင်သူများနှင့် စနစ်တကျ ပြန်လည်စစ်ဆေးသုံးသပ်ပြီး စေ့စပ်ညှိနှိုင်းသင့်ပါသည်။
- ကုမ္ပဏီအနေဖြင့် ကျေးရွာသူကျေးရွာသားများနှင့် ဆက်ဆံရေးကောင်းမွန်မှသာလျှင် နောက်လာမည့် အခက်အခဲများကို ကျော်လွှားနိုင်မည်ဖြစ်ပါသည်။ ကျေးရွာအတွက် လူမှုရေး ဆိုင်ရာလုပ်ငန်းစဉ်များကိုလည်း စဉ်ဆက် မပြတ်လုပ်ဆောင်ပေးသင့်ပါသည်။
- လျှပ်စစ်ဓာတ်အားပေးစီမံကိန်းသည် ထိုကျေးရွာများအနီးတွင် အကောင်အထည်ဖော် ဆောင်ရွက်မည်ဖြစ်ခြင်းကြောင့် ထိုကျေးရွာသူကျေးရွာသာများ အနေဖြင့် ၄င်းတို့အတွက် လျှပ်စစ်မီးရရှိရေး ဆောင်ရွက်ရာတွင် လူမှုစီပွားအကျိုးပြုမှု ဆိုင်ရာလုပ်ငန်းများ (CSR) အနေဖြင့် ပထမအရေးကြီး အစီအစဉ်တစ်ခုအနေအဖြစ် ပါဝင်မည်ဖြစ်ကြောင်း ဖော်ပြသင့် ပါသည်။
- ဤစီမံကိန်းအတွင်း သစ်တော ဧက ၈ဝဝ ကျော်ဖုံးလွမ်းလျှက်ရှိသော သစ်ပင်များ၊ ချုံပုတ် များနှင့် တောအုပ်များရှင်းလင်းဖယ်ရှားမှာဖြစ်ပြီး အနီးအနားရှိ ကျေးရွာသူ/ ကျေးရွာသား များ၏ စိုးရိမ်မှုကိုဖြေဖျောက်နိုင်ရန် ဘေးပတ်ဝန်းကျင်ရှိ ကွင်းပြင်များကို စွမ်းလမ်းစိုပြေသည့် သစ်တောပျိုးခင်းများတည်ထောင်ပေးသင့်ပါသည်။
- စီမံကိန်း အကောင်အထည်ဖော် ဆောင်ရွက်သူသည် ကျေးရွာသူ/ကျေးရွာသားများ၏ လယ်ယာမြေဆုံးရှုံးမှုများသာမက ၄င်းလယ်မြေပေါ် ရှိသီနှံများဆုံးရှုံးမှု အတွက်ပါ လျော်ကြေး ငွေပေးရန်လိုအပ်သည်များကို ကြိုတင်ပြင်ဆင်ထားသင့်ပါသည်။ စီမံကိန်း အကောင်အ ထည် ဖော်ဆောင်ရွက်သူသည် ဒေသအဆင့်၊ ကျေးရွာအဆင့် အာကာပိုင်များနှင့် အခြားပါဝင် ပတ်သက်သူများနှင့် (ပုံစံ-၇)အရ လယ်ယာမြေပိုင်ဆိုင်မှု စာချုပ်မရှိသော်လည်း ဤစီမံကိန် ကြောင့် လယ်ယာမြေများအသိမ်းခံထားရသော လယ်သမားများနှင့်ပါ ဆွေးနွေးညှိနှိုင်း သင့်ပါ သည်။
- ကျေးရွာနေပြည်သူများသည် စီမံကိန်းဆောင်ရွက်သူ၏ လူမှုစီပွားအကျိုးပြုမှုဆိုင်ရာ လုပ်ငန်း များအနေဖြင့် လှုုပ်စစ်မီးရရှိရေး၊ စက်ရေတွင်းများနှင့် ကျောင်းအဆောက်အအုံများ ကို ဆောက်လုပ်လှူခြန်းပေးစေချင်ကြသည်။ စီမံကိန်းဆောင်ရွက်သူများသည် ကျေးရွာသူ/ ကျေးရွာသားများ၏ လိုအပ်ချက်အားလုံးကို မဖြည့်ဆည်းပေးနိုင်ပါက ကျေးရွာ ခေါင်းဆောင် များ၊ ကျေးရွာလူကြီးများ နှင့် ကျေးရွာနေပြည်သူများနှင့် တွေ့ဆုံပြီး ဦးစားပေး လုပ်ဆောင် စေလိုသည့်အရာများကို မေးမြန်းနိုင်ပါသည်။ တွေ့ဆုံရာတွင် ခွဲခြားခြင်းမရှိ လူတိုင်းအားလုံး ပါဝင်နိုင်ရန်စီမံဆောင်ရွက်သင့်ပါသည်။

Environmental Management and Monitoring Plan (EMP)

ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့် ခွဲရေးနှင့် စောင့်ကြည့်စစ်ဆေးရေး အစီအစဉ် (EMP)

သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုပတ်ဝန်းကျင် ထိခိုက်မှုအလားအလာလျော့ပါးရေးနှင့်ပတ်သက်၍ မြန်မာ ဆာဗေးသုတေသနအဖွဲ့မှ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲရေးနှင့် စောင့်ကြည့်စစ်ဆေးရေး အစီအစ ဉ် ကိုရေးဆွဲပေးထားပြီးဖြစ်ပါသည်။ ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲရေးနှင့် စောင့်ကြည့် စစ်ဆေးရေး အစီအစဉ်လုပ်ငန်းစဉ်များတွင် အကျိုးသက်ရောက်မှု လျော့ပေါ့ရေးဆိုင်ရာတိုင်းတာမှုများ၊ အကျိုး သက်ရောက်မှု လျော့ချရေးဆိုင်ရာ တိုင်းတာမှုများများကို ဆောင်ရွက်မည့် တာဝန်ရှိသူများ (သို့မဟုတ်) အဖွဲအစည်းများ၊ စောင့်ကြည့်စစ်ဆေးမည့်နည်းလမ်းနှင့် အကြိမ်အရေအတွက်များ အကြောင်းကို သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုပတ်ဝန်းကျင်အပေါ် ဖြစ်နိုင်ရေရှိသည့် အကျိုးတစ်ခုချင်းစီအတွက် အကြံပြုဆွေးနွေးထားပြီးဖြစ်ပါသည်။ ပတ်ဝန်ကျင်းဆိုင်ရာ စီမံခန့်ခွဲရေးနှင့် စောင့်ကြည့် စစ်ဆေးရေး အစီအစဉ်ဆောင်ရွက်ရန်ခန့်မှန်းလျာထားငွေစာရင်းကိုလည်းဖော်ပြထားပါသည်။ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်စစ်ဆေးရေး အစီအစဉ်အသေးစိတ်ကို စီမံခန့်ခွဲရေးနှင့် ဖော်ပြထားပါသည်။ စီမံကိန်းဆောင်ရွက်သူအနေဖြင့်ပတ်ဝန်းကျင်ဆိုင်ရာ အခန်း(၈)တွင် စီမံခန့်ခွဲရေးနှင့်စောင့်ကြည့် စစ်ဆေးရေးအစီအစဉ်ကို အချိန်နှင့်တပြေးညီမှန်မှန်ကန် ဆောင်ရွက်ရန် တာဝန်ရှိပါသည်။

ပြည်သူ့သဘောထားခံထားရြင်း (Public Consultation)

ပြည်သူ့သဘောထားခံယူပွဲကို ကျေးရွာနှစ်ရွာလုံးတွင် ကျင်းခဲ့ပါသည်။ လေးပင်ကျေးရွာတွင် ပြည်သူ့ သဘောထားခံယူပွဲတွင် မင်းဘူးမြို့နယ်ဆန္ဒနယ်-၁ ၏ လွတ်တော်ကိုယ်စားလှယ်၊ GEP (Myanmar) ကုမ္ပကီ၏ အထွေထွေမန်နေဂျာ၊ စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်မည့် နေရာမှ ကျေးရွာ အုပ်စု အာကာပိုင်များ၊ ကျေးရွာနေရပ်မိရပ်ဖများ၊ လယ်သမားများနှင့် ကျေးရွာသူ/ ကျေးရွာသားများ အပါအဝင် လူပေါင်း(၆၈)ယောက်တက်ရောက်ခဲ့ကြသည်။ ထိုတွေ့ဆုံမှုကို စက်တင်ဘာလ (၁၂) ရက်နေ့ နံနက်ပိုင်း၌ပြုလုပ်ခဲ့ပြီး အချိန် (၂)နာရီခွဲမှု ကြာမြင့်ခဲ့ပါသည်။ ဇီးအိုင်ရွာ၌ တွေ့ဆုံမှုတွင် အနီးအနားရှိကျေးရွာများ ကျေးရွာသူကျေးရွားသားများနှင့် လယ်သမားများအပါအဝင် လူပေါင်း (၃၈) ယောက် တက်ရောက်ခဲ့ပါသည်။ GEP(Myanmar) ကုမ္ပကီ၏ အမှုဆောင်အရာရှိ များလည်း တက်ရောက်ခဲ့ပါသည်။ ထိုတွေ့ဆုံပွဲသည် စက်တင်ဘာလ (၁၂) ရက်နေ့ နေ့လည်တွင် ကျင်းပခဲ့ပြီး အချိန် (၁)နာရီခွဲမှုကြာမြင့်ခဲ့ပါသည်။

ထိုပြည်သူ့သဘောထားခံယူတွေဆုံပွဲနှစ်ခုတွင် အဓိကပါဝင်ပတ်သတ်သူများနှင့် တစ်ဦးချင်း အလိုက် တွေ့ဆုံမေးမြန်းမှုများပါဝင်ပါသည်။ ထိုတွေဆုံမေးမြန်းမှုတွင် အစိုးရဝန်ထမ်း(၅)ဦး၊ ကျေးရွာ အာကာပိုင် (၉)ဦး၊ လေးပင်ကျေးရွာမှ ကျေးရွာသူကျေးရွားသားများ၊ လယ်သမားများနှင့် ကျေးရွာရှိ ဘာသာရေးခေါင်းဆောင်များနှင့် ဇီးအိုင်ကျေးရွာမှလယ်သမား(၇)ဦးနှင့် ကျေးရွာသူ /ကျေးရွာသား များ ပါဝင်ခဲ့ပါသည်။

ပြည်သူ့သဘောထားခံယူပွဲနှင့် တစ်ဦးချင်းအလိုက်တွေ့ဆုံမေးမြန်းမှုမှ ရလာဒ်များအရ ဒေသ ဆိုင်ရာ အာကာပိုင်များ၊ ကျေးရွာအာကာပိုင်များနှင့် ကျေးရွာသူကျေးရွာသားများသည် ဤစီမံကိန်း ကြောင့် ပတ်ဝန်းကျင်ဆိုင်ရာ ပျက်စီး ဆုံးရှုံးမှုများအကြောင်းကို အများအပြားဖော်ပြခြင်း မျိုးမရှိကြောင်း သို့သော် စီမံကိန်းကြောင့် သစ်တောသစ်ပင်များ ပျက်စီးဆုံးရှုံးသွားသည့်အတွက် သစ်တောပြန်လည် စိုက်ပျိုးရေးစီမံကိန်းများ လုပ်ဆောင်ပေးမည် မပေးမည်ကို အချို့က စိုးရိမ်ကြောင့်ကြကြပါသည်။ ရပ်ရွာအာကာပိုင်များ၊ ရပ်မိရပ်ဖများ၊ လယ်သမားများနှင့်ကျေးရွာသူကျေးရွာသားများသည် ဤစီမံကိန်း အကောင်အထည်ဖော်သူထံမှ သူတို့၏ လယ်ယာမြေအတွက်သာမက စိုက်ပျိုးသီးနှံ အတွက်လျော်ကြေးငွေပါ တောင်းဆိုကြပါသည်။ စီမံကိန်းပြုလုပ်သူထံမှလည်း (ပုံစံ-၇ အရ) လယ်ယာမြေ ပိုင်ဆိုင်မှုစာချုပ်မရှိသော်လည်း ဤစီမံကိန်းကြောင့် လယ်ယာမြေဆုံးရှုံးသွားသော လယ်သမားများကိုပါ လျော်ကြေးငွေပေးစေလိုပါသည်။

ကျေးရွာနေပြည်သူများသည် စီမံကိန်းဆောင်ရွက်သူ၏ လူမှုစီပွားအကျိုးပြုမှုဆိုင်ရာလုပ်ငန်းများ အနေဖြင့် လှုုပ်စစ်မီးရရှိရေး၊ စက်ရေတွင်းများနှင့် ကျောင်းအဆောက်အအုံများကို ဆောက်လုပ် လှုုဒါန်း ပေးစေချင် ကြသည်။

ကျေးရွာနေပြည်သူများသည် ကုမ္ပကီအနေဖြင့် စီမံကိန်းနှင့်ပတ်သက်သောအလုပ်အကိုင် ကြော်ငြာခြင်း နှင့် ပတ်သက်၍ ယခုထက်မက ပွင့်လင်းမြင်သာမှုရှိစေချင်ကြသည်။ ကျေးရွာသူ ကျေးရွာသားများ အနေဖြင့် ကုမ္ပကီ၏အလုပ်အကိုင်ကြော်ငြာစာများကို စီမံကိန်း၏အနီးဆုံး ကျေးရွာများဖြစ်သော လေးပင်နှင့်ဇီးအင်ကျေးရွာများတွင် ကြော်ငြာစာများကပ်စေချင်ကြပါသည်။ စီမံကိန်းမှတာဝန်ရှိသူ တစ်ယောက်က ပညာအရည်အချင်းကိုကြည့်၍ ဤစီမံကိန်းအတွက် အလုပ်ခန့်ထားကြောင်း ပြောဆိုခဲ့ ပါသည်။

နောက်ထပ်အစည်းပွဲများတွင် GEP (Myanmar) ကုမ္ပကီအနေဖြင့် နိုင်ငံအဆင့်၊ ဒေသအဆင့်၊ စရိုင်အဆင့်၊ မြို့နယ်အဆင့်နှင့် ကျေးရွာ(သို့မဟုတ်)ကျေးရွာအုပ်စုအဆင့် အာကာပိုင်များနှင့် ရပ်မိရပ်ဖများနှင့် ကျေးရွာသူ/ကျေးရွာသားများနှင့် ဆက်ဆံပြောဆိုရန် ဆက်သွယ်ရေးအရာရှိ (သို့) ဝန်ထမ်းတစ်ဦးဦးထားရှိနိုင်သည်။ ကုမ္ပကီရှိအမှုဆောင်အရာရှိများသည် အစိုးရအရာရှိများနှင့် ကျေးရွာနေပြည်သူများကို လုပ်ငန်းအစီအစဉ်များနှင့်ပတ်သက်၍ ပြောပြနိုင်ရန်နှင့် ကျေးရွာနေ ပြည်သူများအနေဖြင့် သူတို့၏ ဆန္ဒများ၊ လိုအပ်ချက်များနှင့် မကျေနပ်ချက်များနှင့် နစ်နာချက်များအား ကုမ္ပကီသို့ပြောပြရန် မည်သို့ လုပ်ထုံးလုပ်နည်းများဖြင့် လုပ်ဆောင်နိုင်ကို ပြဆိုသင့်ပါသည်။



1.2 EXECUTIVE SUMMARY (ENGLISH VERSION)

Project Description

GEP (Myanmar) Co., Ltd. has initiated a Photovoltaic solar power plant project which is located at Minbu Township, 500km North-West from Yangon and 200km West of Naypyidaw. The land is 836 acre wide, hilly area beside Minbu—Padan-Ann road way, 16 miles distance from Minbu, Magwe Region. Location of main project is between Latitude N2217000 to N2220000 and longitude E674100 to E675000

The project is designed to produce a gross annual output of 352300 MWh with a proposed gross generating capacity of 220.6 MW of direct current DC. The alternating current (AC) will be about 170 MW and to be sold to Ministry of Electricity and Energy through a new 230 kV transmission line that is currently being constructed and to be located 1 mile south from site. The nearest sub-stations where electricity will be distributed to, the Mann Sub-Station 15 miles east near Minbu and Ann Sub-Station 52 Mile west, near Ann. The project construction is expected to commence on March 2015 and will be completed on March 2020.

The project will construct in four phases. Phase 1.will be situated on 160 acre wide and will produce 50 MW, phase 2 will be situated on 160 acre wide and will produce 50 MW and phase 4 will be situated on 356 acre wide and will produce 70 MW of DC ratings respectively. The complete project of solar power plant will be produce 220.6 MW DC power and will be invert to 170 MW AC power. Inverted AC power will be step up to 230 kV by three 50 MVA transformers and one 70 MVA transformer which will be installed at transmission yard. Electricity 230 kV AC power will be transmit into national grid.



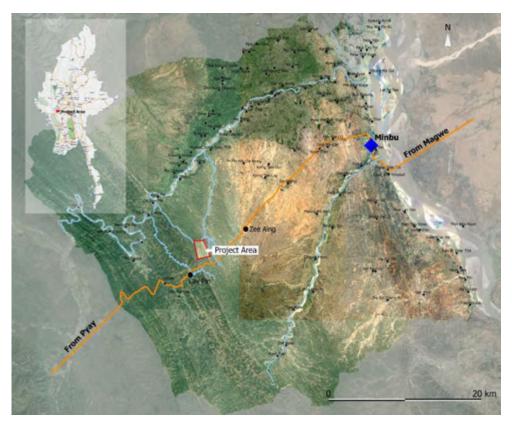
The terrain on the site before the construction and the image of solar power plant to be seen after the completion of construction process

Surrounding Environment

The solar power plant project of the GEP (Myanmar) Co Ltd is located at Minbu Township, 500 km northwest from Yangon and 200 km west of Nay Pyi Taw. The land is 836 acres wide, hilly area beside Minbu-Padan-Ann road way, 16 miles distance from Minbu, Magwe Region.

The land is in the *Lay Pin-Ahing Ma* proposed outside field forest conservation area under the Ministry of Environmental Conservation and Forestry. On the site, large trees are scarce and there are mostly bushes and small trees. A significant feature is that there are a lot of small hills or mounds with steep slopes.

The nearest villages from the sites are Lay Pin and Zee Aing. Lay Pin village (435 households) is located 1.27 miles to the South-West and Zee Aing village (190 households) is 3.34 miles to the North-East.



Map of Minbu Township and Project location

Potential Environmental Impact

The environmental and social impact assessment team of MSR has conducted this ESIA study. The study team of MSR comprises three expert teams: the physical environment study team, the biological environment study team and the social impact assessment team.

Impact on Physical Environment

Physical environmental study team of MSR studied topographic map, site layout plan, hydrology report, design of storm water drains and associated structures, and conceptual design of the project. The team visited the site and observable locations of the proposed project and decided to collect samples as base line data for this environmental impact assessment.

The study team found that soil could be impacted negatively at site by land preparation, construction, operation, and decommissioning. As baseline data, soil samples were collected to analyze soil nutrient and harmful heavy metal of the soil.

Air could be polluted by dust emission, operating of machineries, which use diesel fuel at construction, operation and decommission phases. Ambient air quality baseline data was collected.

Surface water and ground water could be impacted by oil spills, dumping of materials, dumping of solid waste. Surface and ground water samples were collected and analyzed water quality. Laboratory results of water samples were recorded as baseline data.

Impact on Biological Environment

The projects can cause undesirable impact on terrestrial ecosystem. This land's forest cover is not closed type with thick trees and plants; it is open and dry type with scattering trees, but rich with wildlife if it can be kept in actual ecosystem. In terms of aquatic impact,

this area does not have visible change in aquatic ecosystem, but rather change of drainage.

In conversion of landscape from forestland to industrial compound, this level size of 836-acre removal of vegetation has an impact to the ecosystem's functioning of the fragile ecosystem of such dry forest. Vegetation has many essential roles in the ecosystem. Primarily it is the first level in the terrestrial food chain upon which all organisms depend. Secondly vegetation provides habitat and cover for organisms, as well as providing stability of soils with its root systems.

Habitat loss forces moveable animal to migrate to nearby habitable tree-covered areas, unmovable organisms and slow moving creatures are terminated.

Potential toxic effects to plants and animals as a result of air- or water-pollutant discharges or waste-disposal activities of industries will also have negative impact on surrounding ecological function.

Impact on Social Environment

The two nearest villages to Minbu Solar Power Plant Project site are Lay Pin and Zee Aing Villages. Cultivation of beans and pulses and sesame is the mainstay of the local economy. There are livestock farmers who breed cows or goats. There is no rice cultivation in either village. The staple crops grown in both villages are beans and pulses and sesame.

As the land of project area is under the controlled of the Ministry of Natural Resources and Environmental Conservation, there was not much direct impact to the local community due to land acquisition for the project, apart from some households that grow crops on a few acre of land in the area. The area of land cultivated by the farmers in the project area is about 9.55 acre in total. All disputes and claims for this 9.55 acres area has been settled as per Appendix 12.44, 12.43 and 12.46.

The farmers and community members wanted the project developer to give compensations to the farmers not only for their crops but also for their land. They would like the farmers who lost their land in the project but do not have land ownership certificate (Form 7) to be compensated by the project developer.

Impact	Construction Phase	Operation Phase	Decommissioning Phase
Soil	Significant Risk	Low Risk	Moderate Risk
Dust Emission	Significant Risk	Low Risk	Moderate Risk
Water	Significant Risk	Low Risk	Moderate Risk
Air pollution	Significant Risk	Low Risk	Moderate Risk
Noise & Vibration	Significant Risk	Low Risk	Moderate Risk
Solid waste	Significant Risk	Low Risk	Significant Risk
Traffic Flow	Significant Risk	Low Risk	Moderate Risk
Risk of Accident	Significant Risk	Low Risk	Significant Risk
Visual Quality	Significant Risk	High Risk	Moderate Risk
Social Impact	Significant Risk	Significant Risk	Moderate Risk
Flora	Significant Risk	Significant Risk	Moderate Risk
Fauna	Significant Risk	Significant Risk	Moderate Risk

Mitigation measure and Monitoring Plan

This chapter outlines the necessary mitigation measures that will be adopted to prevent or minimized significant negative environmental impacts associated with the activities of the project during preparation phase, construction phase, operation phase and decommissioning phase.

Physical Mitigation Measures

Soil erosion

At the rainy season of during preparation phase, construction phase and operation phase, soil erosion will be occurred at surface water exits. To avoid erosion along exits of five streams the developer should be monitored randomly at site and construction of sand traps, stilling basins and taming works will mitigate. Monitoring to proper drainage gradient and provision of soil erosion and conservation structures will mitigate soil erosion.





Soil Erosion

Dust emission

Dust emission during preparation phase, construction phase and operation phase will be minimized through restricted speed control of earth moving machines, transport buses and traffic within the project site. Pouring water on road ways at site and excavated area cutting area, filling area and compacting area will reduce rising of dust in dry season. The contractor should install a wash deck at the exit way of the site to remove mud from vehicles which may become dust around the site and along the main road. Trucks need to install proper covers when carrying sand, river shingles and cement to avoid falling down along the main road and emission of particulates.



Pouring water on site

Air Pollution

Diesel combustion of earth moving machineries such as loaders, excavators, trucks, dumpers, bulldozers, back holes, compactors, road rollers, graders, diesel generators and management vehicles will contribute dust, CO_2 , NO_2 , and fine particulate matters ($PM_{2.5}$ and PM_{10}).





Air quality sample data collecting

Heavy machineries working at site

MSR survey team observed and collected air quality samples at proposed site. Air quality Haz-scaner machine is installed at the center point of the proposed site. Analytical data of air quality Haz-scaner analyzed and operated by Occupational and Environmental Health Laboratory experts, Ministry of Health, and the results indicates;

Hydrocarbon HC is 9613 ppm and Methane CH_4 is 17404 ppm. PM_{10} (24 Hr) is (24 ug/m3) which is lower than reference value (50 ug/m³). $PM_{2.5}$ (24 Hr) is (35.4 ug/m3) which is quite over than reference value. NO_2 (1 Hr) is (11953 ug/m³) which is enormously higher than its reference value (200 ug/m³).

 SO_2 (24 Hr) is (865.7 ug/m3) which is quite higher than its reference value (20 ug/m³). O_3 (8 Hr) is (6960 ug/m3) which is very higher than its reference value (100 ug/m³). CO (1 Hr) is (76.3 ug/m3) which is very lower than its reference value (30000 ug/m³). VOCS (1Hr) is (88.6 ug/m³) which is lower than its reference value (400 ug/m³).

Harmful substances and gas such as $PM_{2.5}$, NO_2 , SO_2 and O_3 are significantly higher than reference value. These indicated emission of carbon particular content from exhausts and largely diesel fuels are burning around the site. Such emission and air pollution lead to several environmental impacts including global warming and human health as lungs problem, heart attack, asthma and irritate respiratory system which will lead to immature death.

But the proposed project site is quite far from nearest villages, air pollution may not occur to these villages. Surrounding environment of proposed site will be effected air pollution impact to workers, operators and office staffs. During construction phase, a large quantity of preparation of gradient of earthwork will consume diesel fuel oil at proposed site, air pollution will be effected obviously. This impact will be effected during construction phase of the project.

Collected data from developer and contractor, they have used 8200 gallons of diesel fuel for running of earth moving machineries which consumed 24 hours during construction phase of designated grading earth work.

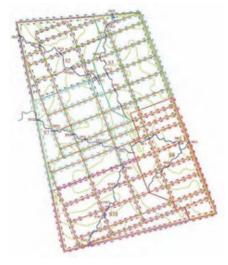
The existing base line analytical report of air quality is significantly higher than ECD standard but impact of air pollution is only temporary impact during preparing of earthwork. This impact will not become as a cumulative impact to environment.

During preparing of earth work, provision of personal protect equipment (PPE) such as nose masks to workers, regular maintenance of machineries, educate to workers to understand working at the surrounding of hazards, educate not to smoke, monitoring to blue and black smoke from engine exhausts to engine tuning will be mitigate the impact of air pollution. Developer should install and record monthly air quality tests during earthwork and installation of PV solar panels.

Noise Vibration

Only during construction phase, noise and vibration impact will be minimized by construction machineries like as machines, excavators, loaders, dumpers, concrete mixers, vibrators and metal cuttings. To reduce the impact of noise and vibration, construction machineries should be maintain properly. Prohibition of working at night shift and limited working hours will mitigate noise and vibration impact during construction phase only.

Surface water/Groundwater contamination

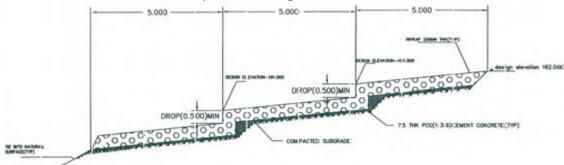


Drain Network

Concrete foundation process at 230 kV towers, Substation construction, office building constructions and construction of quarters and residents will excavate surface earth. Deeply excavated foundation will pass through water layers and water body at ground. Cast in place foundation process needs to use cement and hardener chemicals. These would be take place in ground water till setting time of concrete. Temporary contamination of ground water will occur during concrete construction. The negative impacts during construction phase, especially at rainy season, surface water and ground water will be contaminated by stacking of solid waste, oil spill, improper storage of fuel oil, chemical and hazardous materials, piling of construction materials, handling of PV solar panels, transporting of materials and disordered sewage disposal.

Hydrology and Minimization of rain water flow

During rainy season, to control soil erosion and land slide at site, it is needed to control the velocity of rain water. It should be made ensure that leveling the drains can be minimized at construction phase. Construction of concrete drains at steep levels and proper gradient at temporary drain can control the velocity of rain water and unnecessary erosion. To mitigate unnecessary erosion and land slide, developer needs to construct sedimentation basins, sand traps and taming at water outlet areas.



Typical drain over slopes

Handling of PV Solar Panels

The developer will install PV solar panels at racks, which are constructed as super structure framework above pressed pile foundation. PV solar panels will be imported and carried to worksite. There may not storage warehouse at project yard. The developer will stack PV Solar panels at stacking yards S1, S2, and S3 and will be delivered for installation. During construction and operation phase substitution of damage panels will be used from spare stacking at stacking yards. The developer has planned to remove damages of PV panels with safety package. There is no plan to be stored at ware house, buried or incineration



at site. The package and damage of solar panels would be handled systematically by expertise persons. Negligence of handling and dispose of damaged PV solar panels, these

materials pose serious environmental and public health by gallium arsenide, copperindium-gallium-diselenide and cadmium telluride. Such as dangerous and harmful elements will be followed through with the rainwater and surrounding environment along the streams will be impacted negatively.

Traffic Flow

Proper planning of transportation of heavy machineries and construction materials will reduce unnecessary traffic congestion. During construction and operation phase, assignment of a staff at the entrance of project site will mitigate disturbance of traffic flow during Shwesettaw Pagoda festival. Installing road signs, caution signs and traffic signal lights will mitigate traffic congestion and help a smooth flow of traffic around proposed site during construction phase. The developer has planned car parking spaces at the entrance of office compound. At operation phase, office vehicles and workers ferry will be entered at site that there may be not traffic congestion.

Biological Mitigation Measures

The removal of trees and land leveling over whole project site causes negative impact on wildlife and ecosystem of the forested area in the landscape. Recommended mitigation measures to minimize the negative impact to the biological environment are listed below.



Outside field forest conservation area

- All the marginal and common lands available in the nearby area should be brought into a plantation program giving priority to native species for good green cover.
- Community Forestry (people's committee at village level) should be placed in the center of redevelopment efforts so as to provide protection of common property resources, local employment, and local people's participation.

• Raising public awareness upon presence of healthy ecosystems where trees and wildlife including micro-organisms and invertebrates should be present to maintain food-chains, food-webs, and biogeochemical cycles balanced should be strengthened assisting with an environmental education

• As a large-scale solar power project, management should have separate budget to provide CSR and mitigating activities of negative impacts of Solar Power.

Social Mitigation Measures

program in the region.

Measures to mitigate negative social impact of the project are recommended as follows: As this solar project is the first and foremost project in Myanmar, the party concerned should meet the local people and give educative talk to let them know that they should not be worried about it because it will have the least effects on the environment.

• In order to help Lay Pin villagers, as their village is closest to the project, they should have more job opportunities to work for the village. In order that to happen,

- the administrator of the village and village elders should form a team to help the villagers know about job vacancies in consultation with the project developer.
- During the period of the project implementation, arrangements should be systematically made by the company in order that relations with the community of Lay Pin and Zee Aing villages would be smooth and good.
- Compensation for land of Lay Pin village should be systematically reviewed and negotiations with the land-owners should be held.
- Only if the company is on friendly terms with the villages, difficulties that could come up in the future will be overcome. Activities related to social activities for the villagers should be constantly done.
- As a big electricity-generation project is about to come into being near them, the first priority of providing electricity to them should be included in the agendas of CSR activities.
- During the project, as the trees, bushes and groves that cover over 800 acres of forest area have been felled and cleared, the surrounding area of the open field, that can be seen should systematically be reinstalled with lush green plants by creating greening nurseries so that it will alleviate the worries of people in the neighbourhood.
- Developer has formulated the clear CSR plan to include
 - a. Development Plan of Water Supply system in Rural Area
 - b. Development Plan of Solar Power for Household Use in Rural Area
 - c. Development of Plan of Health Clinic Center
 - d. Development Plan of Education, Schools and Libraries which will cover all nearby villages and expand to further villages during the 30 Years CSR paln. (See Appendix 12.55)
- GEP (Myanmar) ha contributed Dry Zone Greening Committee for the replantion trees in accordance with field survey and this field survey was conducted by Magway Region Forestry Department. (See Appendix 12.49)
- All necessary compensation for land has been contributed by GEP (Myanmar)...
- Community members want to have electricity installed, tube wells sunk, and school buildings constructed as part of the developer's CSR activities or as donations to the communities concerned. The developer may organize meetings with local authorities, local elders and community members and tell them which would be their priorities if it cannot fulfill all their wishes. The meetings should be inclusive and participatory.

Environmental Management and Monitoring Plan (EMP)

In order to mitigate potential negative environmental and social impacts of the project, environmental management and monitoring plan was formulated by MSR to be in accordance with the Envitomental Conservation Law of 2012. In the EMP matrix, mitigation measures, responsible person or organization to undertake the mitigation measures, monitoring means and frequency are recommended for each and every potential environmental or social impact. Estimated budget for the implementation of EMP is also included. EMP in details is provided in the chapter 8 of this report. The developer is responsible for duly implementation of the EMP as necessary.

Public Consultation

Public consultations were held in both villages. The public consultation in Lay Pin village was attended by 68 participants including Member of Parliament of Minbu Township Constituency-1, Regional Parliament, and the general manager of GEP (Myanmar) company, the project developer, village-tract authorities, local elders, farmers and

community members. It was held on September 12 morning and lasted for about two hours and a half. The consultation in Zee Aing village was attended by 38 participants who included farmers and community members from neighbouring villages. The GEP company officials were also present. The meeting was held in the afternoon of September 12. It also lasted about one hour and a half.

In addition to two public consultations, key informant interviews were held with key stakeholders. They included five government personnel, 9 local authorities, community members, farmers and religious leaders from Lay Pin Village and seven farmers and community members from Zee Aing Village.

Findings from public consultations and in-depth interviews with key stakeholders revealed that regional and local authorities as well as community members do not express much concern about causing damage to the environment due to the project. However, some stressed that there should be some reforestation programmes initiated to compensate for the loss of trees felled in clearing land for the project. Local authorities, local elders, farmers and community members wanted the project developer to give compensations to the farmers not only for their crops but also for their land. They would like the farmers who lost their land in the project but do not have land ownership certificate (Form 7) to be compensated by the project developer. Land compensation settlement for the acres of 9.55.

Community members want to have electricity installed, tube wells sunk, and school buildings constructed as part of the developer's CSR activities or as donations to the communities concerned. (See appendix 12.55)

Local residents want the company to be more transparent about advertising jobs related to the project. They want the company to put job announcements in their villages—Lay Pin and Zee Aing—which are closest to the project area. A representative of the project developer stated that those who meet the job requirements, especially educational qualifications, could be employed at the project.

For further ongoing consultations, the GEP shall have a liaison officer or officers who will deal with the national regional, district, township and ward/village-tract authorities as well as local elders and community members. Mechanisms should have been developed for the company officials to inform the government officials and local people of their plans and for the local people to inform the company officials of their wishes, desires and complaints and grievances.



This assessment comprises two components:

Environmental Impact Assessment (EIA)

The EIA covers the site proposed for development of a Solar Power Plant, about 15.5 miles to the south-west of Minbu (Sagu) Township, Magwe Region.

Socio-economic Impact Assessment (SIA)

The SIA covers the residential place near the proposed project site, known as "Lay Pin" and "Zee Aing" Villages.

Both EIA and SIA are collectively termed "ESIA" in this report.

TERMS AND ACRONYMS

TERMS

U	"U" is an honorific placed before the name of a male adult. It is an equivalent of "Mr." It does not say whether the person addressed is single or married.
Daw	"Daw" is an honorific placed before the name of a female adult. It does not say whether the person addressed is single or married.
Ma	"Ma" is used to address a female child or a young lady. Women of same age—young or old—also address each other using this honorific. Especially older persons use this address for younger persons.
Ko	"Ko" is used to address a young man. Men of same age—young or old—also address each other using this honorific. Older persons also use this address for younger persons.
pyi	Myanmar volume measuring unit. There are 16 pyi's in a basket. There are 8 tin-fuls in a pyi. (tin = condensed milk tin)
viss	Myanmar weight measuring unit: One viss is equal to 3.6 pounds or 1.65 kilograms.

Basic Education System in Myanmar	
	1 st Grade (Kindergarten)
	2 nd Grade
	3 rd Grade
	4 th Grade
	5 th Grade
	6 th Grade
	7 th Grade
	8 th Grade

9 th Grade
10 th Grade
11 th Grade (Matriculation)

After completing 11 years of Basic Education, a student can join an institution of higher learning.

Post-Primary School	A primary school teaching some more Middle S addition to the Primary School grades.	School grades in
	addition to the Primary School grades.	

ACRONYMS

AC	Alternating Current
ASL	Above Sea Level
COD	Commercial Operating Date
CSR	Corporate Social Responsibility
DC	Direct Current
ECD	Environmental Conservation Department
MNREC	Ministry of Natural Resources and Environmental Conservation
EIA	Environmental Impact Assessment
ELT	English Language Teaching
EMP	Environmental Management Plan
ESIA	Environmental and Socio-economic Impact Assessment
GEP	GEP (Myanmar)
kW	Kilowatt
kWh	Kilowatt hour
GWh	Gigawatt hour
TWh	Terawatt hour
EPGE	Electric Power Generation Enterprise
MMK	Myanmar kyat
MoU	Memorandum of Understanding
MSR	Myanmar Survey Research
MW	Megawatt
NLD	National League for Democracy
NPED	National Planning and Economic Development
NPT	Nay Pyi Taw (the capital city)
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PV	Photovoltaic
SCF	Save the Children Fund (INGO)
SIA	Socio-economic Impact Assessment
SMP	Socioeconomic Management Plan
CDDC	State Peace and Development Council (Title of the former military
SPDC	government)
THB	Thai baht
USD	United States dollar
USDP	Union Solidarity and Development Party



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2. INTRODUCTION

2.1 THE PROJECT AND THE PROJECT PROPONENT

GEP (Myanmar) Company Limited ("GEP"), who has been engaged in a development of 220 MW (DC) solar power plant in Minbu (Approximately 200 km west of Nay Pyi Taw, the capital city), Myanmar

GEP has been awarded a concession to develop and operate the project under 30 years Built-Operate-Transfer basis, with a tariff rate of USD 0.1275 per kWh

The project will be divided into 4 phases of which the first 3 phases with an installed capacity of 50 MW (DC) and the last phase of approx. 70 MW (DC). The first phase is expected to be completed with a COD date by Q2, 2017. The other 3 phases will have COD dates in the following next 12 months, 24 months and 36 months respectively

GEP already engaged Black & Veatch, a top global engineering design firm, to draw the conceptual, detailed, construction and as-built designs for the Project.

GEP opened EPC bidding for the Project on the turn-key EPC basis (EPC + Financing) and the finalist is CTIEC.

The total construction cost is approx. at USD 1.35 million per MW, which equivalent to USD 297 million for 220MW (DC) project.

PROJECT SUMMAR	PROJECT SUMMARY				
Project Name	Minbu Solar Power Plant				
Location:	Minbu Township, Magway Region 15 miles from the city of Minbu.				
Site area:	836 Acres				
Land Lease	 30 years Lease plus 10+10 years extension Leasehold from Government Perpetual lease co-terminus with project 				
Capacity	Approx. 220.6 MW (DC) / 170MW (AC) (Phase I 50 MW, Phase II 50 MW, Phase III 50 MW and Phase IV 70 MW)				
Transmission Line	Minbu substation : 15 miles east Ann substation : 52 miles west				
Off-Taker	Electric Power Generation Enterprise (EPGE), Ministry of Electricity and Energy, The Government of the Republic of the Union of Myanmar.				
Tariff	30 Years USD 0.1275/kWh				
Construction Time	48 months (Phase I complete in 12months, Phase II in 24 months, Phase III in 36 months and Phase IV in 48 months)				
Capital Investment	USD 297 million (1MW = USD 1,350,000)				
	GEP (Myanmar) Co., Ltd.				
	Add: Bldg C, Rm 213~217, 2nd Flr, Kaba Aye Pagoda Rd.,Pearl Condo, Bahan, Yangon				
	Tel: +95-1-8604660~5				

Technical Consultant	Black & Veatch
Main Contractor:	CTIEC
Local Civil Sub- Contractor	SKG&RGP
Local Electrical Sub-Contractor	EPE

GEP (Myanmar) Co., Ltd. is developer of the project and Vintage engineering public Co;

Ltd is a partner. Black and Veatch is consultant and designer. Main contractor is CTIEC Co Ltd; and local sub- contractors are SKG Co Ltd; and RGP Co Ltd; for civil engineering works and EPE Co Ltd; for electrical construction and installation works.





Officials of Green
Earth Power (Thailand)
and Deputy Minister
for Electric Power U
Aung Than Oo and
officials of the Ministry
of Electric Power seen
after signing MoU on
developing a USD 275
million solar power
plant project to be
implemented in Minbu
(Sagu) Township,
Magwe Region,
Myanmar.

2.2 ELECTRICITY CONSUMPTION & STATE OF NEED IN MYANMAR

Myanmar has recently enter into era of reformation politically and economically. To develop the country in such require pace, the infrastructure is in high demand. Energy sector is part of infrastructure which plays the vital role of developing country. Without the infrastructure with sufficient power supply, the incentive to the foreign investment would not be attractive. The Ministry of Electricity and Energy is aware of such demand and the important of nature of industrial reformation, therefore, recent presentation took place at Hilton Hotel, Nay Pyi Taw on 17th May, 2016 mentioned the requirement of the energy rate in Myanmar. Not only the need of energy, but also the development of policy, institutional framework and opportunities in Energy sector were highly emphasized during the presentation. The need and lack of facility to supply amount of energy around the country is in such difficult situation, however, it is the best opportunity to invest and develop the infrastructure with require support and laws from the government. Energy sector power usage and the supply are as follow.

 Total energy capacity generated is 5.235 GWh, yet about 3.5 GWh are in operation level.

- The power consumption of the whole country is the lowest in South East Asia, however, the amount of consumption is nearly 14 TWh. Which is three times more than what is supplying currently
- The house hold connected to the national power grid line are less than 35%, yet more to be connected. The amount of rate increasing to the connection grid line is up to 5% every two years with promising rate.
- The transmission line available around the country has sufficient amount up to 5TWh. However, the nature of tropical country, the power line may be overloaded as the power grids needed to be upgraded.

Additional, the people are preferred to use power from the grid line, the Minbu, Solar power plant has big opportunity to the high demand market with sufficient market distribution grid line for 220 MWh capacity. Nevertheless, it will enhance the use of recyclable energy as green energy which can have great opportunity to gain significant reputation of energy sector in South East Asia to the worldwide.

Current Status of Electricity Supply in 2015-2016

Table 1: Installed Capacity of Power Plant in 2015-2016							
Type of Plant	Coal	Hydro	Gas	Diesel	Total		
Capacity (MW)	120	3185	1829	101	5235		
Energy Mix by Capacity	2%	61%	35%	2%	100%		

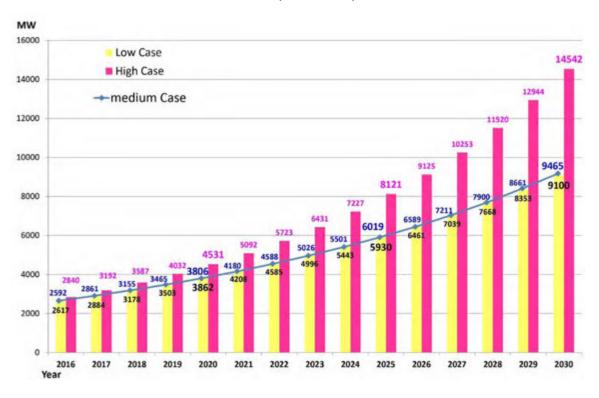
Table 2: Power Generation in 2015-2016							
Type of Plant	Coal	Hydro	Gas	Diesel	Total		
Generation (GWh)	-	9398.98	6517.75	55.23	15971.96		
Energy Mix by Capacity	-	58.85%	40.80%	0.35	100%		

Table 3: Electricity Consumption in 2015-2016						
Type of Use	Industrial	Residential	Commercial	Others	Total	Per Capital Consumption
kWh Million	4120.768	6674.658	2506.079	248.762	13550.26	
Percentage	30.41%	49.26%	18.49%	1.84%	100%	

Table 4: Current Status of Electrification in 2015-2016						
Rural Electrification Electrified Household(Million)						
	Total Nos. of Villages	Electrified Villages	%	Total Household (Million)	Electrified Household (Million)	%
428	63,860	31,416	49%	10.8	3.8	35%

	Table 5: Growth Electricity Consumption and Electrification							
			Electrified Household					
			No of Household (Million)	Percentage				
1	2010-2011	6,467.30	2.22	25%	108			
2	2011-2012	7,876.72	2.42	27%	131			
3	2012-2013	8,441.04	2.63	29%	141			
4	2013-2014	9,795.09	2.91	32%	163			
5	2014-2015	11,406.76	3.26	30%	222			
6	2015-2016	13,550.27	3.80	35%	263			

Demand Forecast for 15 Years Period (2016-2030)



2.3 THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT EXPERT TEAM

It is obligatory for the project proponent, GEP (Myanmar) Co., Ltd, to submit an Environmental and Socio-economic Impact Assessment (ESIA) with regard to the Project to the government authorities concerned. Hence, it has contracted Myanmar Survey Research – an independent and private research firm in Myanmar – to conduct this assessment to ensure that the Project will be environmentally sound and acceptable to local communities and in full compliance with guidelines and regulations of ECD and the Myanmar Environmental Conservation Law.

Myanmar Survey Research is a leading research company in Myanmar with more than 20 years of research experiences in social, Market, industry and ESIA.

Assessment team members



The MSR's assessment team for conducting this ESIA has been formed with the following environmental and social experts:

Name and designation	Position in team	Responsibility
U Kyaw Hlaing President, MSR	Leader	Overseeing the EIA assessment process and the project
Dr. San Tun Aung Senior Adviser	Dy Leader	Advising on socio-economic impact assessment and editing the report
U Tin Than Head, EIA Department, MSR	Member	Biological Impact Assessment, preparation of written documentation and report writing
Engr. U Myint Swe Consultant Engineer	Member	Specialist gathering data of Physical Environment and devising the Environmental Management and Monitoring Plan
U Aung Lin Librarian-cum-Databank Manager, MSR	Member	Co-writer of ESIA report and gathering data (Social impacts)
U Ko Ko Soe Lwin Thaw (a) Ko Soe GIS & IT Specialist, MSR	Member	Cartography, photography and designing
Daw Ei Ei Htwe (EIA Specialist)	Member	Environmental Policy
Daw Khin Moe Moe Aung, M.B.,B.S Medical Officer	Member	Health and Safety Specialist
Daw Tin Tin Htwe Staff, MSR	Member	Supporting Staff
National Health Laboratory Ministry of Health	Associate	Air, Noise Pressure, Water analysis
Land used Department	Associate	Soil

U Kyaw Hlaing (President-cum-Research Director)

U KYAW HLAING (PRESIDENT-CUM-RESEARCH DIRECTOR) is a founding member of Myanmar Survey Research (MSR), which was officially established in 1995.

He has had experience in conducting more than 300 research projects on various industries, macroeconomics, international relations and socio-economics and health. He is also a cofounder of AV Media Ltd, Yangon, Myanmar Monitor, Yangon and Myanmar Think Tank, which is attached to MSR. He has had experience in conducting five ESIA surveys.

He worked for Daikan Service Co Ltd in Tokyo, Japan, as a managerial assistant from 1992 to 1994. In 1995, he was an Administrative Associate at California Institute of Biological Research, San Diego, USA. In MSR, he was the Vice-President of MSR from 1995 to 1998.



U Kyaw Hlaing obtained a B Sc degree from Yangon University in 1985 and MA degree, specializing in International Management, from the International University of Japan in Niigata, in 1992.

U San Tun Aung, Ph.D (Sociology, University of Hawaii)

U SAN TUN AUNG has been Technical Advisor to Myanmar Survey Research since 2009. Before joining MSR, he served with IFRCR (International Federation of Red Cross and Red Crescent Societies), Myanmar Delegation Yangon, at various positions—Regional Information Officer and Senior Field Officer—from August 2004 to August 2008. From September 2002 to July 2004, he worked for Myanmar Red Cross Society, Yangon, in the position of Head of Communications. He was also Editor of The Myanmar Times, a weekly news journal published in two versions—Myanmar and English. He taught English to undergraduate students as a lecturer at English Language Institute, Thammasat



University, Bangkok, for one year from June 1993 to June 1994. The first organization he joined after university graduation was The Working People's Daily (Now renamed: The New Light of Myanmar), a State-owned English language newspaper. He was an editor there from July 1983 to July 1992.

He studied mathematics at University of Rangoon for BS and MS degrees which were conferred on him in 1977 and 1983 respectively. He obtained MA (International Development Program) from International University of Japan in 1998. Now he holds a Ph D, specializing in sociology, conferred by University of Hawaii, USA.

U Tin Than, M.Sc. (Ygn.), M.Sc. (AIT)



U TIN THAN started his career as a demonstrator and later was promoted to lecturer at Zoology Department of Rangoon University from 1972 to 1990. From 1990 to 1993 he worked as a private biology and English teacher at British American English Language School, Bangkok, Thailand. He was a consultant in Natural Resources Management and Development for Fifty-fifty Export-Import Co in Sangyaung, Yangon, from September to November in 1994. He worked as Program Associate at Environment and Natural Resources Program and Business Development Unit, Continuing Education Centre, Asian Institute of Technology, Bangkok, from 1995 to 1997. He joined World Wide Fund for Nature (WWF) at Thailand

Project Office as a Programme Officer from 1997 to 1999. He was promoted to the position of Senior Programme Officer up to 2005. From 2005 to 2013, he served as the Myanmar Program Coordinator/Myanmar Conservation Liaison Officer for Regional/Sub-regional Conservation Unit at WWF Thailand, WWF International Greater Mekong Program.

U Myint Swe, A.G.T.I (Civil), R.S.E. (M.Eng.C), M MES. Senior Licensed Engineer.

U MYINT SWE is currently the Civil Engineer of MSS Engineering Co Ltd, which is an affiliate of MSR. He received his degree of (A.G.T.I-Civil-74) from the Associateship of Government Technical Institute Insein Myanmar. He was formerly a YCDC official and conducted over 52 construction projects in Yangon City Development Committee (YCDC) from 1975 to 1992. He has had experienced in construction engineering And environmental sector for more than 21 years in inspection, surveying, site evaluation, drawing and calculating structure designs and consultation to building projects.



He was a Senior Licensed Building Engineer from Yangon City Development Committee and consulting building projects at Yangon.

He is now a member of the MSR's survey team as a consultant Engineer. He has conducted more than 11 projects in Physical Environmental Data Collection and devicing Environmental Management Plan and Monitoring Plan (EMP).

U Ye Nyunt (Senior Research Executive)



U YE NYUNT (SENIOR RESEARCH EXECUTIVE) joined Myanmar Survey Research in September 2008, four months after the outbreak of Nargis Cyclone in Myanmar, as a Research Executive. He has experienced more than 40 research projects—market, socioeconomics, health and the environmentalimpact assessment, **including five ESIA surveys conducted for CNOOC and Daewoo.**

Before joining MSR, he was a journalist for nearly 20 years—working as an editor for the State-owned New Light of Myanmar (former: The Working People's Daily) (in English), as a Business Writer for IT Myanmar Business and Technology Magazine (in English) and as the Chief Translator for The Popular Weekly News Journal (in Myanmar). After graduating from

International University Japan (Niigata) in 2000, he worked as a researcher at Association for Communication of Transcultural Studies (ACT Foundation) in Tokyo for one year.

As a writer with the pen-name "Ye Nyunt—MahaWeikzarNaing-Hset", he contributes articles to Today Media publications and B2B magazine (Device Co Ltd, Myanmar). The book "100 Ways to Motivate Others" translated by him into Myanmar was published by Today Media in 2012.

He obtained a B Sc, majoring in physics, from Yangon University in 1982 and MA, specializing in Political Economy, from the International University of Japan in Niigata, in 2000. He also studied journalism for a diploma at International Institute for Journalism in West Berlin, Germany, in 1990.

U Aung Lin (Librarian-cum-Databank Manager)



U AUNG LIN (LIBRARIAN-CUM-DATABANK MANAGER) joined MSR 15 years ago in 1998 as an Assistant Librarian who was responsible for gathering data and information.

He occasionally takes charge of MSR's data collection teams as supervisor on social and economic research projects. He was promoted to Librarian and Databank Manager in 2003. He monitors political and economic news stories carried by State-owned newspapers and private weekly news journals, and also carries out radio and television monitoring. He has had experience in conducting five ESIA surveys.

He is knowledgeable in almost all sectors and fields—the environment, deforestation, water and sanitation, mangroves, fishery industry, special economic zones (SEZs) and industrial zones, national infrastructure projects, hydropower and other sources of electricity, rice industry and agri-products, mining, etc.

Before joining MSR, he was a teacher from 1981 to 1998. With pen-names "Ko Lin Nwe (Main Ma Hla Island)" and "Ko Lynn Man Aung," he has written a total of 200 articles on the natural environment and reduction of natural disasters among other topics.

He was conferred a B.Sc with specialization in physics by Yangon University in 1979.

U Ko Ko Soe Lwin Thaw (GIS & IT Specialist)

U KO KO SOE LWIN THAW (GIS SPECIALIST), or better known as KoSoe,has officially been appointed a GIS and IT specialist since 2012. In fact, he has worked for MSR off and on since its founding, especially for cartography, designing and audio-video producing.

He was an Assistant Manager and also a Creative Director for Lao Fo Ye Co Ltd in Singapore from 2008 to 2012. He also worked as a producer/editor for MRTV 3 and MRTV 4, government television channels in English version, from 1996 to 2008. He is also engaged in live show production and post-production. From 1992 to 1995, he worked as a freelance videographer and video editor in Singapore. Bangkok Bureau of NHK Japan appointed him Assistant Cameraman (TV) from 1991 to 1992. Earlier from 1989 to 1991, he worked for AV Media Co Ltd (Yangon) as a cameraman.



He pursued his academic education, computer applications and advanced English in Singapore.

Daw Ei Ei Htwe (Environmental Policy Specialist)



DAW EI EI HTWE (EIA Specialist) joined MSR in 2010 as an Assistant Research Executive.

She is responsible for designing survey questionnaires, doing translation between Myanmar and English, serving as moderator at Focus Group Discussions on market and socio-economic surveys, and analyzing data and information for preparing research reports. During her studies in Japan, she compiled a Research Paper on **Reforestation and Deforestation of Myanmar**. She has had experience in conducting five ESIA surveys.

She specializes in natural environment. She has obtained a Diploma in Environmental Policy Program from International University of Japan in March, 2010. Her basic degree is BA (Honours) in International Relations, conferred by Yangon University, in 2004, and two years later, she upgraded her degree to MA (International Relations).

ESIA field data collection time period

The ESIA of the proposed Minbu Solar Power Plant project was conducted from September 2013 to early October 2013 and a follow-up ESIA study in September 2016.





Field Survey by MSR



Field Survey by MSR



Field Survey by MSR

Field Survey by MSR



3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 THE APPLICABLE LAWS AND LEGAL COMMITMENTS FOR SOLAR POWER PLANT

1. The Environmental Conservation Law (2012)

Purpose: to construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations; to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.

- The project proponent has to pay the compensation for damages if the project will causes injuries to environment under the sub-section (o) of section 7 of said law
- The project proponent has to purify, emit, dispose and keep the polluted materials in line with the stipulated standards, under section 14 of said law
- The project proponent has to install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment, under section 15 of said law.
- The project proponent has to allow relevant gover nmemt organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not, under section 24 of said law.
- The project proponent has to comply with the terms and conditions included in prior permission, under section25 of said law.
- The project proponent has to abide by the stipulations included in the rules, regulation, by-law, order, notification and procedure, which are issued by said law, under section 29.

2. The Environmental Conservation Rules (2014)

- The project proponent has to avoid emit, discharge or dispose the materials which can pollute to environment, or hazardous waste or hazardous material prescribed by notification in the place where directly or indirectly injure to public under subrule (a) of rule 68.
- The project proponent has to avoid performing to damage to ecosystem and the environment generated by said ecosystem under sub-rule (b) of rule 68.

3. Environment Impact Assessment Procedure (2015)

- The project proponent has to be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant who is appointed or hired to perform on behalf of project owner under sub-rule (a) of rule 102.
- The project proponent has to support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project under sub-rule (b) of rule 102.
- The project proponent has to fully implement all commitments of project and conditions included in EMP. Moreover the project proponent has to be liable for contractor and sub-contractor who perform on behalf of him/her have to fully abide by the relevant laws, rules, this procedure, EMP and all conditions under rule 103.

- The project proponent has to be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under rule 104.
- The project proponent has to inform the completed information, after specifying the adverse impacts caused by the project, from time to time under rule 105.
- The project proponent has to continuously monitor all adverse impacts in the preconstruction phrase, construction phrase, operation phrase, suspension phrase, closure phrase and post-closure phrase, moreover has to implement the EMP with abiding the all conditions included in ECC, relevant laws & rules and this procedure under rule 106.
- The project proponent has to submit, as soon as possible, the failures of his or her responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure or failure should be known by the Ministry the project proponent has to submit within 24 hours and other than this situation has to submit within 7 days from knowing it under rule 107.
- The project proponent has to submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP under rule 108.
- The project proponent has to prepare the monitoring report in accord with the rule 109
- The project proponent has to show this monitoring report in public place such as library, hall and website and office of project for the purpose to know this report by public within 10 days from the date which the report is submitted to the Ministry. Moreover has to give the copy of this report, by email or other way which way agreed with the asked person, to any asked person or organization under rule 110.
- The project proponent has to allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project & other work-place related to this project in any time under rule 113.
- The project proponent has to allow inspector to immediately enter and inspect in any time if it is emergency or failure to implement the requirements related to social or environment or caused to it under rule 115.
- The project proponent has to allow inspector to inspect the contractor and subcontractor who implement on behalf of project under rule 117.

4. Emission Quality Standards Guideline (2015)

 The project proponent has to emit, discharge or dispose in line with the standards stipulated in said guideline.

5. The Myanmar Investment Law (2016)

Purpose; to ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the prescribed insurance in line with the above law.

- The project proponent has to lease the land or building owned by government or private with lease agreement and register it by the registration of deeps law under sub-section (a) and (d) of section 50 of said law.
- The project proponent has to appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise, in line with the sub-section (b) of section51of said law.
- The project proponent has to appoint the nationalities in normal work without expertise, , in line with the sub-section (c) of section51of said law.
- The project proponent has to appoint either foreigner or nationality with the appointment agreement in accord with the law, in line with the sub-section (d) of section51of said law.

- The project proponent has to comply with the international best practices, existing laws, rules and procedures to not damage, pollute, and injure to environment, cultural heritage and social, in line with the sub-section (g) of section65of said law.
- The project proponent has to close the project after paying the compensation to the employees in accord with the existing laws if violates the appointment agreement or terminate, transfer or suspend the investment or reduce the number of employees, in line with the sub-section (i) of section65of said law.
- The project proponent has to pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period, in line with the sub-section (j) of section65of said law.
- The project proponent has to pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work, in line with the sub-section (k) of section65of said law.
- The project proponent has to stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, directives, in line with the sub-section (I) of section65of said law..
- The project proponent has to abide by labour laws, in line with the sub-section (m) of section65of said law.
- The project proponent has to pay the compensation to the injured person for damages if damages of environment or socio-economy is occurred by misuse of project, in line with the sub-section (o) of section65of said law.
- The project proponent has to allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project, in line with the sub-section (p) of section65of said law..
- The project proponent has to obtain the permission of MIC before EIA process and report back this process to MIC, in line with the sub-section (q) of section 65of said law.
- The project proponent has to insure the prescribed insurance by rules, under section 73 of said law.

6. The Electricity Law (2014)

Purpose: To ensure the compliance with the conditions of permission for productions of electricity, abiding by any stipulation, implementing with the best practices and paying compensation in line with above law.

- The project proponent will implement the project with the best practices to reduce the damages on the environment, health and socio-economy, also will pay compensation for the damages and will pay the fund for environmental conservation, under sub-section (b) of section 10 of said law.
- The project proponent has to take the certificate of electric safety, issued by the chief-inspector, before the commencement of power generation under section 18 of said law.
- The project proponent has to be liable for damages to any person or enterprise by failure to abide by the quality standards or rules, regulation, by-law, order and directive issued under said law according to sub-section(a) of section 21 of said law.
- The project proponent has to be liable for damages to any person or enterprise by negligence of project owner according to sub-section (a) of section22 of said law.
- The project owner has to comply with the permission for electric searching and generation under sub-section (a) and (b) of section 26 of said law.
- The project proponent will inform promptly to chief-inspector and head officer of related office while occurring of accident in electricity generation under section 27 of said law.

- The project proponent will comply with the standards, rules and procedure, moreover will allow the inspection by respected governmental department and organization if it is necessary under section 40 of said law.
- The project proponent will pay the compensation to anyone who is injured or caused to death in electric shock or fire caused by the negligence or omitting of the project owner or representative of project owner, under section 68 of said law.

7. Protection the Rights of National Races Law (2015)

Purpose: To ensure to disclose to residents ethnic nationalities about the project fully, moreover to ensure to cooperate with them. This law focuses the following matters;

- **Section 5** The project proponent has to disclose to the residents national races all about the project fully.
 - The project proponent has to cooperate with the residents national races.

8. The Public Health Law (1972)

Purpose: To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department. The project owner will cooperate with the authorized person or organization in line with the section 3 and 5 of said law.

- **Section 3** The project proponent has to abide by any instruction or stipulation for public health.
- Section 5 The project proponent has to allow any inspection, anytime, anywhere if it is needed

9. Prevention and Control of Communicable Diseases Law (1995)

Purpose: To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.

- The project proponent has to built the housing in line with the health standards, distribute the healthful drinking water & using water and arrange to systematically discharge the garbage & sewage under clause (9) of sub-section (a) of section 3 of said law.
- The project proponent has to abide by any instruction or stipulation by Department of health and Ministry of Health under section 4 of said law.
- The project proponent has to inform promptly to the nearest health department or hospital if the following are occurred: (section 9)
 - (a) Mass death of animals included in birds or chicken;
 - (b) Mass death of mouse;
 - (c) Suspense of occurring of communicable disease or occurring of communicable disease:
 - (d) Occurring of communicable disease which must be informed.
- The project proponent has to allow any inspection, anytime, anywhere if it is need to inspect by health officer under section 11 of said law.

10. The Control of Smoking and Consumption of Tobacco Product Law (2006)

Purpose: To ensure the creation of smoking area and non-smoking area in the power plant area for health and control of smoking.

- The project proponent has to keep the caption and mark referring that is nonsmoking area in the project area under sub-section (a) of section 9 of said law.
- The project proponent has to arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations under sub-section (b) of section 9 of said law.

 The project proponent has to supervise and carry out the measures so that no one shall smoke at the non-smoking area under sub-section (c) of section 9 of said law.

The project proponent has to allow the inspection of supervisory body in the power plant area under sub-section (d) of section 9 of said law.

11. The Myanmar Fire Force Law (2015)

Purpose: To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law. This law focused the following

- The project proponent has to institute the specific fire services, under sub-section (a) of section 25.
- The project owner has to provide materials and apparatuses for fire precaution and prevention. Sub-section (b) of section 25.

12. The Motor Vehicles law (2015) and Rules (1987)

Purpose: When the construction period and if it is needed in operation and production period for the all vehicles.

The project proponent has to promise to abide by the nearly all provisions of said law and rules, especially the provisions related to air pollution, noise pollution and life safety.

13. The Myanma Insurance Law

Purpose: The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanma Insurance. This law focuses the following matters;

Section 15 - If the project proponent uses the owned vehicles the project owner has to insure the insurance for injured person.

Section 16 The project proponent has to insure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public.

14. Labour Organization Law (2011)

Purpose: To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labour organizations systematically and independently.

- Section 17 The project owner promises to allow the labour organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labour laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached.
- **Section 18** The project proponent promises to demand the reappointment of worker who is dismissed by the employer without the conformity with the labour laws.
- **Section 19** The project proponent promises to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker.
- **Section 20** The project proponent promises the labour organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee's rights or interest contained in the labour laws.

- Section 21 The project proponent promises the labour organization to participate in solving the collective bargains of the employees in accord with the labour laws.
- **Section 22** The project proponent promises the labour organization to carry out the holding the meetings, going on strike and other collective activities in line with the procedure, regulation ,by-law and directive of relevant Chief Labour Organization .

15. The Settlement of Labour Dispute Law, 2012

- The project proponent has not to absent to negotiation within the stipulated time for complaint under section 38 of said law.
- The project proponent has not to change the existing stipulations for employees within conducting period before Tribunal under section 39 of said law.

16. Employment and Skill Development Law (2013)

Purpose: To ensure the job security and to develop the employee's skill with the fund of project owner.

- The project proponent has to appoint employees with the contract in line with the provision of section 5 of said law.
- The project proponent has to carry out the training programs with the policy of Skill Development Body to develop the employment skill of employees who is appointed or will be appointed, under section 14 of said law.
- The project proponent has to monthly pay to the fund, which is fund for development of skill of employees, not less below 0.5 percentage of the total payment to the level of worker supervisor and the workers below such level under sub-section (a) of section 30 of said law.

The project proponent has to promise not to deduct from the payment of employees for above mentioned fund under sub-section (b) of section 30 of said law.

17. 2013,The Minimum Wages Law

Purpose: To ensure the project owner pay the wages not less than prescribed wages and notify obviously this wages in work place, moreover to be inspected.

- The project proponent has to pay the wages in line with section 12 of said law.
- The project proponent has to notify the prescribed wages obviously in work place under sub-section (a) of section 13 of said law.
- The project proponent has to correctly record the lists, schedules, documents and wages and report these to the relevant department and give if these are asked while inspecting, in accord with the stipulations under sub-section (b)(c)(d) of section 13 of said law.
- The project proponent has to allow to be inspected by the inspector, under subsection (d) and (e) of section 13 and section 18 of said law.
- The project proponent has to allow holiday for medical treatment if the employee' health is not fit to work, under sub-section (f) of section 13 of said law.
- The project proponent has to allow holidays without deducting from the wages if one of parents or one of family dies, under sub-section (g) of section 13 of said law

18. Payment of Wages Law (2016)

• The project proponent has to pay the wages in accord with the section 3 and 4 of said law under section 3 & 4 of said law.

- The project proponent has to submit with the agreements of employees & reasonable ground to department if it is difficult to pay because of force majeure included in natural disaster under section 5 of said law.
- The project proponent has to abide by the provisions of section 7 to 13 in chapter (3) in respect of deduction from wages.
- The project proponent has to pay the overtime fees, prescribed by law, to the employees who work over working hours under section 14 of said law.

19. Workmen's Compensation Act (1923)

Purpose: To ensure the compensations to injured employee while implementing in line with the above law. To abide by the prescribed compensations in various kinds of injury. This law focuses as follow;

• **Section 13** The project proponent has to pay the compensation in line with the provisions of said law base on kind of injury and case by case.

20. The Leaves and Holiday Act (1951)

Purpose: The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves. This law focuses the following matters; The project proponent has to allow the leaves and holidays in line with the law.

21. Social Security Law

Purpose: The project proponent has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security offices and to pay the prescribed fund.

- The project proponent has to register to the respected social security office under sub-section (a) of section 11 of said law
- The project proponent has to pay the social security fund for at least four types of social security included in sub-section (a) of section 15 under section 15 of said law
- The project proponent has to pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees .Moreover the project owner will pay the cost for paying the above mentioned fund only myself under sub-section (b) of section 18 of said law.
- The project proponent has to pay the fund for accidence under sub-section (b) of section 48 of said law. (but this fund is not related to workmen compensation)
- The project proponent has to make correctly and submit the list and record provided in section 75 to respected social security office under section 75 of said law.

22. **Petroleum Act (1934)**

Purpose: The project will carry the oil in any phase and may import it. So, to ensure to take the license for importation and storage and abide by the stipulations in the license.

 The project proponent has to obtain the license for importation, transportation and storage of the fuel under section 3 of said law and abide by the stipulations in the license.

23. The Petroleum Rules (1937)

Purpose; To ensure the project owner has to abide by the stipulations for transportation of oil.

• The project proponent will abide by the provision of chapter (3) of the Petroleum Rules for transportation and the provisions of chapter (4) of said rules for storage.

24. The Underground Water Act (1930)

 The project proponent has to obtain the licence granted by the water officer for sinking the underground water before sinking water, under section 3 of said law

25. Conservation of Water Resources and Rivers Law (2006)

Purpose: The project proponent will avoid the disposal of stipulated materials into river-creek.

- The project proponent has to avoid any performing to damage to the river, creek and water resource under sub-section(a) of section 8.
- The project proponent has to avoid the violation of conditions stipulated by the directorate for prevention of water pollution under sub-section (b) of section 24.

26. Freshwater Fisheries Law (1991)

Purpose: According to the sub-section (e) of section 2 of said law, the freshwater area includes any river, creek, pond and water area so the project will use the river or creek which is freshwater area. If the project will build the dam beside the river and to change the water way in freshwater area to ensure getting the permission is granted by the fishery department before construction.

The project proponent has to avoid any water pollution and disturbing to fish &other aquatic lives in any fresh-water such as river, creek under section 40 of said law.

27. The Protection and Preservation of Cultural Heritage Regions Law (1998)

Purpose: To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made.

- Section 13 The project proponent has to apply to get the prior permission of Directorate of Ancient-Research to build the road, bridge or dam in the cultural heritage area.
- Section 22 The project proponent promises not to build the building which is not in line with the stipulations prescribed by the Ministry of Culture in the cultural heritage area.

28. The Protection and Preservation of Antique Objective Law (2015)

Purpose: To ensure the protection of ancient monument and information about it if it was in the project area. This law focus as follows;

• The project proponent has to inform to the village-tract or ward administrator if any antique objective is found in project area under section 12 of said law.

29. The Protection and Preservation of Ancient Monument Law (2015)

Purpose: To ensure the protection of ancient monument and information about it if it was in the project area. This law focus as follows;

- **Section 12** The project proponent has to report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water.
- Section 15 The project proponent has to obtain the prior permission of Department of Archaeology, Ministory of culture if the project area is in the prescribed area of Ancient monument.
- Sub-section (f) of section 20

 The project proponent has to obtain the prior permission, by written, of Department of Ancient Research and National Museum if the project proponent dispose the chemical and solid waste in the Ancient Monument are

30. The Farm Land Law (2012)

 The project proponent has to obtain the permit, to use the farm land other means except paddy land, issued by Magawe Region Government under sub-section (b) of section 30.

31. The Forest Law (1992)

• **Sub-section (a) of section 12** - The project proponent has to obtain the approval of Ministry if the project area is included in the forest land or the land administrated by the government which covers the forest under section 12.

3.2 CORPORATE ENVIRONMENTAL AND SOCIAL POLICIES

The National Environment Policy was drafted in 1994. The excerpts are stated below: To establish sound environment policies, utilization of water, land, forests, mineral, marine resources and other natural resources in order to conserve the environment and prevent its degradation, the Government of the Union of Myanmar adopts the following policy:

"The wealth of the nation is its people, its cultural heritage, its environment and its natural resources."

The objective of Myanmar's environmental policy is to achieve harmony and balance between its people, its cultural heritage, its environment and its natural resources through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens. Every nation has the sovereign right to utilize its natural resources in accordance with its environmental policies; but great care must be taken not to exceed its jurisdiction or infringe upon the interests of other nations. It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations.

The development of the environmental policy was followed by the drafting of 'Myanmar Agenda 21' in 1997, which follows a UN framework for a multi-pronged approach to sustainable development. Agenda 21 is a non-binding, voluntarily implemented action plan of the United Nations with regard to sustainable development. It is a product of the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in 1992. Agenda 21 – a global programme of action for achieving sustainable development to which countries are 'politically committed' rather than legally obligated.

The Myanmar Agenda 21 recognizes the need for Environmental Impact Assessments. Myanmar, in its Agenda 21, calls for integrated management of natural resources and provides a blueprint for achieving sustainable development.

3.3 POLICY AND LEGAL FRAMEWORK INCLUDING INTERNATIONAL CONVENTIONS, TREATIES AND AGREEMENTS, AND INTERNATIONAL STANDARDS, GUIDELINES

International Conventions, Treaties and Agreements

Myanmar has signed a number of international treaties related to the environment which may have implications for the Project. These include:

- a. Plant Protection Agreement for the Asia and Pacific Region; Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer;
- b. London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Laver:
- c. United Nations Framework Convention on Climate Change (UNFCCC); United Nations Convention to Combat Desertification;
- d. International Civil Aviation Organization: ANNEX 16 Annex to the Convention on International Civil Aviation Environmental Protection Vol. I, II, Aircraft Noise;
- e. Vienna Convention for the Protection of Ozone Layer;

- f. Montreal Protocol on Substances that Deplete the Ozone Layer;
- g. Convention Concerning the Protection of the World Cultural and Natural Heritage;
- h. Convention on Biological Diversity (CBD); International Tropical Timber Agreement (ITTA);
- i. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- j. ASEAN Agreement on the Conservation of Nature and Natural Resources;
 Catagena Protocol on Bio-safety
- k. Kyoto Protocol to the United Nations Framework Convention on Climate Change;
- I. Ramsar Convention on Wetlands; and
- m. Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer.
- n. United Nations Declaration on the Rights of Indigenous Peoples

International Standards and Guidelines

The following international standards, guidelines, policies and procedures are referred to, in preparation of this Report:

- a. UNEP Environmental Impact Assessment Training Resource Manual
- b. European Bank for Reconstruction and Development Sub-sectoral Environmental and Social Guidelines
- c. International Finance Corporation, World Bank Group Environmental, Health, and Safety Guidelines
- d. NHS, Health, Scotland
 Health Impact Assessment in Practice
- e. BS 14001:2004 Environmental management systems Requirements with guidance for use
- f. Principles of Environmental Impact Assessment Best Practice International Association for Impact Assessment
- g. OHSAS 18001, Occupational Health and Safety Assessment 3.3 Institutional Framework

3.4 INSTITUTIONAL FRAMEWORK

National Sustainable Development Strategy

The National Sustainable Development Strategy (NSDS) is part of a broader programme of the UN Sustainable Development Commission set up after the World Summit on Sustainable Development in 2002. Every country, including Myanmar, that signed Agenda 21 at the Earth Summit in Rio de Janeiro in 1992, agreed to develop an NSDS by 2010 in line with the Millennium Development Goals (MDGs). UNEP provided funding for Myanmar to develop an NSDS. The main aim of the process was to develop an NSDS in line with international standards by meeting the MDGs and ensure that environmental and social impacts are mitigated when implementing development projects. Myanmar's NSDS was published in August 2009.

The three goals described in Myanmar's NSDS are sustainable management of natural resources, integrated economic development and sustainable social development. Specific strategies are outlined under each goal. For example, the goal for Sustainable Management of Natural Resources suggests strategies for forest resource management, sustainable energy production and consumption, biodiversity conservation, sustainable freshwater resources management, sustainable management of land resources, sustainable management for mineral resources utilization, and so on.

3.5 PROJECT'S ENVIRONMENTAL AND SOCIAL STANDARD

Principle 17 of the Rio Declaration on Environment and Development stated;

'Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.'

3.5.1 Aims and objectives of EIA

Immediate objectives of EIA are to:

- improve the environmental design of the proposal;
- ensure that resources are used appropriately and efficiently;
- identify appropriate measures for mitigating the potential impacts of the proposal; and
- facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal

Long term objectives of EIA are to:

- protect human health and safety;
- avoid irreversible changes and serious damage to the environment;
- safeguard valued resources, natural areas and ecosystem components; and
- enhance the social aspects of the proposal

3.5.2 The evolving scope of EIA process and practice

In the early stages of EIA, only the biophysical impacts of proposals were considered (such as effects on air and water quality, flora and fauna, noise levels, climate and hydrological systems). Increasingly EIA processes are used to analyses a range of impact types within a single framework, include social, health, and economic aspects, e.g. social impact assessment (SIA), health impact assessment (HIA) and risk assessment.

However this trend toward integrated assessment for decision-making is by no means universal or uniform.

Even in EIA systems where this trend is well established, the degree and extent of integration varies with legal requirements and accepted practice.

Despite a lack of internationally consistent practice, integrated impact assessment, linking biophysical and socio-economic effects, is identified as an important priority in Agenda 21.

3.5.3 United Nations Declaration on the Rights of Indigenous Peoples

Myanmar has endorsed the United Nations Declaration on the Rights of Indigenous Peoples in September 2007 as one of 144 states. Article 32 describes indigenous peoples' right to free and prior informed consent (FPIC):

"States shall consult and co-operate in good faith with the Indigenous Peoples concerned through their own representative institutions in order to obtain FPIC prior to approval of any project affecting their land or territories".

Article 10 and Article 26 elaborate on forcible relocation of indigenous people, the need for FPIC and land rights. It is required to ensure conformance to all relevant international environmental and social conventions in relation to this project.

3.5.4 World Bank classification

World Bank Operational Directive on EIA, which is illustrative and provides a framework for screening.

Category A: for projects likely to have significant adverse environmental impacts that are serious (i.e., irreversible, affect vulnerable ethnic minorities, involve involuntary resettlement, or affect cultural heritage sites), diverse, or unprecedented, or that affect an area broader than the sites of facilities subject to physical works. A full EIA is required.

Category B: for projects likely to have adverse environmental impacts that are less significant than those of Category A projects, meaning that few if any of the impacts are likely to be irreversible, that they are site-specific, and that mitigation measures can be designed more readily than for Category A projects. Normally, a limited EIA will be undertaken to identify suitable mitigation and management measures, and incorporate them into the project.

Category C: for projects that are likely to have minimal or no adverse environmental impacts. No EIA is required.

3.5.5 Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment

The EIA Directive (85/337/EEC) has been in force since 1985 and applies to a wide range of defined public and private projects, which also respectively list projects subject to mandatory EIA and non-mandatory EIA.

Usually this kind of major projects, will warrant a full EIA, because they are known or considered to have potentially significant adverse impacts on the environment; for example, on human health and safety, rare or endangered species, protected areas, fragile or valued ecosystems, biological diversity, air and water quality, or the lifestyle and livelihood of local communities.



4. PROJECT DESCRIPTION AND ALTERNATIVE

4.1 PROJECT DESCRIPTION

GEP (Myanmar) Co., Ltd. has initiated a Photovoltaic solar power plant project which is located at Minbu Township 500 Km North West from Yangon and 200 KM west of Naypyidaw. The land is 836 acre wide, hilly area beside Minbu –Padan-Ann road way, 16 miles distance from Minbu, Magwe Region. Location of main project is between Latitude N2217000 to N2220000 and longitude E674100 to E675000 (exact location see at topographic map)

The project is designed to produce a gross annual output of 352300 MWh with a proposed gross generating capacity of 220.6 MW of direct current DC. The alternating current (AC) will be about 170 MW and to be sold to Ministry of Electric power through a new 230 kV transmission line that is currently being constructed and to be located 1 mile south from site. The nearest sub-stations where electricity will be distributed to, the Mann Sub-Station 15 miles east near Minbu and Ann Sub- Station 52 Mile west, near Ann. The project construction is expected to commence on March 2015 and will be completed on March 2020.

The project will construct in four phases. Phase 1.will be situated on 160 acre wide and will produce 50 MW, phase 2 will be situated on 160 acre wide and will produce 50 MW and phase 4 will be situated on 385 acre wide and will produce 50 MW of DC ratings respectively. The complete project of solar power plant will be produce 220.6 MW DC power and will be invert to 170 MW AC power. Inverted AC power will be step up to 230 kV by 3 NOs; 50 MVA transformers and 1 No; 70 MVA transformer which will be installed at transmission yard. 230 kV AC will transmit into national grid. Average annual product MWh is 352300.

The bulk of the total project area of 836 acres is the virgin land. Trees have been cut down and compensations were paid to the Department of Forestry for the trees that were felled. The project also covered some just 1.7 acres of farmland. Among them, a farmer of two acres had Form 7 (land rights certificate) while others just said they had been ploughing the land for generations but had no such certificates. The former had been compensated for his crops as well as his landownership. Since other farmers, who claimed land rights of the land but had no certificate, were compensated for their crops alone.

	PROJECT SUMMARY					
Project Name	Minbu Solar Power Plant					
Location:	Minbu Township, Magway Region 15 miles from the city of Minbu.					
Site area:	836 Acres					
Land Lease	 30 years contract plus 10+10 years extension Leasehold from Government Perpetual lease co-terminus with project 					
Capital Investment	USD 297 million (1MW = USD 1,350,000)					
Capacity	Approx. 220 MW (DC) (Phase I 50 MW, Phase II 50 MW, Phase III 50 MW and Phase IV 70 MW)					
Transmission Line	Minbu substation : 15 miles east Ann substation : 52 miles west					
Off-Taker	Electric Power Generation Enterprise (EPGE),					

	Ministry of Electricity and Energy, The Government of the Republic of the Union of Myanmar.			
Tariff	30 Years USD 0.1275/kWh			
Construction Time	48 months (Phase I complete in 12months, Phase II in 24 months, Phase III in 36 months and Phase IV in 48 months)			
	GEP (Myanmar) Co., Ltd			
	Add: Bldg C, Rm 213~217, 2nd Flr, Kaba Aye Pago Rd.,Pearl Condo, Bahan, Yangon			
	Tel:	+95-1-8604660~5		
Technical Consultant	Black & Ve	eatch		
Main Contractor:	CTIEC			
Local Civil Sub- Contractor	SKG&RGP			
Local Electrical Sub-Contractor	EPE			

The terrain on the site for construction of proposed Solar Power Plant

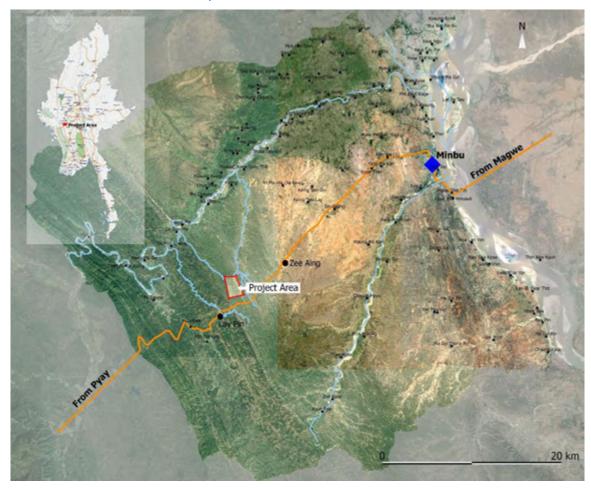




Image to be seen after the completion of the construction process



4.2 PROJECT LOCATION, OVERVIEW AND SITE LAYOUT MAPS



Map 1: Project location, overview and site layout maps



Image 1: Image of project area, Approach road

4.3 PROJECT DEVELOPMENT AND IMPLEMENTATION TIME SCHEDULES

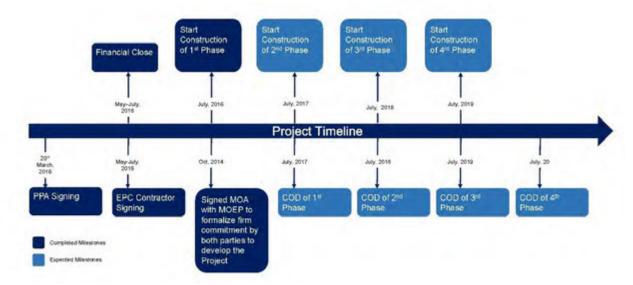


Figure 1: Project development and implementation time schedules

Table 6: Electricity production plan by phase

	Per Block	Total Plant	Phase 1	Phase 2	Phase 3	Phase 4
Block QTY		170	40	40	40	50
DC Rating (MWp)	2.62	220.6	50	50	50	70
AC Rating (MW)	2.0	170.0	40.0	40.0	40.0	50.0
MVA Rating	2.2	187	44	44	44	55
Transformer Rating (MVA)	2.2		40	40	40	50
Average Annual MWh	4,145	352,300	82,900	82,900	82,900	103,600

4.4 BLOCK DESIGN

- 14 Columns per row
- 30 Rows
 Mostly 2x24 racks, two 2x12 racks per row
- 3 meter "Combiner Box Access path" running N/S
- Two half-rows per 16 string Combiner Box Leaves two spare strings
- CB to Inverter cables through this path 7 inputs per inverter (one spare)
- 416 strings total, removed 4 strings for inverter house

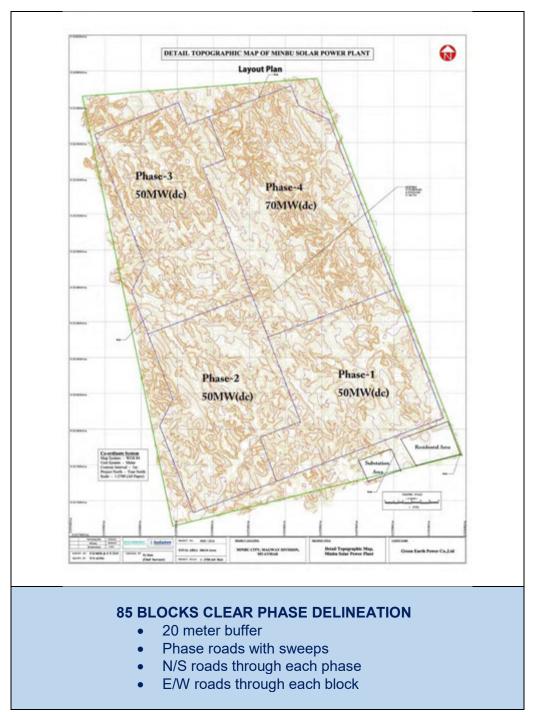
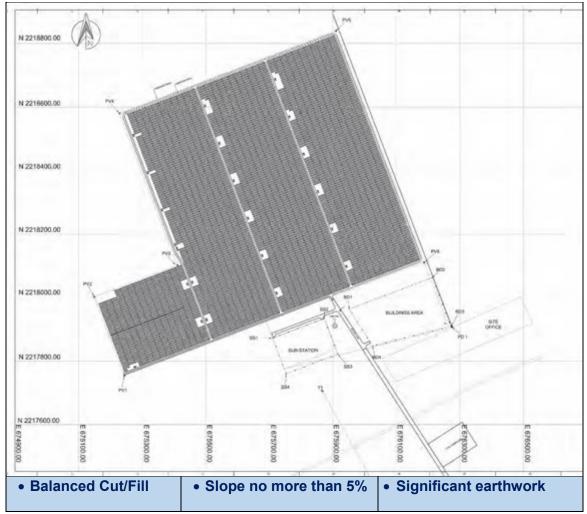


Figure 2: 85 Blocks clear phase delineation

Very simple construction method for solar power plant is preparing to earth work to be designated grading and slopes. Earth work in excavation, cutting, filling, shifting and compacting are significantly exist at construction phase. A large numbers of earth moving machines such as excavators, bull dozers, back holes, loaders, transporters, tippers, dumpers, rollers and compactors will be working at work site. Estimated cutting volume at all phases will be 3.79 million cu meter and filling volume will be 3.56 million cu meter.



Phase 1 Layout Plan

Description of Plant Phase	Cutting Volume (cu m)	Filling Volume (cu m)	Net Volume (Cu m)
All Phases	3,793,071 (3.79 Million)	3,563,997 (3.56 Million)	229,074
Phase-1	684,978 (0.685 Million)	7,99,961 (0.8 Million)	-114,983

Galvanize Iron C channels will be pressed into soil as pile driving about 2 to 3 meters and foundation of solar racks will be welded and fixed on. Aluminum frame structure racks will be installed for PV solar panels.

Product DC power will be inverted to AC power and step up to 230 kV and transmit to Mann sub- station and Ann sub-station.

4.5 FOUR CONSTRUCTION PHASES

The approach road, transmission, sub-station area and residential areas, drainage system, water resource / ground water & usage and electricity mentioned under Phase I will also be applicable to the remaining three phases.

4.5.1 CONSTRUCTION OF PHASE I

4.5.1.1 Approach road

The approach road way to work site is 920 meter length and 19.5ft (6) meter wide. The road is well compacted granular earth road at construction phase and after completion of the project the developer will be upgraded to cement concrete road. Cross sectional road limit is 100ft, wide, formation and subgrade is 40ft wide. Intersection road ways and parameter road ways will be constructed macadam road.



Approach road way to project site

4.5.1.2 Transmission Line

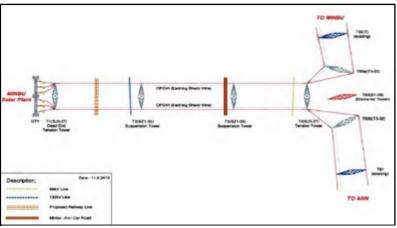


Figure 3: Minbu Solar Plant 230kV Transmission Line (IN & OUT) Project

230 kV transmission line is constructed with 4 Nos; average 29.5 meter towers and stringing work along left side of road way is completed to national grid. Each base of tower foundations take place 100ft x 100ft and mesh wire net fencing will be constructed for safety and unnecessary entry inside.



4.5.1.3 Sub-station area and residential area

Proposed residential area is 10 acres wide land at the right side of entrance gate. VIP guest houses, plant manager, deputy plant managers, staff quarters, workers quarters, lawn, water fountain and internal road way will be included.



Image 2: Phase 1, sub-station area and residential area

Sub-station area is 5 acres wide land at the left side of entrance gate. A single storey reinforced concrete design control building will be constructed to install 33 kV switch gear, AC/DC cabinet room, protection relaying room and telecommunication equipment, back up battery room, meeting room toilets, pantry and canteen. Inverter house with monitoring room will be provided. Maintenance and ware house building will be constructed to store electrical equipment, office area, meeting room and well-designed separated storage room to store oil and inflammable materials. Control office building is two storey RCC building with office room, meeting room, and VIP reception room, internet server rooms, manager rooms, toilet pantry rooms. Canteen building and security guard house will be constructed.

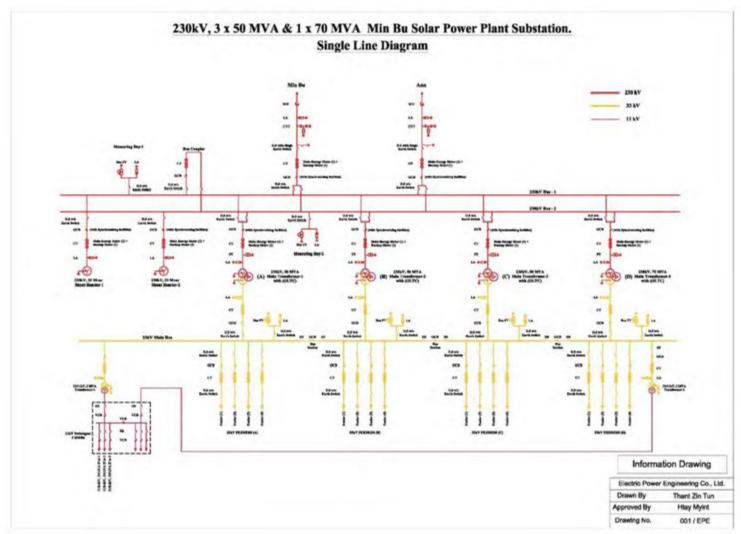


Figure 4: Minbu Solar Power Plant Substation, Single Line Diagram

4.5.1.4 Drainage System

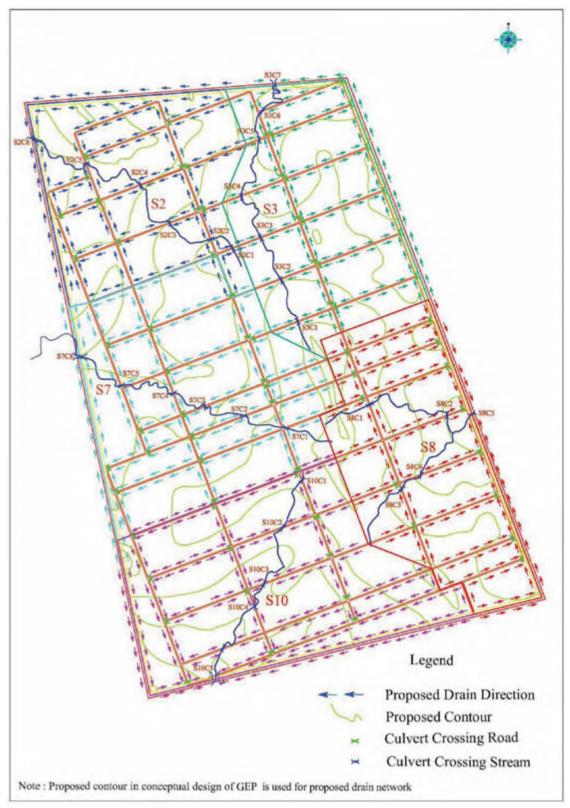


Figure 5: Proposed drain network

Compacted earthen drains will be constructed along the parameter road way, intersection road ways and main road ways. To mitigate erosion of soil during heavy rains the

developer will construct concrete pavements and drains at steep gradients such as near the outlet to (S2),(S3),(S7),(S10) and (S8).

Typical drain over slopes

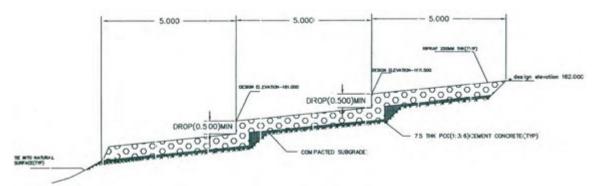


Figure 6: Typical drain over slopes

4.5.1.5 Water Resource / Ground Water and usage



The developer has already planned 4 numbers (6) inch diameter sunk tube wells with pump inside the project compound, Tube well No.1 is already installed with pump which can deliver 2245 gallons per hour. 600ft depth underground water will be supplied for its requirement of water during construction of phase 1. A 33000 gallons capacity of concrete ground tank is constructed near tube well no1 and delivering the requirement of water volume. Estimated daily usage, one hundred and fifty thousands (150000) gallons of water will be mainly used for spraying and pouring to earth work and approach road way. Tube well No. 2 is already drilled 580ft and the well be delivered 3300 gallons/hour. Tube well No.3 is drilled 465ft and can deliver 2126

gallons/hour. For next phases, tube well No.2 and No.3 will be installed pumps during construction phase including with each 33000 gallons capacity of concrete ground tanks. Transmission lines construction, sub-station construction, office construction, resident constructions, sanitary and washing purposes for a day will be used 30000 gallons. Tube well No.4 will be installed and use for residents. During installation phase, average usage of water will be 16000 gallons per day for cleaning and removing dust.

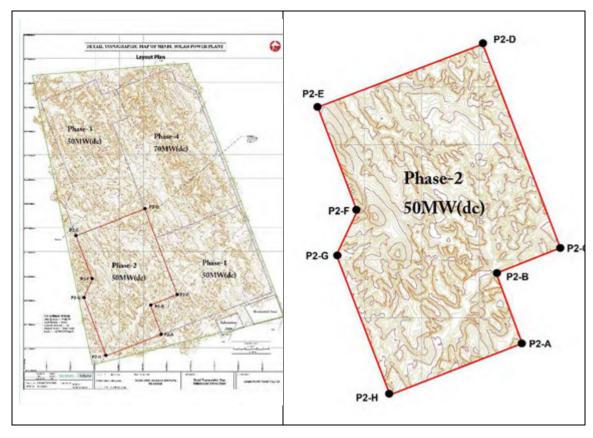
The major usage of water will be used for cleaning PV Modules during the operation phase and it is estimated 16,000 gallons per day. With our current design, the project area of 836 acres has drilled 4 Tube Wells. The capacity of storage ground tanks are 33,000 gallons each. The cleaning of the panels are scheduled to be carried out once every 3 months and based on the assumption of 16,000 gallons per day. As such, an acre of land would be consumed only 19-20 gallons per day of underground water resource. This amount of water is negligible to consider the underground water catchment of the proposed project.

4.5.1.6 Electricity

The project will use high consumption of electricity. The electricity will be supplied by government and installed from 66-11 kV Mann switch yard near Minbu which is 15 miles east of the project site. 11 kV high tension line is under construction and ranged 15 miles to work site. Existing electricity source is diesel generator. The developer will install 3 No;

315 kV transformers and drop to 440V. Tentatively, the developer arranged to install 315 kV transformers at eastern boundary of proposed land till the project completed. After construction phase is over, the developer will be installed at residential area for operation phase and rest two will be contributed to near villages. Along the parameter road, security lights will be installed.

4.5.2 CONSTRUCTION OF PHASE II

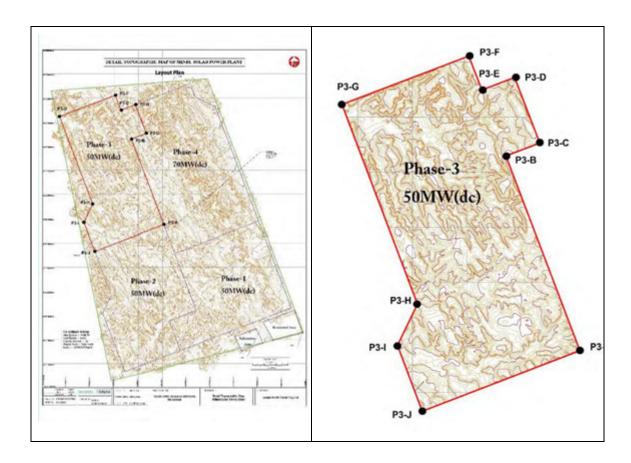


Phase II will be located at following latitude and Longitude:

	Latitude	Longitude
P2-A	20.048815°	94.675756°
P2-B	20.050864°	94.674965°
P2-C	20.051676°	94.677039°
P2-D	20.058040°	94.674630°
P2-E	20.056070°	94.668950°
P2-F	20.052906°	94.670198°
P2-G	20.051529°	94.669600°
P2-H	20.047243°	94.671055°

It will have a total coverage of 158 acres and generate 50MW (DC) of electricity.

4.5.3 CONSTRUCTION OF PHASE III

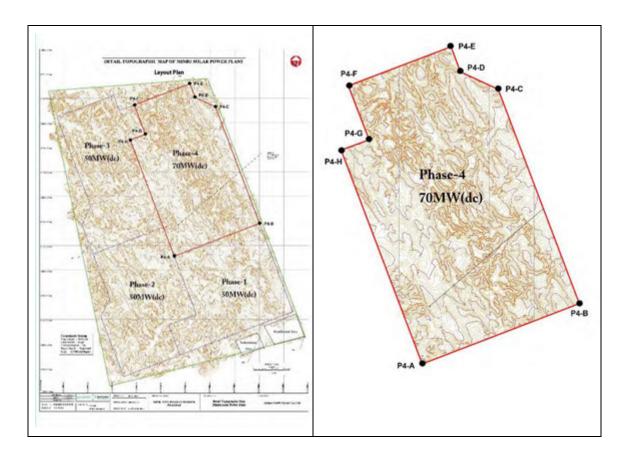


Phase III will be located at following latitude and Longitude:

	Latitude	Longitude
Р3-А	20.058040°	94.674630°
Р3-В	20.064343°	94.672020°
Р3-С	20.064820°	94.673220°
P3-D	20.066951°	94.672373°
Р3-Е	20.066555°	94.671212°
P3-F	20.067562°	94.670726°
P3-G	20.066096°	94.666274°
P3-H	20.059630°	94.668882°
P3-I	20.058237°	94.668151°
P3-J	20.056070°	94.668950°

It will have a total coverage of 158 acres and generate 50MW (DC) of electricity.

4.5.3 CONSTRUCTION OF PHASE IV



Phase IV will be located at following latitude and Longitude:

	Latitude	Longitude
P4-A	20.055937°	94.675411°
P4-B	20.058140°	94.682174°
P4-C	20.066763°	94.678777°
P4-D	20.067401°	94.677273°
P4-E	20.068472°	94.676730°
P4-F	20.066951°	94.672373°
P4-G	20.064820°	94.673220°
P4-H	20.064343°	94.672020°

It will have a total coverage of 220 acres and generate 70MW (DC) of electricity.

4.6 CURRENT STATUS OF CONSTRUCTION

MSR survey team visited Photovoltaic solar power project Minbu at 9-9-2016 to 13-9-2016. Earthwork in preparing for designated gradient is working day and night with heavy machineries. Phase 1 is under construction. Earth work in cutting, transporting, earth work in filling, and levelling works are running on. Bulldozers, back holes, loaders, tippers, dumpers, graders, road rollers, compactors are working at site. Cutting and filling works are under strictly controlled by surveyors and engineers. Continuous watering to earth work has seen. Phase (1) is under construction at 185 acre wide land. Earth work for designated gradient is working systematically and impressive.

Approach road way is completed with compacted earth surface. Spraying and pouring water to road ways are seen. 6 inch tube wells are drilled at each locations and a 30000 gallons concrete ground tank is constructed near tube well No.1 beside main sub-station area.

230 kV transmission line construction is completed with stringing to Mann and Ann both sides. Temporary looping is connected and center tower of national grid is removed.

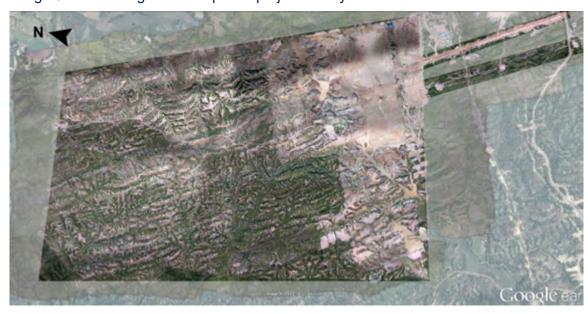


Image 3: Aerial Image of Solar power project site by MSR team



Aerial Photo of Solar Power Plant Project



Aerial Photo of Solar Power Plant Project



Spraying and pouring water to mitigate dust emission



Spraying and pouring water to mitigate dust emission



Designated grading levelling and compacting earth surface



Designated grading levelling and compacting earth surface

4.6.1 Temporary and permanent Worker's Quarters



Along the site cleaning phase, construction phase and operation phase of proposed solar power project, temporary offices, permanent offices, residents, quarters for workers, clinic, garage, canteen, dining rooms such infrastructure will be constructed with necessary toilets and bath rooms. At construction phase sewage of 800 workers will be generate at various location of work site and at operation phase sewage of 100 workers will be generate at office yard. Developer will construct septic tanks with systematic buffer walls, settling tank and soak pits. Irrigated area is very wide, low rainfall, high evaporation and arid region, the function will be going smoothly.

During construction phase of the proposed project 800 workers including with engineers, technicians and supervisors will be working daily. The contractor and developer have planned some temporary accommodations at site. Some workers who stay at nearby villages will be managed themself for transporation and accommodation.

At operation phase of the proposed project 100 workers including with 30 engineers, technicians and supervisors will be working daily. Only 70 ordinary workers including security persons will be working at site. The developer has planned permanent accomodations at office area. Only a few workers who stay at nearby villages will be managed theirself for transporation and accomodation.

Detail of Worker's Quarters

GEP (Myanmar) has arranged the temporary housing facilities for workers during the construction period. GEP (Myanmar) separates two labourer- groups: Civil and Electrical.

For the Civil work group, the temporary building are as follows.

- 9 long Dormitories/houses which is 25 feet x 40 feet (each for 30 people-33.33 square feet per person)
- 1 dormitory/house which is 45 feet x 20 feet (for 4 people) (225 square feet per person)
- 1 dormitory/house which is 40 feet x 20 feet including 1 living room (for 16 people) (50 square feet per person)
- 3 long Dormitories/houses which is 70 feet x 20 feet (each for 28 people) (50 square feet per person)
- 4 water tanks for the present population and some building has bathroom

For the Electrical work group, the temporary building are as follows.

• 2 long Dormitories/houses which is 10 feet x 70 feet (each for 14 people) (50 square feet per person)

- 4 long Dormitories/houses which is 26 feet x 64 feet (each for 48 people) (35 square feet per person)
- 4 water tanks for the present electrical work force

Note: 41 toilets for the total work force mentioned above (one toilet for every 15 persons/staff)

If more laborers arrive to join the current work force as an addition need, GEP (Myanmar) will build an increased number of accommodations for the migrant workers. Workers from nearby villages will join as additional workforce by arranging their stay themselves.

4.6.2 Solid Waste Disposal

During construction phase, large quantities of solid waste from site clearing, tree leaves, roots, cut logs, and other disposed will be generated as a result of the excavation and grading earth level at the site. Construction phase solid waste will consist of rejected parts of pre-casted concrete, solid components, surplus materials, rejected materials, papers, containers, broken bricks, solvent containers, empty paint drums, surplus oil and waste from workers. Developer has planned to collect solid waste at work site and incinerated at dumping ground. Such solid waste will be injurious to the environment through blockage of drainage system, choking of water bodies, and negative impact on human and animal health. This may be accentuated by the fact that some of the waste materials contain hazardous substances such as paints, solvent, cement, adhesives, and chemicals. Some of waste materials including plastic containers and plastic bags are not biodegradable and can have long term and cumulative effects on the environment. Developer will be sorted solid waste to be refined, reused and recycled. Disposal dumping ground will be buried and incinerate.

4.6.3 Toilets for construction phase

Sanitary equipment such as toilets construction for phase are constructed at lower level of the land and squat type pans are installed. Septic tanks are constructed systematically with necessary buffer walls and soak pits. Irrigated area is very wide, low rainfall, high evaporation and arid region, no need to install sewage treatment plant.



4.6.4 Health and safety

Parameter road way of the project compound is 20 meter wide and paved with compacted soil. It is fire protection distance to nearest surrounding forest. 30000 gallons capacity water storage tanks will be constructed at various location of project area and fire hydrants at passages for washing PV solar panels will be useful for emergency firefighting. Fire extinguishers are installed at office, canteen, garage, clinic and other supporting ware houses. Workers at construction phase and operation phase will be trained and drilled regularly.

Health and safety plans related to both electrical and civil engineering works are described in the appendices. Some of them are concerned with prevention and treatment of injuries and ill health.

Training to be provided to the employees, health and safety equipment/facilities to be installed and built as well as qualified persons to be assigned are mentioned in the appendices and the environmental management plan.

(Please see detail health and safety policy and plan in appendices 13.55 for electrical and 13.56 for civil engineering work)



4.6.5 Drinking water

A drinking water purification plant is installed at work site for workers and office staffs use. Water from tube well No1 is purified to be drinking water and distributed to work yards. A single storey clinic building is constructed at site office yard and handling emergency cases.





Drinking water purification plant

Clinic building

4.6.6 Security

Ten feet high mesh wire net fencing will be constructed along boundary of proposed project land. To prohibit entry of unauthorized persons and animals inside the project compound, the developer will construct concrete retaining wall at the base and mesh wire net will install above it, along the parameter. Main entrance gate will inspect and register all workers and office staffs during construction and operation phase. Site entrance gate will check all workers and engineers not to enter limited area where heavy machineries are working during construction phase.

4.7 ELECTROMAGNETIC WAVE EFFECT MANAGEMENT

The Major Equipment to be utilized for the Project construction includes SMA Brand's 2000 SC MV Power Station Inverter. SMA is the leading central inverter manufacturer used worldwide and the Grid-Friendly inverter is EMC certified with its built in Electro Magnetic (Environmental) Compatibility. The EMC compatibility ensures that the inverters works without causing any electromagnetic disturbances which are unacceptable to other devices in the vicinity. To conduct these properties, the inverters seamlessly function together and do not emit disturbances too large (emitted interference) and are able to resist a certain level of disturbances (interference stability). This inverter has come recommended by our Technical Advisor, Black and Veatch.



Flexible

- Globalsolution for international markets
- For all medium-voltage grids from 6.6 kV to 35 kV
- Various options

Robust

- · All components are type-tested
- 5-year statutory warranty
 Optimally suited to extreme
- ambient conditions

Easy to use

- Plug and play concept
- Ide ally suited to be exported to overseas markets
- Transportation in standard shipping container
- Preinstalled and mechanically protected cabling

Cost-effective

- Easy planning and installation
- Increased system availability and longer service life
- Lower transportation costs due to standardized dimensions

SMA Brand's 2000SC MV Power Station Inverter

4.8 CONSTRUCTION MANAGEMENT

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MINBU - PHASE 1 - 50 MW SITE MANAGEMENT ORGANIZATION CHART

The Management is committed to take all reasonable steps within its means to ensure a safe and healthy working environment to its employees, contractor personnel, clients, visitors and anyone else who is affected by the work.

In particular term, our policy is:

- (a) To place the Safety and Health of all employees ahead of the company's commercial interest.
- (b) To arrange, provide and maintain safe system of work for all employees.
- (c) To clearly define areas of safety and health responsibility.
- (d) To provide adequate and proper facilities, equipment and safety apparel and ensure its correct use.
- (e) To provide adequate training, information and instruction on safety and health conditions at the workplace.

With this policy, the Management believes that, with the support of its Employees and Sub-Contractor, we shall strive to continually improve our performance by:

- (a) Prevention of Injury
- (b) Prevention of ill health

All members of the workforce should acknowledge their responsibility for health, safety and welfare in conjunction with the above policy, and provide a positive contribution to the health and safety of themselves as well as others in the workplace.

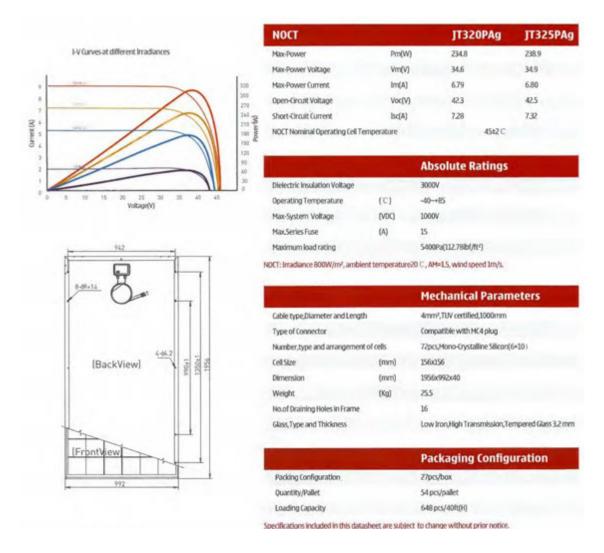
GENERAL SITE SAFETY RULES

Wear your safety helmet at all times in the hard hat or helmet zone.

- Wear safety glasses / goggles when chipping, grinding or whenever an eye injury hazard exists.
- Wear ear plug / mufflers when hacking or whenever a noise induced deafness (NID) hazard exist.
- Wear protective hand gloves when welding, gas cutting or whenever a hand injury hazard (burning) exists.
- Wear safety harness when working at height, edge of structures or whenever a falling hazard exists.
- Wear safety shoe / protective footwear at all times.
- Do not consume any form of alcoholic drink during working hour.
- No horse plays whilst working.
- Do not misuse or remove any fire protection equipment.
- Observe and obey all warning signs and notices.
- Report all unsafe conditions to your Supervisors or Safety Supervisor.
- Always follow the operating instruction, when in doubt ask your Supervisor.
- Do not remove any barricades or guardrails. If you need to do so, report to your Supervisor or Safety Supervisor.
- Always use grounded electrical equipment and hand tools which are in good condition.
- Do not throw any debris from height.

4.9 DESIGN, PARTS AND PROCESS OF SOLAR MODULES

The proposed project site will use Hi-Tech Solar panel a product of Jetion Solar Co., Ltd. was founded in 2004. Since its establishment Jetion Solar has been recognized as Key Hi-Tech Enterprise of China. In 2014, Jetion Solar joined CNBM (China National Building Materials Group Corporation). The State Council of People's Republic of China has approved to set up CNBM in1984, and the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) has started to directly supervise and manage CNBM. Currently, CNBM is one of the Fortune Global 500 firms holding a total asset of over 410 billion Yuan. As one of the top suppliers of solar photovoltaic products, Jestion Solar, possesses diversified production and operation ability.



PV Module Auto-production line introduction

Following images are some sample steps of PV module production.



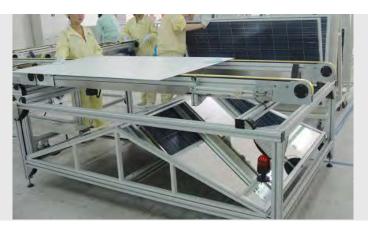
Lay up Inspection



Electro Luminescence test Before Lamination

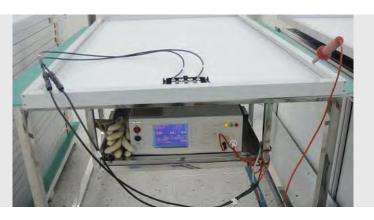


Lamination



Lamination inspection

Insulation test



I-V test

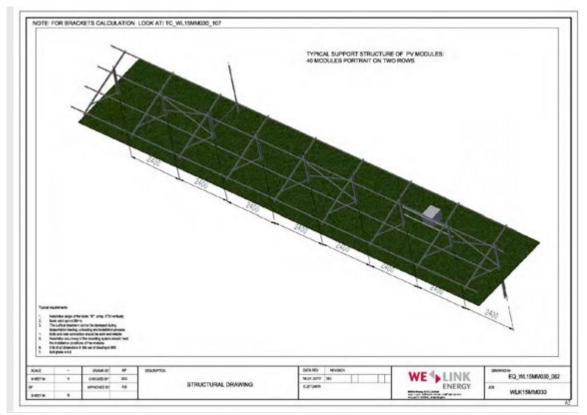


Electro Luminescence test



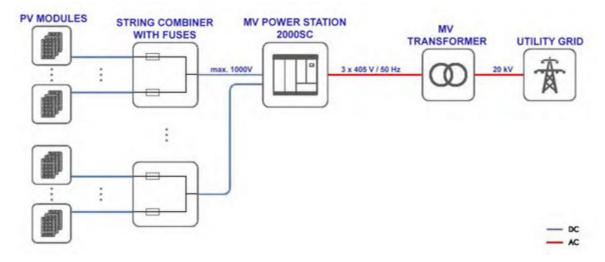
Production inspection





PV module mountain structure

PLANT DIAGRAM



Plant Diagram

4.10 CULTURAL HERITAGE

The 1.3 mile In/Out Line which is to be constructed to connect to the Minbu-Ann 230 kV transmission line will run along the existing access road that has been constructed. The existing route, runs directly from the Project Site to the Minbu-Ann road and there are no existing historical building and religious artifacts located along this right of way or nearby.

After receiving the 1st Review Team comments, GEP (Myanmar) Co., Ltd has checked with different levels of Department of Archeology, Ministry of Religious Affairs and Culture, regarding the existence of cultural heritage buildings which can be found along the route of 230 kV transmission line. GEP (Myanmar) Co., Ltd was told that no such buildings exist.

GEP (Myanmar) gives its assurances to abide by the existing laws of Myanmar. GEP (Myanmar) will follow the laws, bylaws and regulations related to archeological sites and buildings in Myanmar. GEP (Myanmar) also made the commitment to follow specific laws such as "The Protection and Preservation of Cultural Heritage Regions laws (1988)", "The Protection and Preservation of Antique Objective Law (2015)", and "The Protection and Preservation of Ancient Monument Law (2015)". Therefore, Department of Archaeology, Ministry of Religious Affairs and Culture replied to GEP (Myanmar) that GEP (Myanmar) does not need to ask for an endorsement letter from the department as GEP (Myanmar) has mentioned its commitment as above to follow archaeological laws and other relevant laws of the Republic of the Union of Myanmar.

4.11 ANALYSIS OF PROJECT ALTERNATIVE

4.11.1 Relocation option

Relocation option to a different site is an option available for the project implementation. Relocation option to a different site is within a limit because nature of work to construct and develop of PV solar power plant needs dry zone, low rain fall and arid environment. The developer has to look for the land instead of developing the existing land. The relocated land must be clear the ownership, settlement on the land, cultivated crops on site and must be easier water resources, electricity resources, road way, transport and requirement of workers than existing land. Depends on geography of relocation land needs to consult a new design, a new survey, a new permission must implement. Developer would spend so much finance and another long period of time on design and approval of the plan by the government departments. The other consequence of this is that it would discourage both foreign and local investors. In consideration of the above concern and assessment of current proposed site, relocation is not a better option.

4.11.2 "No project alternative"

This option will involve several losses both to the project developer and government because electricity requirement per year is so high. This solar power plant is quite expensive than other electricity products but it is least impacted to environment such as resettlements, catchment area, malaria disease, situated land area and other negatives. The region also suitable to develop such as project because of low rains. The above analysis, the "no project alternative" is not the appropriate alternative to the interest if Myanmar peoples and Myanmar government.



5. DESCRIPTION OF THE SURROUNDING ENVIRONMENTAL AND BASELINE DATA COLLECTION

5.1 SITE DESCRIPTION

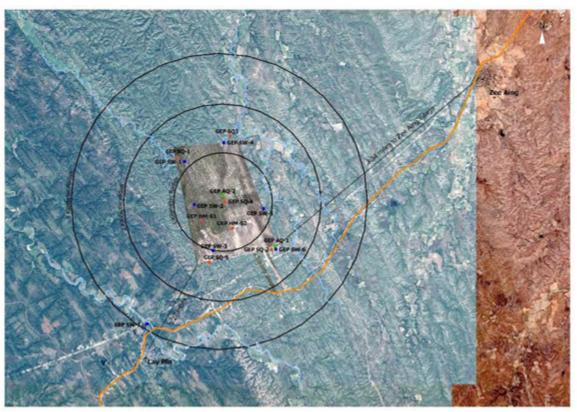


Image 4: Site Description

The solar power plant project of the Green Earth Power Co Ltd is located at Minbu Township, 500 Km North-West from Yangon and 200 Km west of Naypyidaw. The land is 836 acre wide, hilly area beside Minbu-Padan-Ann road way, 16 miles distance from Minbu, Magwe Region.

The land is in the Lay Pin- Ahing Ma/ Proposed Outside Field Forest Conservation Area under the Ministry of Environmental Conservation and Forestry.

On the site, large trees are scarce and there are mostly bushes and small trees. A significant feature is that there are a lot of small hills or mounds with steep slopes. The nearest villages from the sites are Zee Aing and Lay Pin. Lay Pin village is located 1.27 miles to the South-West and Zee Aing village is 3.34 miles to the North-East.

5.2 LAND USE

The Project Site consists of two land parcels and types. For the 700-acre land parcel, this falls under the land category of Vacant, Fallow and Virgin Lands; this land was approved by The Central Management Committee for Vacant, Fallow and Virgin Lands. The developer has been permited to utilize this land for the construction and operations of a solar power plant. For the 136-acre parcel, the land category of this site is part of the Protected Public Forest Area, and upon the approval of the MIC Permit, will be directly

leased to the GEP (Myanmar) to be used for the construction and operations of the solar power plant. (See appendix 12.47, 12.48 and 12.49)

GEP (Myanmar) Co., Ltd has been instructed by Department of Forestry to get the endorsement letter from Ministry of Energy and Electricity for the use of 136 acres. The Department of Forestry will give its approval if the 136 acres is required for the project. The MOEE has included those areas in its project plan and it is expected that the ministry will issue its letter of endorsement soon.

5.3 TOPOGRAPHY



Map 2: Topography Map of Minbu Solar Power Plant Project

The proposed project land is between latitude N2217000 to 2220000 and longitude E 674100 to E 676500 included with approach road way from Mnbu-Padan-Ann road way. Main PV solar plant is located at

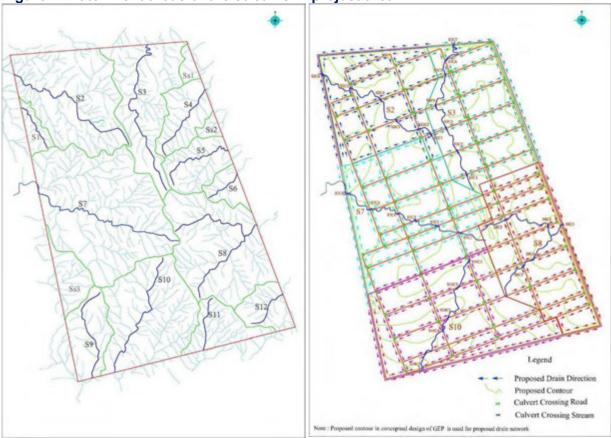
(A) E 676275.155, N 2217907.804

(B) E 674675.155, N 2217507.804 (C) E 674181.962, N 2219875.130 (D) E 675486.458, N 2219978.131

Point (A) at the edge of south east is highest and 173.67 meter Above Sea Level(ASL). Point (B) is 155.67 meter ASL, Point(C) is 158.00 meter ASL and Point (D) is 155.50 meter ASL. Highest to lowest different level is 18.17 meter (59 ft) south east to south west. As a part of the Rakhine foot hill it has rolling terrain with the highest point of the small sub-catchments approximately 180 meter ASL. Existing soil and vegetation cover of the area reveals character of the dry zone showing patches of bushes, small trees and bare lands even without healthy grass cover. Periodical erosion occurred during heavy rains can be discovered visually with some eroded gullies and resulted splinters of sand stone exposed along the streams. Size of 12 significant catchment ranged from 0.05 sqkm to 0.73 sqkm and the natural streams have fairly steep slopes of 1% to 5%. Based on this prevailing topography, drainage system in the area is presumed technically viable for effective results, provided there is no constraint at the downstream boundary. Existing streams from the project area principally flow out in two directions and the streams enter into Kaingmagyi Chaung at the west and Pindale chaung at the east. Because of the prevailing steep gradients of small streams and two recipient streams as well, it is very unlikely to suffer back water effects from larger streams. Lay Pin villagers confirm that there was no flooding area during last major floods at 2015 and 2016. Mann chaung was seriously flooded and potential back water cannot reach at the northern of proposed project site.

5.4 HYDROGEOLOGY

Figure 7: Catchment areas of the streams in project area



Before development

After development

Hydrology report for proposed Minbu solar power plant area is submitted by National Engineering and Planning Services Co Ltd; on October 2015. NEPS has done hydrological study and hydraulic study to proposed site. At pre-construction phase streams (S1),(S2),(S3),(S4),(S5),(S6),(S7),(S8),(S9),(S10),(S11),(S12) and small streams (SS1),(SS2),(SS3) are flowing inside the project area which is 836 acres wide. Each catchment area is mentioned at table 4.2(A). After designated grading earth work is completed, only five streams will be remain at site.(S2) will flow to original direction of Aing Ma chaung.(S7) and (S10) will flow to the direction of Kaing Ma Gyi chaung and (S3) and (S8) will flow to the direction of Pin Da Le chaung. Annual flow of the largest steam (S7) is estimated as 115340 Cubic meter or 25 million gallons only. Evaporation loss in this area is very high and total annual loss of up to 2 meter depth is anticipated and remarked that area for solar panel will be significantly reduced to provide the lake area.(*Report of National Planning and Engineering Services Co Ltd;is attached:)

5.5 CLIMATE

5.5.1 Rainfall Status

Minbu Township, Minbu District, Magwe Region, is located in the mid-region of Union of Myanmar. Rain fall patterns range from 2015 to 2016(Jan to Aug), average months of rainfall per year is 83.33mm in 2015 and 81.75mm in 2016(Jan to Aug) are reported by Meteorology and Hydrology Department.

Table 7: Monthly Rainfall 2015

2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	50	0	0	0	56	112	304	140.0	105	226	0	1
(mm)	50	U	U	U	50	113	304	140.0	105	220	U	4

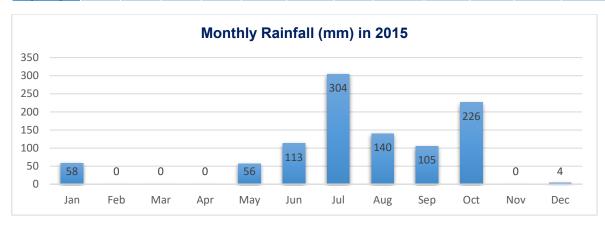
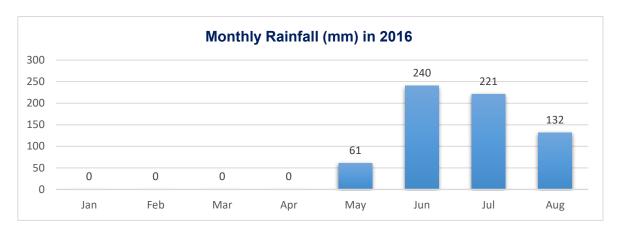


Table 8: Monthly Rainfall 2016 (January – August)

2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Rainfall (mm)	0	0	0	0	61	240	221	132.0



5.5.2 Highest and Lowest Temperatures

Average monthly highest and lowest temperatures of Minbu Township in 2015 and 2016(Jan to Aug) are collected. Notable highest temperature in 2015 is 39.5°C on March and 42.2°C on April in 2016(Jan to Aug). Notable lowest temperature of Minbu Township 2015 is 12.2°C on December and 9.5°C on January in 2016 (Jan to Aug).

Table 9: Monthly mean Maximum and Minimum Temperature (°C) in 2015

2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Temperature (°C)	28.8	34.1	39.5	4.07	4.2	35.9	31.8	33.7	34.0	32.4	31.3	26.7
Minimum Temperature (°C)	14.2	12.5	17.0	21.0	24.0	23.4	22.8	22.5	22.3	19.6	17.4	12.2

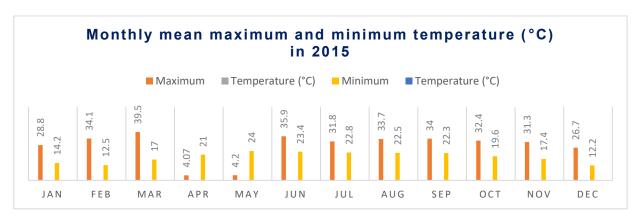
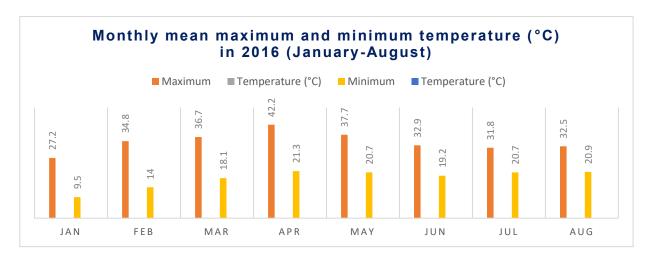


Table 10: Monthly mean Maximum and Minimum Temperature (°C) in 2016 (January – August)

2016 (Jan – Aug)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Maximum Temperature (°C)	27.2	34.8	36.7	42.2	37.7	32.9	31.8	32.5
Minimum Temperature (°C)	9.5	14.0	18.1	21.3	20.7	19.2	20.7	20.9



5.5.3 Irradiation Data (Sunshine Hours Duration)

According to the Project technical design from our third party technical advisor, Black and Veatch, the production estimate of the solar power plant is for a total of 338,897,000 kWh per year which equates to a daily average irradiation of 5.2 sunshine hours per day. The daily average irradiation is based on the full radiation output assumed at 1000 w/m2.

5.5.4 Relative Humidity

The relative humidity plays an important role in the amount of evaporation and evapotranspiration. The mean monthly values of relative humidity are relatively similar throught the year and relatively high during the summer period. The annual mean of daily relative humidity is on the range of 70-90% (Minhla, 2014). The monthly mean values of relative humidity for the whole year are presented in table.

The values of the monthly relative humidity depends on various parameters, such as the local wind, vegetation, general wind circulation. The value of the monthly relative humidity decreases from September (80 %) to March (63 %), where it reaches its minimum value, then increase again to reach its maximum value at June (91 %) as shown in the following table.

Table 11: Monthly mean values of relative humidity

Monthly Mean Values of Relative Humidity	Relative Humidity (%)
January	(62-83%)
February	(52-72%)
March	(52-76%)
April	(57-63%)
May	(57-64%)
June	(63-91%)
July	(67-88%)
August	(73-89%)
September	(70-90%)
October	(59-80%)
November	(62-73%)
December	(60-70%)

Source: Minhla, 2014

5.5.5 Wind Direction and Wind Speed

Data of wind direction and wind speed reported by Meteology and Hydrology Department at Minbu District Station are collected and shown as below:

Average wind direction from South-East is in October, November and December, North-East and North-West winds are in April, May, June, July, August and September.

Table 12: Monthly Mean Wind Direction 2015

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
6:30	SE	SE	SE	NE	NE	NE	NW	N	NE	SE	SE	SE
9:30	SE	SE	SE	NE	NE	NE	NW	NW	NW	NE	SE	SE
12:30	SE	SE	SE	SE	NE	NE	NW	NE	NE	SE	SE	SE
18:30	SE	SE	SE	SE	NE	NE	NW	NE	NE	SE	SE	SE

Table 13: Monthly Mean Wind Direction 2016 (January – August)

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
6:30	SE	E	W	Е	NE	NE	NE	NE
9:30	SE	SE	SE	NE	NW	NW	NE	NW
12:30	SE	SE	SE	NE	NE	NE	NE	NE
18:30	SE	SE	SE	NW	NW	NW	NE	NE

Table 14: Monthly Mean Wind Speed (mph) 2015

٦	Γime	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(6:30	8.0	0.9	1.0	0.7	0.9	1.2	1.0	1.0	0.9	0.7	0.2	0.5
	9:30	1.0	1.2	1.2	1.2	1.1	1.1	1.0	1.2	1.1	1.2	1.1	1.1
1	2:30	1.1	1.2	1.2	1.2	1.1	1.2	1.1	1.2	1.2	1.3	1.2	1.2
1	8:30	0.3	8.0	1.0	1.4	1.4	1	0.5	0.7	0.6	0.5	0.4	0.2

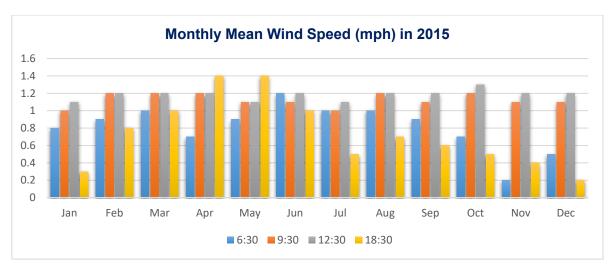
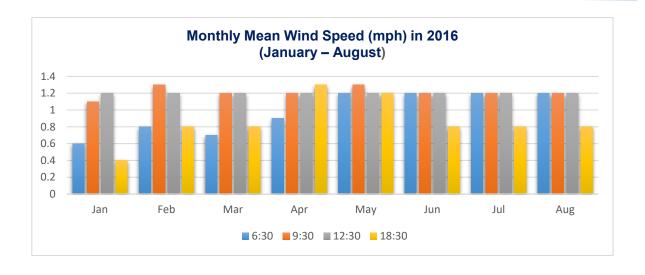


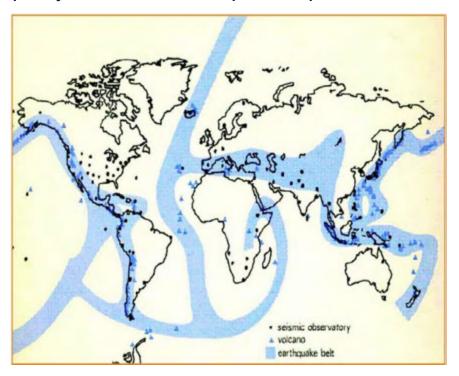
Table 15: Monthly Mean Wind Speed (mph) 2016 (January – August)

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
6:30	0.6	8.0	0.7	0.9	1.2	1.2	1.2	1.2
9:30	1.1	1.3	1.2	1.2	1.3	1.2	1.2	1.2
12:30	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
18:30	0.4	8.0	8.0	1.3	1.2	8.0	8.0	8.0

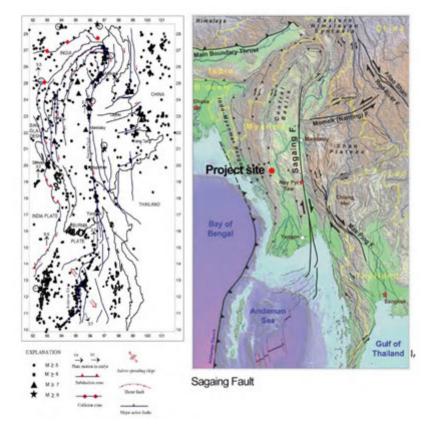


5.5.6 Earthquake

Map 3 :Map of Myanmar Situated in the Alpide Earthquake Belt



Source: Manual on Earthquake, UN-Habitat



Map 4 and 5: The Map of Earthquake Zone and The Map of Sagaing Fault

Source: Department of Geological Engineering, Gadjah Mada University and www.sagaingfault.info/index.html#info

The proposed site is located at approximately 90 miles at the west of Sagaing fault.

Earthquake data at Magwe region (2013-2016) is shown below and Most of them occurred along the Sagaing Fault.

Table 16: Earthquake data of Magway Region (2013-2016)

	abio for Latinquako data or magnay kogion (2010-2010)													
		D	ate/Tim	ie(UT	C)		Epice	enter		Mag	gnitu ۱۱)	de Sc /I)	ale	
No.	Dat	Mo	Yea	Hou	Min	Sec	Latit ute (N)	Lon gitu de	^ c	<5.	. 6.	<7.	∧ × 0	Class
1	3	4	2013	12	35	48	19.31	95.56			5.5			Moderate
2	3	4	2013	23	30	23	19.32	95.77		4.7				Slight
3	4	4	2013	15	17	36	19.36	95.67			5.4			Modreate
4	11	4	2013	3	47	4	19.35	95.7			5.5			Modreate
5	8	8	2013	0	0	26	20.565	94.091		4.9				Slight
6	22	3	2014	8	35	35	21.91	94.28		4.3				Slight
7	17	11	2014	4	34	20	20.78	94.32			5.4			Modreate
8				2015	(No e	arthq	juake eve	ents reco	rded	in Ma	gwe	regio	n)	
9	7	3	2016	3	14	27	20.74	94.74		4.8				Slight
10	27	7	2016	4	20	53	21.48	94.53		4.9				Slight
11	1	8	2016	10	1	8	21.29	94.92			5.3			Moderate
12	24	8	2016	10	34	55	20.9	94.63				6.8		Strong

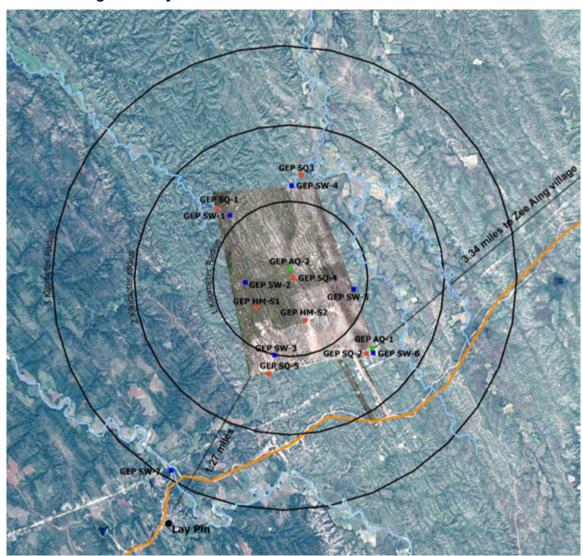
Table 17: List of some strong earthquakes in Myanmar

No	Date	Epicentre Lat N Long E	RM	Remarks
1	2 April 1762	21° 30′ 92° 00′	7.0	Sittwe Area; very destructive violent earthquake felt over Bengal, Rakhine up to Calcutta (Kolkata)
2	23 Mar 1839	21° 42′ 96° 00′	8.0	Amarapura; almost the whole city destroyed, the ground surface broken; the river's flow was reversed for some time. Mingun Bell fallen down; 300 to 400 killed
3	24 Aug 1858	19° 00′ 95° 00′	7.5	Thayet (Pyay); houses and tops of pagoda collapsed; felt Innwa, Sittwe and Yangon
4	23 May 1912	21° 00' 97°00'	8.0	North of Taunggyi, serious landslides; foreshock noted on 18 May 1912
5	06 Mar 1913	17° 00' 96°50'	7.0	"Hti" (decorative umbrella) of Shwe Maw Daw Sedi in Bago grounded
6	05 Jul 1917	17° 00' 96° 50'	7.0	"Hti" of Shwe Maw Daw Sedi in Bago grounded
7	19 Jan 1929	25° 90' 98° 50'	7.0	Brick buildings destroyed in Htaw Gaw
8	08 Aug 1929	19° 25' 96° 25'	7.0	Railway lines bent at Swa
9	16 Dec 1929	25° 90' 98° 50'	7.0	Landslides at Htaw Gaw
10	05 May 1930	17° 00' 96° 50'	7.3	Many houses destroyed, and 500 killed in Bago; Some houses destroyed, and 50 killed in Yangon
11	03 Dec 1930	18° 00' 96° 50'	7.3	Some houses destroyed, about 30 killed in Phyu
12	27 Jan 1931	25° 60' 96° 80'	7.6	Brick building collapsed, landslides at Karmine
13	12 Sep 1946	23° 50' 96° 00'	7.7	Pagodas collapsed at Tagaung, 32 houses destroyed, 380 acres of crop damaged
14	16 Jul 1956	22° 00' 96° 00'	7.0	Pagodas and buildings at Sagaing destroyed, about 40 killed, Sagaing bridge displaced slightly
15	08 Jul 1975	21° 50' 94° 70'	6.8	Many historical Pagodas destroyed, 2 killed near Bagan
16	05 Jan 1991	23° 48 ' 95° 98'	7.1	Landslides, ground cracks, sand blows, pagodas and buildings destroyed at Tagaung, Htigaint, Kawlin and Thabeikkyin
17	22 Sep 2003	19° 94' 95° 72'	6.8	Landslides, liquefaction and destruction of pagodas, some bridges in Taungdwingyi (7 persons killed)



5.6 PHYSICAL ENVIRONMENT

5.6.1 Setting the study limit



Map 6: Map of setting the study limit

MSR study team sets the study limit 3 km radius from center of the project site for physical data collection and impact assessment. The study covers areas along approach road and along transmission tower and lines to national grid.

For the social environment, the study covers Lay Pin and Zee Aiang villages which are located within 6 km from the project site. In fact, overall social impact of the solar power project is not limited to the surrounding area of the project site. Therefore, the study looks at wider scope and contribution to regional and national level.

Main focus area for the biological environment is within 3 km from the project site.

5.6.2 Physical Baseline Data collection

Physical environmental study team of MSR studied topographic map, site layout plan, hydrology report, design of storm water drains and associated structures, conceptual design and brief presentation of GEP (Myanmar) Co Ltd;. The team visited the site and

observable locations of the proposed project and decided to collect samples as base line data for this environmental impact assessment report.

- 1. Soil may be impacted negatively at site by preparation, construction of designated grading, construction, operation and decommissioning that 5 samples should collected to analyze soil nutrient and 2 samples are collected to analyze soil heavy metal (Harmful). These analytical reports are baseline data of soil.
- 2. Air may be polluted by dust emission, operating of machineries which use diesel fuel at construction and operation and decommission phases that 24 hours ambient air quality test should analyze at the center of the proposed project. These analytical reports are baseline data of air.
- 3. Surface water and ground water may be impacted by oil spills, dumping of materials, dumping of solid waste and improper handling of PV solar panels that the main discharge points of surface water samples should collected to analyze water quality. These analytical reports are baseline data of surface water and ground water. (S2), (S3), (S7) and (S10) samples are collected.(S8) out let is dried and cannot collect samples.
- 4. Analytical data of four tube wells are collected from developer.

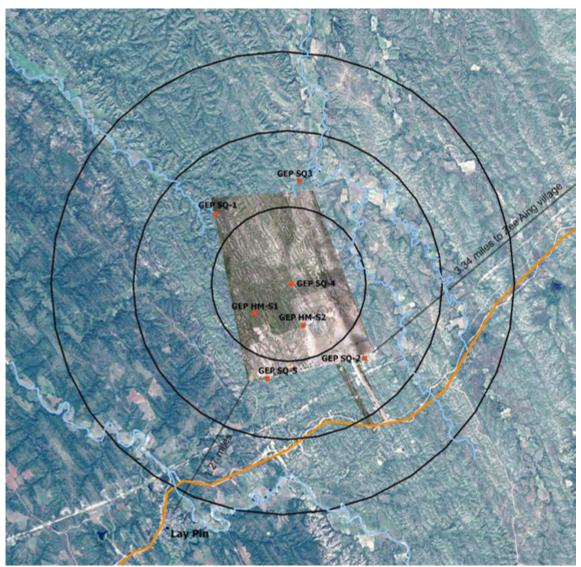
5.6.2.1 Soil

Soil survey methods

Land Use Division, Agricultural Department conducted soil survey by using the Russian soil scientist soil analysis method and F.A.O/UNESCO method.

When soil survey was conducted physical properties of soil such as soil colour, texture, structure, moisture, hardness, drainage, inclusion and new formation were recorded and gave the soil name by using Hussian soil classification, F.A.O soil classification method.

When classified the soil types, soil horizontal characteristics were based and identified the soil type. Soil properties are formed according to the soil forming process and it is not possible to give nomenclature on the base of site seeing different norms of the soil characteristics. It needs thousands of million years to from one inch cubic of soil but soil can be easily deteriorated in a few years due to improper use of the land and soil.



Map 7: Location Map of Soil Sample Collection

Collecting Soil sample



Soil sample collecting at the center of project Checking soil color with color chart site







Soil sample collecting with special tool

Packing soil sample







Collection soil sample at near Pin Da Le chaung

Soil survey results

Soil samples were taken from five places on the project site and, according to the soil survey results, the surveyed soils are Gravelly Yellow Brown Forest Soil and Indine, also called Cambisols according to F.A.O soil classification. The top soil texture is sandy loam and structure is Crumby of sub angular blocky. The sub soil about 10 inches depth are Yellow Brown Forest Soil. The second layer soils, about 25 inches depth are sub-angular blocky but it is easily soluble, stone and gravels.

These soils have rapid water infiltration rate and rain water will be disappeared as soon as after raining. It contains well drainage infiltration rate. It has moderately alkaline soil pH and medium cation exchangeable capacity and high in ${\rm Ca^{+2}}$, medium in ${\rm Mg^{+2}}$ and low in ${\rm K^{+}}$. It has low humus content and reduces in micro nutrient content. The soils are very shallow stoney soil, not suitable for orchard and vegetable cultivation, and suitable for grass land and forest land.

The soil survey results are expressed as Profile Description, External Features, chemical analysis and water soluble salts.

Table 18: Soil Survey Results: Nutrients

Sr	Profile No	Soil depth & Layer	Location Lat : log	Soil name
1	GEP-SQ -1	A (0-12") A/B (12-25")	N 20° 30′ 59.00" E 94° 39′ 58.1"	Gravelly Yellow Brown Dry Forest & Indaing Soil
2	GEP-SQ -2	A/C ₁ (0-10") A/C ₁ (10-25") B/C (25-42")	N 20° 02′ 58.3" E 94° 41′ 04.5"	II
3	GEP-SQ -3	A/C (0-10") A/C ₁ (10-25")	N 20° 04′ 13.3" E 94° 40′ 35.5"	Ш
4	GEP-SQ -4	A (0-10") A/B (10-25")	N 20° 03′ 29.8" E 94° 40′ 31"	II
5	GEP-SQ -5	A (0-10") A/B (10-25")	N 20° 02′ 50.8" E 94° 40′ 21.1"	II

Soil Samples were tested at the Laboratory of Myanmar Agriculture Services (Land Use), Ministry of Agriculture and Irrigation.

Soil analysis results

Soil texture Soil Structure Soil pH Nitrogen content (N ₂) Phosphorus content (P) Potassium content (K ₂ O) Humus Organic carbon Calcium (Ca ⁺⁺) Magnesium (Mg ⁺⁺) Potassium (K ⁺) Aluminium (Al ⁺³) Hydrogen (H ⁺) Sodium (Na ⁺)	Sand Loam, Loam, Sandy Clay Loam Crumbly of sub angular blocky Moderately alkaline Low Low Medium Low Medium 13.56 (High) 1.36 (Medium) 0.20 (low) Not detected Not detected 0.44(Medium)
Cation Exchange capacity	15.59 (Medium)
(C.E.C)	
Electrical conductivity (Ec)	Very low

Soil soluble salts analysis

Total dissolved solids TDS	Low
Electrical conductivity (Ec)	very Low & Low
Sodium Adsorption Ratio SAR	Not detected & Low
Residual Sodium Carbonate RSC	Not detected & Low
pH	Moderately alkaline
Dorminate salts	Ca (HCO ₃) ₂ , CaCl ₂ , MgCl ₂

Analytical data evaluation and recommendation

There is no plant nutrient problem and TDS- Total Dissolved salt in water soluble salt analysis. Even though high in pH value is not a problem because it is common in tropical arid region. And also there is no problem Sodium Absorption Ratio (SAR) and Residual Sodium Carbonate (RSC) analysis. Electrical conductivity value (Ec) is not also problem for plants.

Therefore, these soils are not problemative soils in plant nutrient content and soil soluble salts. Even though there is no problem in chemical properties, there is somewhat problem in physical properties for cultivation because of high content in stone and carbonate. Evaluation and recommendation is continuously mentioned.

The soils from Min-Bu Solar Plant Project are Gravelly Yellow Brown Dry Forest Soil and Indine. These soils include Inn-ma outside ring protective area and low in land capability class for economic cultivation. These soils are very shallow stoney soil and suitable for grass land and forest land. It contains in soil standard VIIs and it is mentioned that it requires fire protection.

Soil Survey Results: Heavy Metal

Table 19: Analytical data evaluation and recommendation (Heavy Metal)

Soil analytical data of heavy metal					
Sr.	Sample	Depth	Lead(Pb)	Arsenic(As)	Cadmium(Cd)
1	GEP-HM-S1	0-12"	11.15/85	ND/29	ND/0.8
2	GEP-HM-S2	0-12"	4.65/85	ND/29	ND/0.8

Soil analytical data of heavy metal analyzed at Pesticide Analytical Laboratory, Plant Protection Division, Department on Agriculture, Ministry of Agriculture, Livestock and Irrigation resulted. Heavy metal of lead, Arsenic and Cadmium are lower than reference value.

5.6.2.2 Air quality and sound pressure data collection

Air quality survey method

Ambient air sampling was conducted at above mentioned site. Sampling period was based on 24-hour measurement level of $PM_{2.5}$ and PM_{10} using EPAS air sampler and other gases are also measured by auto sensors of the EPAS haz-scanner.

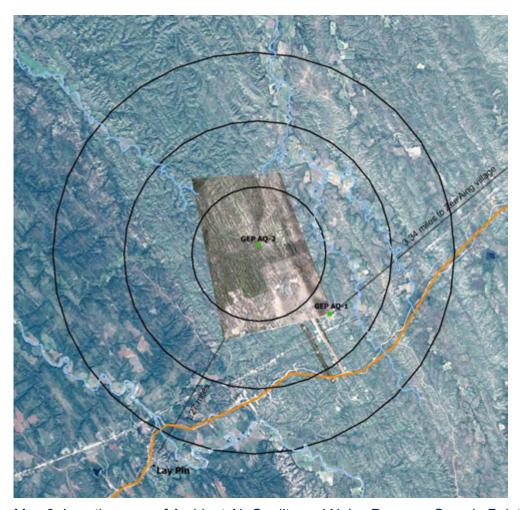
Sound pressure survey method

Maximum Sound Pressure Level (L_{max}) and the Equivalent Continuous Sound Level (L_{eq}) were measured at available site of the Project area.

Acoustic environment monitoring was performed in accordance with standard procedures adopted by American Conference of Governmental Industrial Hygienist (ACGIH) which is authoritatively and currently used in Myanmar.

The sample site was chosen for the ambient Air Quality Monitoring in the area of solar plant project in Minbu Township. Air quality sampling and sound level measurement was done for 24 hrs on February 6, 2016 at sampling site. Efficiency of Ambient air quality and Noise pressure testing machines can roam 5 miles radius circle. So, this air quality measuring could cover these areas and villages, Zee Aing, Lay Pin, Pyawbwe and Min Hla Kyin village along the Minbu-Ann Road. MSR team decided to locate the testing points at the corner of the project area and near main substation and office building.

Air quality and noise pressure (AQ)



Map 8: Location map of Ambient Air Quality and Noise Pressure Sample Points

Collecting of Air Quality



Setting the EPAS haz-scanner



Setting the EPAS haz-scanner



Measuring by auto sensors of the EPAS hazscanner (Day)



Measuring by auto sensors of the EPAS hazscanner (Evening)



Setting the EPAS haz-scanner



Measuring by auto sensors of the EPAS hazscanner (Day)

Air Quality Survey Results

Measured ambient air quality

Ambient air sampling was conducted at above mentioned site. Sampling period was based on 24-hour measurement level of $PM_{2.5}$ and PM_{10} using EPAS air sampler and other gases are also measured by auto sensors of the EPAS haz-scanner. Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur dioxide (SO_2), Nitrogen dioxide (SO_2), Carbon Monoxide (SO_2), Total Volatile Organic Compound (SO_2), Hydrocarbon (SO_2), and Methane (SO_2) are measured 1 hour average and Ozone (SO_2) is measured 8 hours average. The report covers the observations for the baseline data obtained in one cross-sectional survey.

Air quality (Location 1)

Air Quality was tested by the Occupational and Environmental Health Laboratory, Ministry of Health on 6 February 2016. The test results are presented below.

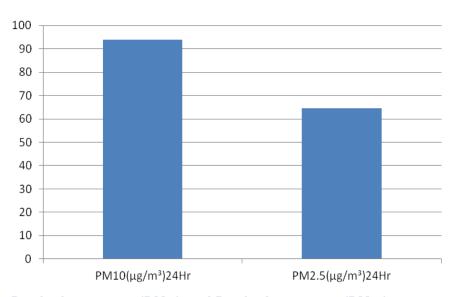
Table 20: Summary of air quality results

Name	GEP AQ-1	Reference Unit	Unit
PM ₁₀ (24 hr)	93.772	50	μg/m³
PM _{2.5} (24 hr)	64.489	25	μg/m³
SO ₂ (24 hr)	375.582	20	μg/m³

NO ₂ (1 hr)	60.812	200	μg/m³
CO (1 hr)	145.838	30000	μg/m³
O ₃ (8 hr)	1567.706	100	μg/m³
TVOCs	133.936	400	μg/m³
HC	0	-	ppm
CH ₄	21060.7	-	ppm

Air Quality Parameters

Particulate matter (PM₁₀) and particulate patter (PM_{2.5})

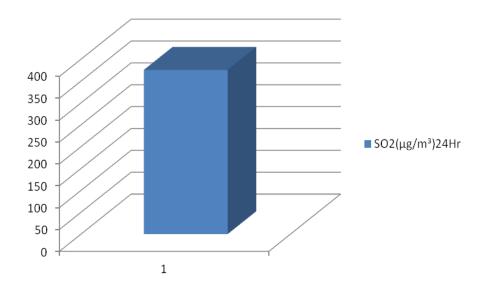


Particulate matter (PM₁₀) and Particulate matter (PM_{2.5}) concentration

The result of Particulate Matter (PM_{10}) from sample site is revealed 93.772 µgm/m³ and higher than WHO guide line values ($50\mu\text{gm/m}^3$).

The result of Particulate Matter ($PM_{2.5}$) from sample site is revealed 64.489 μ gm/m³ and higher than WHO guide line values (25μ gm/m³).

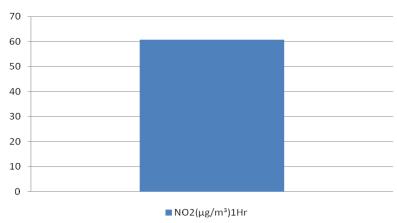
Sulphur dioxide (SO₂)



Sulphur dioxide (SO₂) concentration

The result of Sulphur Dioxide (SO_2) concentrations obtained from sample site was 375.582 µgm/m³ and much higher than WHO guide line values ($20\mu gm/m^3$).

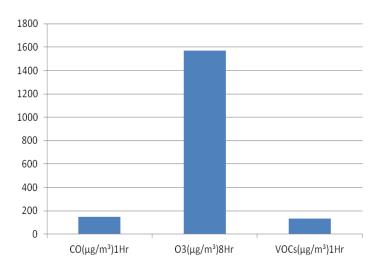
Nitrogen Dioxide (NO₂)



Nitrogen Dioxide (NO₂) concentration for 1 hr mean

The result of Nitrogen Dioxide (NO₂) concentrations obtained from sample sites was 60.812 µgm/m³ for 1 hr mean and lower than WHO guide line values (200µgm/m³).

Carbon Monoxide (CO), Ozone (O₃) and Total Volatile Organic Compounds (TVOCs)



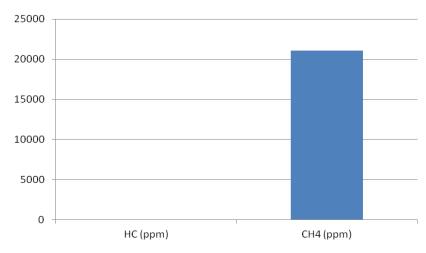
Carbon monoxide (CO), ozone (O₃) and total volatile organic compounds (TVOCs) concentration

The result of Carbon Monoxide (CO) concentrations for 1 hr obtained from sample site was $145.838 \, \mu \text{gm/m}^3$ and much lower than WHO guide line values ($30000 \, \mu \text{gm/m}^3$).

The result of Ozone (O_3) concentrations obtained from sample site was 1567.706 µgm/m³ for 8hr mean and much higher than WHO guide line values (100μ gm/m³).

The result of total volatile organic compound (TVOC) concentrations obtained from sample site was $133.936 \, \mu gm/m^3$ and lower than WHO guide line values ($400 \mu gm/m^3$).

Hydro carbon (HC) and methane (CH₄)



Hydro carbon (HC) and methane (CH₄) concentration

The result of Hydrocarbon (HC) concentrations obtained from sample site was 0 ppm. The result of Methane (CH_4) concentrations obtained from sample site was 21060.7 ppm.

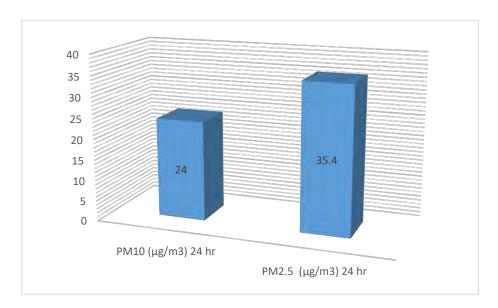
Air Quality (Location 2)

Table 21: Summary of Air Quality Lab Results (10 September 2016)

Name	GEP AQ-2	Reference Unit	Unit
PM ₁₀ (24 hr)	24	50	μg/m³
PM _{2.5} (24 hr)	35.4	25	μg/m³
SO ₂ (24 hr)	865.7	20	μg/m³
NO ₂ (1 hr)	11953	200	μg/m³
CO (1 hr)	76.3	30000	μg/m³
VOCs(1 hr)	88.6	400	μg/m³
O ₃ (8 hr)	6960	100	μg/m³
HC	9613	-	ppm
CH₄	17404	-	ppm

Air quality Haz-scaner machine is installed at the center point of the proposed site on 10 September 2016. Analytical data of air quality Haz-scaner analyzed and operated by Occupational and Environmental Health Laboratory experts, Ministry Of Health indicates

Particulate matter (PM₁₀) and particulate patter (PM_{2.5})

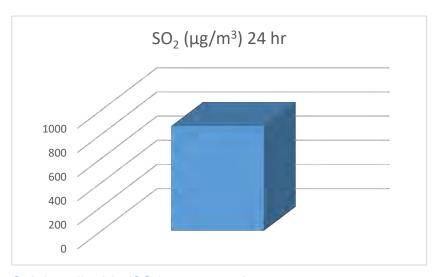


Particulate matter (PM₁₀) and Particulate matter (PM_{2.5}) concentration

The result of Particulate Matter (PM_{10}) from sample site is revealed 24 μ gm/m³ and lower than WHO guide line values (50μ gm/m³).

The result of Particulate Matter ($PM_{2.5}$) from sample site is revealed 35.4 μ gm/m³ and higher than WHO guide line values (25μ gm/m³).

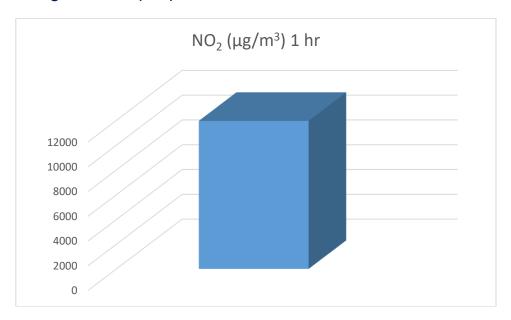
Sulphur dioxide (SO₂)



Sulphur dioxide (SO₂) concentration

The result of Sulphur Dioxide (SO₂) concentrations obtained from sample site was 865.7µgm/m³ and much higher than WHO guide line values (20µgm/m³).

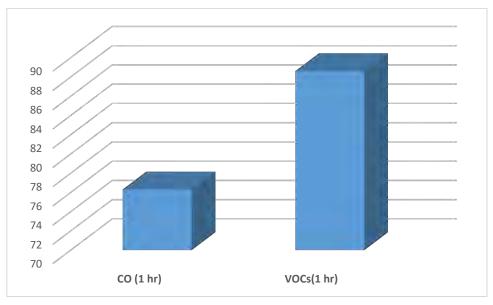
Nitrogen Dioxide (NO₂)



Nitrogen Dioxide (NO₂) concentration for 1 hr mean

The result of Nitrogen Dioxide (NO₂) concentrations obtained from sample sites was 11953 µgm/m³ for 1 hr mean and much higher than WHO guide line values (200µgm/m³).

Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs)

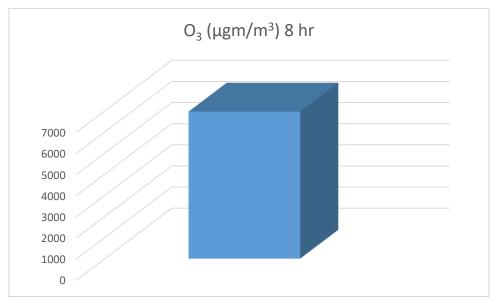


Carbon monoxide (CO), ozone (O₃) and total volatile organic compounds (VOCs) concentration

The result of Carbon Monoxide (CO) concentrations for 1 hr obtained from sample site was 76.3 µgm/m³ and much lower than WHO guide line values (30000µgm/m³).

The result of total volatile organic compound (VOCS) concentrations obtained from sample site was $88.6 \, \mu gm/m^3$ and lower than WHO guide line values ($400 \mu gm/m^3$).

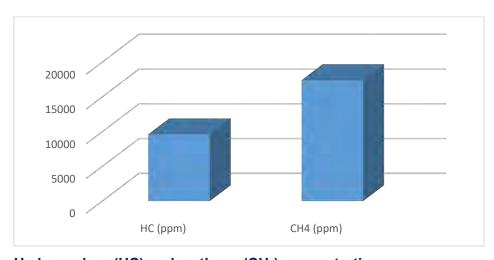
Ozone (O₃)



Ozone (O₃) Concentration

The result of Ozone (O_3) concentrations obtained from sample site was 6960 μ gm/m³ for 8hr mean and much higher than WHO guide line values (100μ gm/m³).

Hydro carbon (HC) and methane (CH₄)



Hydro carbon (HC) and methane (CH₄) concentration

The result of Hydrocarbon (HC) concentrations obtained from sample site was 9613 ppm.

The result of Methane (CH₄) concentrations obtained from sample site was 17404 ppm.

Harmful substances and gas such as $PM_{2.5}$, NO_2 , SO_2 and O_3 are very higher than reference value. These indicated dust emission and largely diesel fuel burning.

Sound Pressure Level (Location 1)

Table 22: Summary of Sound Pressure Level Results (6 February 2016)

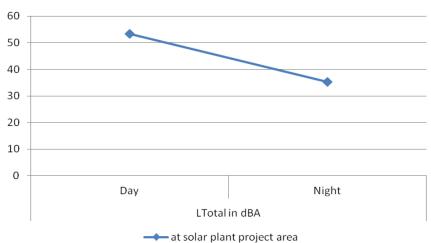
Sample Sites	Lī	otal in dBA	4	L _{max} in dBA			
	Day	Night	Total	Day	Night	Total	
Near site explanation room	53.322	35.203	51.320	32.789	25.460	30.249	

Sound level parameters

The sound level monitoring was performed in accordance with standard procedures adopted by American Conference of Governmental Industrial Hygienist (ACGIH) which is authoritatively and currently used in Myanmar.

Maximum Sound Pressure Level (L_{max}) and the Equivalent Continuous Sound Level (L_{eq}) are measured at available site of the Project area.

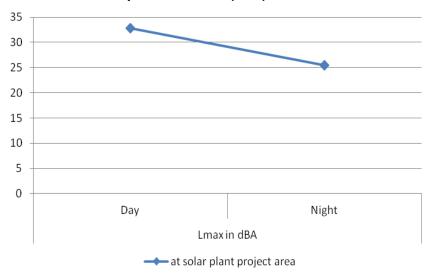
Equivalent continuous sound level (Leq)



Equivalent continuous sound level (Leq) in sample site

Equivalent continuous sound level (L_{eq}), the constant noise level that would result in the same total sound intensity being produced over a given period, in day is 53.322 dBA and that in night is 35.302 dBA. All values are not increased that the position of observation should be taken into account.

Maximum sound pressure level (Lmax)



Maximum sound pressure level (L_{max}) in sample site

Maximum sound pressure level (L_{max}), square root of mean of the square of the measurement values (RMS) in day is 32.789 dBA and at night is 25.46 dBA. All values are not increased at the position of observation should be taken into account.

Sound Pressure Level (Location 2)

Table 23: Summary of Sound Pressure Level Results (10 September 2016)

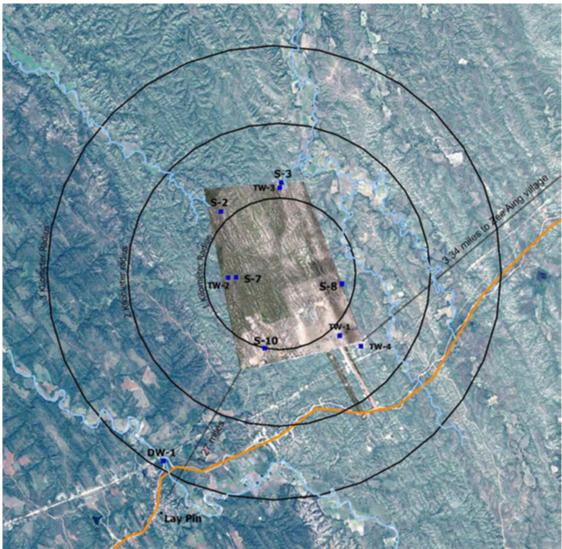
Sample Sites	L _{Total} in dBA			L _{max} in dBA			
	Day	Night	Total	Day	Night	Total	
Center Point	37.4	32	36.1	22.3	22.2	22.2	

Analytical data of noise results of sample at center point of the proposed site analyzed by Occupational and Environmental Health Laboratory, Ministry Of Health indicates equivalent continuous sound level ($L_{\rm eq}$) in d BA is 36.1 and maximum sound pressure level ($L_{\rm max}$) in dBA is 22.2. Acoustic environment monitoring was performed in accordance with standard procedures adopted by American conference of Government Industrial Hygienist (ACGIH) which is authoritatively and currently used in Myanmar.

5.6.2.3 Water quality data collection

Water Quality Survey method

- Drinking water sample was collected from shallow well (DW -1) from the nearest village called Lay Pin and surface / ground water samples (S2),(S3),(S7) and (S10) were collected from proposed site, which were chemically treated by sampling officer of Occupational and Environmental Health Department.
- Water samples were analysed at the Occupational and Environment Health Department Laboratory by using spectrophotometer, atomic absorption spectrophotometer (Graphite furnace method), pH meter with waste-water analysis standard method and POTATEST incubation method.



Map 9: Location map of water quality samples collecting points

Drinking water samples collecting



Shallow well near Lay Pin Village



Sample collecting from Shallow well near Lay Pin Village

Drinking water (DW)

One point for Drinking Water samples was collected at Shallow Well (depth-10ft) closed to Lay Pin village (DW-1).

Drinking Water quality Lab results

Samples were tested at the Occupational and Environmental Health Laboratory, Ministry of Health. The lab results are presented below.

Table 24: Summary of Drinking Water Results

Analyte	Ref: Value	Unit	Results
			DW-1
Color	15	TCU	1
Turbidity	5	NTU	0.1
Arsenic	50	ppb	0
Copper	2	ppm	0
COD	200	ppm	2
Dissolved Oxygen	11	ppm	4.6
Electro Conductivity	1500	µmhos/cm	980
Phenol	1	ppm	0
Zinc	3	ppm	0
Magnesium	150	ppm	37
Mercury	0.01	ppm	0
Phosphate	0-70	ppm	0
Fluoride	1.5	ppm	0.17
Lead	10	ppb	0.4
Nitrate	50	ppm	0
Manganese	0.4	ppm	0.007
Chloride	250	ppm	4
Hardness	500	ppm as CaCo₃	290
Iron	1	ppm	0.3
Oil and Grease	10	ppm	1.27
рН	6.5-8.5		7.4
Sulphate	250	ppm	138
Total Dissolved Solid	1000	ppm	410
Chlorine (Residual)	4	ppm	0

Every result is normally lower than reference value.

Surface Water/ Ground Water

Surface water samples collecting



S-2 water sample collecting



S-3 water sample collecting





S-7 water sample collection

S-10 water sample collecting

Table 25:Summary of Surface Water/ Ground Water Results

Analyte			und water		14	
Analyte	Ref:	Unit	00	Res		040
	Value		S2	S3	S7	S10
Arsenic	50	ppb	1.174	0	0	0
Chloride	250	ppm	6.7	1.6	0.2	4.7
Chloride (Residual)	4	ppm	0.54	0.06	0.02	0.23
Color	15	TCU	5	10	1	20
Copper	2	ppm	0.01	0.04	0.07	0.17
Dissolved Oxygen	11	ppm	7	8	7	6
Electro	1500	µmhos/c	720	510	320	100
Conductivity		m				
Fluoride	1.5	ppm	0.82	0	0.09	0
Hardness	500	ppm as CaCO3	276	259	138	73
Iron	1	ppm	0.6	1.1	0.3	5.0
Lead	10	ppb	0	0	0	0
Nitrate	50	ppm	5	8	4	23
Manganese	0.4	ppm	1.09	0.11	0.08	0.26
Magnesium	150	ppm	128	84	86	15
Mercury	1	ppb	0	0	0	0
Oil & Grease	10	ppm	4.73	8.32	7.75	6.42
Phenol	1		0.41	0	0	0.85
рН	6.5- 8.5	ppm	7.1	7.3	7.4	7.6
Sulphate	250	ppm	2	7	2	25
Total Dissolved Solid	1000	ppm	410	260	150	50
Turbidity	5	NTU	1	1	1	5
Zinc	3	ppm	0.09	0	0	4.3

Analytical data of surface / ground water results of samples (S2),(S3),(S7) and (S10) analyzed by Occupational and Environmental Health Laboratory, Ministry Of Health indicates no harmful substances such as Arsenic, Lead and Mercury are not found. Oil and grease are found lower than reference value at samples of every outlet, these may be impacted from site clearing and preparing to the land.

Groundwater (Tube well)



Map 10: Location Map of groundwater sample

Summary of Tube wells Results

Table 26: Groundwater, Tube Well No.1

S r	Quality Parameter	Quantity	Method	Drinking Standard	Effluent Standard	Remark
1	pН	7.8	pH meters	6.5-8.5	6.0-9.0*	Normal
2	Hardness	137.64 mg/L	EDTA Titration Method (volunmetric analysis)	≤10 FAU	NG	Clear
3	Chloride	37.86 mg/L	Mohr's method (volunmetric analysis)	NG	≤2000 mg/L*	-
4	Conductivity	0.6 mS/cm	Consort Multi- parameters Conductivity meter	NG	≤50 mg/L*	-
5	Arsenic	0 mg/L	Lovibond Arsenic test kit code. No-400700	≤2.5mS/c m	NG	Normal
6	TurbidIty	39 FAU	LovibondSpectroDi rect Method No.385	≤60 mg/L	NG	
7	Cadmium	<0.01 mg/L	AAS, Shimadzu AA-6200 Cd (228.8 nm)	≤60 mg/L	NG	

8	Copper	0.01 mg/L	≤3 mg/L	NG	-
9	Iron	<0.1 mg/L	≤3 mg/L	≤50 mg/L*	-
1 0	Lead	<0.4 mg/L	NG	≤250 mg/L*	-
1	Aluminium	0.01 mg/L	≤250 mg/L	NG	
1 2	Potassium	4.2 mg/L	≤250 mg	NG	
1	Nitrite	<0.01 mg/L	NG	≤0.2 mg/L*	-
1	Zinc	0.21 mg/L	NG	NG	-
1 5	Manganese	<0.2 mg/L	≤0.07 mg/L*	≤0.1 mg/L*	Normal

Table 27: Groundwater, Tube Well No.2

Sr	Quality Parameter	Res	ult	Method	Drinking Standard	Effluen t Standa rd	Remark
1	рН	7.9		pH meters	6.5-8.5	6.0- 9.0*	Normal
2	Turbidity	<5	FAU	LovibondSpectroD irect Method No.385	≤10 FAU	NG	Clear
3	Total dissolved solids	~	mg/L	Consort Multi- parameters conductivitiy meter	NG	≤2000 mg/L*	-
4	TSS	~	mg/L	Oven-drying method	NG	≤50 mg/L*	-
5	Conductivity	0.3	mS/c m	Consort Multi- parameters conductivity meter	≤2.5mS/cm	NG	Normal
6	Hardness	82. 93	mg/L	EDTA Titration Method (volumetric analysis)	≤60 mg/L	NG	
	Hardness	~	mg/L	LovibondSpectroD irect Method No.200	≤60 mg/L	NG	
7	Dissolved Oxygen	~	mg/L	Jenway Dissolved Oxygen Meter (Model 970)	≤3 mg/L	NG	-
8	BODs	~	mg/L	Estimated by Eco- Lab with Jenway Dissolved Oxygen Meter (Model 970)	≤3 mg/L	≤50 mg/L*	-
9	COD	~	mg/L	LovibondSpectroD irect Method No. 130, 131, 132	NG	≤250 mg/L*	-

10	Chloride	33. 41	mg/L	Argentro Metric method (volumetric analysis)	≤250 mg/L	NG	Normal
	Chloride	~	mg/L	LovibondSpectroD irect Method No.90	≤250 mg	NG	
11	Chlorine total residual	~	mg/L	LovibondSpectroD irect Method No.100	NG	≤0.2 mg/L*	-
12	Free Chlorine	~	mg/L	LovibondSpectroD irect Method No.100	NG	NG	-
13	Free Cyanide	<0. 01	mg/L	LovibondSpectroD irect Method No.157	≤0.07 mg/L*	≤0.1 mg/L*	Normal
14	Nitrate- Nitrogen	~	mg/L	LovibondSpectroD irect Method No.265,267	≤10 mg/L*	NG	-
15	Nitrite	<0. 01	mg/L	LovibondSpectroD irect Method No.270	≤0.5 mg/L*	NG	Normal
16	Phosphate	~	mg/L	LovibondSpectroD irect Method No.320,321	NG	NG	-
17	Aluminium	0.0	mg/L	LovibondSpectroD irect Method No.40	≤0.2 mg/L*	NG	Normal
18	Arsenic	0	mg/L	LovibondSpectroD irect Method No.400700	≤0.01 mg/L*	≤0.1 mg/L*	
	Arsenic	~	mg/L	AAS, Shimadzu AA-6200 As(193.7 nm)	≤10 mg/L*	≤100 mg/L*	
19	Cadmium	~	mg/L	AAS, Shimadzu AA-6200 Cd(228.8 nm)	≤0.005 mg/L*	≤0.1 mg/L*	-
20	Copper	~	mg/L	AAS, Shimadzu AA-6200 Cu(324.8 nm)	≤0.05 mg/L*	≤0.5 mg/L*	-
21	Iron	~	mg/L	LovibondSpectroD irect Method No.220	≤0.2 mg/L*	≤3.5 mg/L*	
	Iron	~	mg/L	AAS, Shimadzu AA-6200 Fe(248.3 nm)	≤0.2 mg/L*	≤3.5 mg/L*	
22	Lead	~	mg/L	AAS, Shimadzu AA-6200 Pb(283.3 nm)	≤0.01 mg/L*	≤0.1 mg/L*	-
23	Manganese	0.3	mg/L	LovibondSpectroD irect Method No.240	≤0.5 mg/L*	≤2 mg/L*	Normal

24	Potassium	1.8	mg/L	LovibondSpectroD irect Method No.340	≤20 mg/L*	NG	Normal
25	Zinc	0.1 5	mg/L	LovibondSpectroD irect Method No.400		≤2 mg/L*	Normal

Table 28: Groundwater, Tube Well No.3

Sr	Quality	Result	•	Method	Drinking	Effluent	Remark
Si	Parameter	Nesui		Wiethou	Standard	Standard	Kemark
1	рН	7.8		pH meters	6.5-8.5	6.0-9.0*	Normal
2	Turbidity	109	FAU	LovibondSpectroDir ect Method No.385	≤10 FAU	NG	Turbid
3	Total dissolved solids	~	mg/L	Consort Multi- parameters conductivitiy meter	NG	≤2000 mg/L*	-
4	TSS	~	mg/L	Oven-drying method	NG	≤50 mg/L*	-
5	Conductivit y	0.7	mS/c m	Consort Multi- parameters conductivity meter	≤2.5mS/c m	NG	Normal
6	Hardness	152. 77	mg/L	EDTA Titration Method (volumetric analysis)	≤60 mg/L	NG	
	Hardness	~	mg/L	LovibondSpectroDir ect Method No.200	≤60 mg/L	NG	
7	Dissolved Oxygen	~	mg/L	Jenway Dissolved Oxygen Meter (Model 970)	≤3 mg/L	NG	-
8	BODs	~	mg/L	Estimated by Eco- Lab with Jenway Dissolved Oxygen Meter (Model 970)	≤3 mg/L	≤50 mg/L*	-
9	COD	~	mg/L	LovibondSpectroDir ect Method No. 130, 131, 132	NG	≤250 mg/L*	-
10	Chloride	54.2 9	mg/L	Argentro Metric method (volumetric analysis)	≤250 mg/L	NG	
	Chloride	~	mg/L	LovibondSpectroDir ect Method No.90	≤250 mg	NG	
11	Chlorine total residual	~	mg/L	LovibondSpectroDir ect Method No.100	NG	≤0.2 mg/L*	-
12	Free Chlorine	~	mg/L	LovibondSpectroDir ect Method No.100	NG	NG	-
13	Free Cyanide	0.03	mg/L	LovibondSpectroDir ect Method No.157	≤0.07 mg/L*	≤0.1 mg/L*	Normal
14	Nitrate- Nitrogen	~	mg/L	LovibondSpectroDir ect Method No.265,267	≤10 mg/L*	NG	-

15	Nitrite	<0.0 1	mg/L	LovibondSpectroDir ect Method No.270	≤0.5 mg/L*	NG	Normal
16	Phosphate	~	mg/L	LovibondSpectroDir ect Method No.320,321	NG	NG	-
17	Aluminium	0.02	mg/L	LovibondSpectroDir ect Method No.40	≤0.2 mg/L*	NG	Normal
18	Arsenic	0	mg/L	LovibondSpectroDir ect Method No.400700	≤0.01 mg/L*	≤0.1 mg/L*	
	Arsenic	~	mg/L	AAS, Shimadzu AA-6200 As(193.7 nm)	≤10 mg/L*	≤100 mg/L*	
19	Cadmium	~	mg/L	AAS, Shimadzu AA-6200 Cd(228.8 nm)	≤0.005 mg/L*	≤0.1 mg/L*	-
20	Copper	~	mg/L	AAS, Shimadzu AA- 6200 Cu(324.8 nm)	≤0.05 mg/L*	≤0.5 mg/L*	-
21	Iron	~	mg/L	LovibondSpectroDir ect Method No.220	≤0.2 mg/L*	≤3.5 mg/L*	
	Iron	~	mg/L	AAS, Shimadzu AA-6200 Fe(248.3 nm)	≤0.2 mg/L*	≤3.5 mg/L*	
22	Lead	~	mg/L	AAS, Shimadzu AA-6200 Pb(283.3 nm)	≤0.01 mg/L*	≤0.1 mg/L*	-
23	Manganes e	<0.0 2	mg/L	LovibondSpectroDir ect Method No.240	≤0.5 mg/L*	≤2 mg/L*	Normal
24	Potassium	2.3	mg/L	LovibondSpectroDir ect Method No.340	≤20 mg/L*	NG	Normal
25	Zinc	0.05	mg/L	LovibondSpectroDir ect Method No.400	-	≤2 mg/L*	Normal

Table 29: Groundwater, Tube Well No.4

Sr	Quality Parameter	Result		Method	Drinking Standard	Effluent Standar d	Remar k
1	pН	7.9		pH meters	6.5-8.5	6.0-9.0*	Normal
2	Turbidity	14	FAU	LovibondSpectroDir ect Method No.385	≤10 FAU	NG	Turbid
3	Total dissolved solids	~	mg/L	Consort Multi- parameters conductivitiy meter	NG	≤2000 mg/L*	-
4	TSS	~	mg/L	Oven-drying method	NG	≤50 mg/L*	-
5	Conductivit y	0.5	mS/c m	Consort Multi- parameters conductivity meter	≤2.5mS/c m	NG	Normal
6	Hardness	~	mg/L	EDTA Titration Method (volumetric analysis)	≤60 mg/L	NG	
	Hardness	20 0	mg/L	LovibondSpectroDir ect Method No.200	≤60 mg/L	NG	
7	Dissolved Oxygen	~	mg/L	Jenway Dissolved Oxygen Meter (Model 970)	≤3 mg/L	NG	-

8	BODs	~	mg/L	Estimated by Eco- Lab with Jenway Dissolved Oxygen Meter (Model 970)	≤3 mg/L	≤50 mg/L*	-
9	COD	~	mg/L	LovibondSpectroDir ect Method No. 130, 131, 132	NG	≤250 mg/L*	-
10	Chloride	~	mg/L	Argentro Metric method (volumetric analysis)	≤250 mg/L	NG	
	Chloride	10	mg/L	LovibondSpectroDir ect Method No.90	≤250 mg	NG	
11	Chloride total residual	~	mg/L	LovibondSpectroDir ect Method No.100	NG	≤0.2 mg/L*	-
12	Free Chloride	~	mg/L	LovibondSpectroDir ect Method No.100	NG	NG	-
13	Free Cyanide	<0. 01	mg/L	LovibondSpectroDir ect Method No.157	≤0.07 mg/L*	≤0.1 mg/L*	Normal
14	Nitrate- Nitrogen	~	mg/L	LovibondSpectroDir ect Method No.265,267	≤10 mg/L*	NG	-
15	Nitrite	0.0	mg/L	LovibondSpectroDir ect Method No.270	≤0.5 mg/L*	NG	Normal
16	Phosphate	~	mg/L	LovibondSpectroDir ect Method No.320,321	NG	NG	-
17	Aluminium	0.0	mg/L	LovibondSpectroDir ect Method No.40	≤0.2 mg/L*	NG	Normal
18	Arsenic	~	mg/L	LovibondSpectroDir ect Method No.400700	≤0.01 mg/L*	≤0.1 mg/L*	
	Arsenic	0	mg/L	AAS, Shimadzu AA-6200 As(193.7 nm)	≤10 mg/L*	≤100 mg/L*	
19	Cadmium	~	mg/L	AAS, Shimadzu AA-6200 Cd(228.8 nm)	≤0.005 mg/L*	≤0.1 mg/L*	-
20	Copper	~	mg/L	AAS, Shimadzu AA- 6200 Cu(324.8 nm)	≤0.05 mg/L*	≤0.5 mg/L*	-
21	Iron	~	mg/L	LovibondSpectroDir ect Method No.220	≤0.2 mg/L*	≤3.5 mg/L*	
	Iron	~	mg/L	AAS, Shimadzu AA- 6200 Fe(248.3 nm)	≤0.2 mg/L*	≤3.5 mg/L*	
22	Lead	~	mg/L	AAS, Shimadzu AA-6200 Pb(283.3 nm)	≤0.01 mg/L*	≤0.1 mg/L*	-
23	Manganes e	<0. 02	mg/L	LovibondSpectroDir ect Method No.240	≤0.5 mg/L*	≤2 mg/L*	Normal
24	Potassium	5.1	mg/L	LovibondSpectroDir ect Method No.340	≤20 mg/L*	NG	Normal
25	Zinc	0.1	mg/L	LovibondSpectroDir ect Method No.400		≤2 mg/L*	Normal

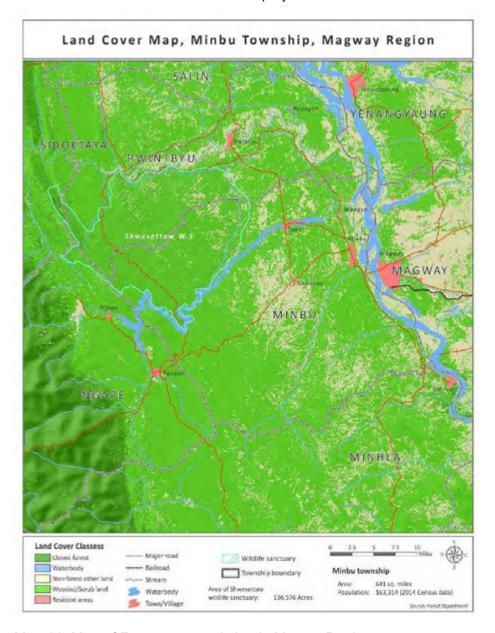
Analytical data of four tube wells

Analytical data of four tube wells are collected from developer. Developer has analyzed four samples of water from each tube wells. The results from Ecological Laboratory, advancing life and Regenerating Motherland (ALARM) found no harmful related to reference value.

5.7 BIOLOGICAL ENVIRONMENT

5.7.1 Setting the Study Limit

Study limit of the biological survey is just inside the 840 acre land of the project site and 3 km radius area of land surround the project site.



Map 11: Map of Forest types existing in Magwe Region

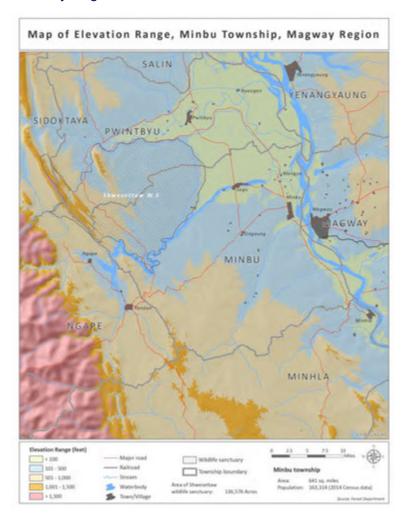
5.7.2 Methodology and Objectives

The main objective of the field study is to know the presence and absence of different types of animal and trees both in the project site and its adjacent area that surround it, as it looks superficially a unfertile land with less tree presence in its ecosystem.

The biological environment setting here is described in terms of habitat types, selected floral and faunal species, endangered or threatened species, and some special features of existing ecosystem's status and quality with a perspective of how to maintain some value of ecological quality in rural and semi-natural setting.

The plant species in both direct impact zone (project area) and indirect impact zone are studied, observed and recorded. The method of identification is visual identification by local villager and the floral experts. The visual investigation is carried out by walking through some areas of field at western and eastern side of the project site as well as inside the project site.

Information of plants, wildlife and animal presence is largely relied on interviewing the local inhabitants/villagers and secondary data, while tracks and signs were observed with direct eye sight as we walk in the field.



Map 12: Map of elevation range in Minbu Township, Magwe Region



From the solar power project site towards the western boundary and Rakhine Yoma



Soon after the clearance of the land, grass starts to grow with first rain.



Secondary growth has started, after the original forest cover is removed.





Surrounding area of the project site is rich with median-sized trees.

5.7.3 Existing Biological Conditions

The landscape of the area has a flat to gently undulating topography with an average elevation of about 190 m (58 feet). The soil is alluvial sands and gravels, mixed with sandstones (very commonly on literite). The western border of the dry zone is to some extent covered by dry deciduous forest, a dominant type among the different vegetation types of Myanmar. No bamboo species is naturally growing in this area.

Actually forests currently existing near the project area are largely *Indine*, not Than-Dahat and Thorn forest. The Indine forest occurs on certain gravel and sand soils and very commonly on literite. *In, ingyin* and *thitya* are three typical trees of this type, while Than-Dahat and thorn forests are usually found in the edges of dry zone, where the rainfall is 30" to 50" and the dominant species grown in such forest are: Than (*Terminelia oliveri*), Dahat (*Tectona hamiltonii*), Sha (*Acacia catechu*) and Ziphu. Thorn forest grows in drier area where the rainfall is round about 30". Dominant species of this type of forests are Sha (*Acacia catechu*), Tanaung (*Acacia leucophloea*), Zi (*Zizyphus jujube*), and Thanakha (*Limonia acidissima*). However, the area is seen as wooded/ scrub land in general and wider perspective (Map 1)

Dry Deciduous Forests grow on hill slopes with stony, poor soils. These forests are thought to be widely distributed at the western edges of the central Dry Belt. Fuel wood and house-post are only major forest produce of the dry type. Common trees are *than, daht, sha, tanaung, zi, thanakha* (Shirley, 1955).

Habitat of this region where the proposed project is **scrub indaing**. This type is found on dry shallow soils where the **high indaing** merges gradually into scrub owing to lack of moisture and exposure to the heat of the sun. **Ingyin** and **thitya** are more often more numerous on such areas than **in. Scrub indine** yields no sown timber, only fuel and house-posts.

Habitat itself has been degrading throughout last 50 years since then area had been a full of natural vegetation in the project site and surrounding area. The more eastern the land reaches, the less trees exist on the drier land and the more intrusion of the agricultural activities occur on the land.



Eastern side of the project has more farm land than western side.



Just clearing the land for agriculture



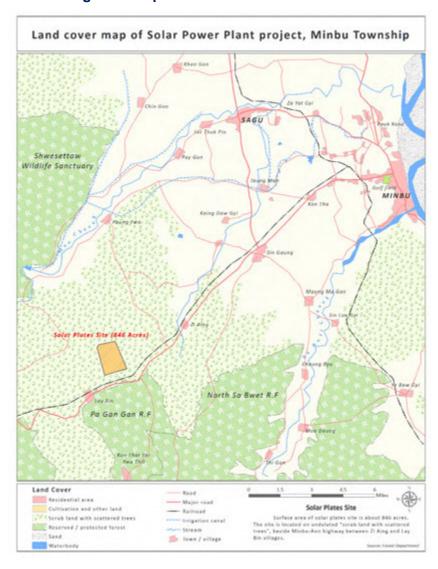
Corn has already been grown up

5.7.3.1 Agricultural Land

Most of the surrounding area of the project site is covered with Scrub Indine forest and agricultural activities can be made by removing the trees occurring there. The agricultural land are used for growing Green gram, *Vigna radiate* (L) Wilezek and Pigeon pea, *Cajanus canlan* (Wills) sp, corn and sesame which are compatible with the soil type and climate of the area.

The project area is surrounded by some reserved forests where Shwesetaw is well known.

5.7.4 Biological Component



Map 13: Land cover Map

According to what Map 3 depicts, project site and surround natural landscape is covered by scrub indine forest trees are scattered. As the Indaing occurs on gravelly, sandy and laterite soils, the following trees have been growing naturally on this landscape. The following trees are found currently growing at the surrounding area of the project site.

In (Dipterocarpus tuberculatus Roxb),
Inbo (Dipterocarpus obtusifolius),
Thitsae (Melanorrhoea usitata Wall.),
Thitya (Shorea oblongifolia),
Ingyin (Pentacme siamensis),
Sha (Acacia catechu),
Kokeko (Albizia lebbek L. Benth),
Pyinma (Lagerstroemia reginae Rox),
Phankha (Terminaalia chebula Retz.),
Deedu (Bombax insigne Wall.),
Nipasae (Moranda tinctoria Roxb.),
Lein (Terminalia pyrifolia Kruz),
Kyot (Schleichera oleosa (Lour.) Oken),

Khunpho (<i>Premna pyramidata</i>),
Yinma (Chukrasia tabularis A. Juss),
Thitpoke (<i>Tetrameles nudiflora</i> R. Br.),
Tayaw (<i>Grewia tiliifolia</i> Vahl),
Thitswele (Schebera swie tenioides
Roxb.),
Thanut (Cordia dichotoma Forst.), and
Ziphu (Emblica officinalis Gartn.),
Than (Terminalia olivery),
Dahat (Tectona hamiltoniana)
Shawphyu (Sterculia versicolaor Wall.)
Thanakar (<i>Limonia acidissma</i>)

Nabe (Lannea coromanelica (Houtt)

Wall.)



Thanakar (*Limonia acidissma*) and Shawphyu (*Sterculia versicolaor* Wall.) are economically important. Some villagers in Laybin grow these two kinds of trees for their income.

5.7.4.1 Common Animals

Common animals found in the area are: cobra, and variety of snakes, monitor Lizard and variety of butterfly. moles, squirrels, porcupine and hare are very common in surrounding area, while jungle cat, barking deer, jackal are frequent visitors. Thamin is receeding towards West.



This is the track of a jungle cat visiting current project site.



Eld's Deer, Thamin is IUCN's vulnerable animal, but it is approaching to endangered leve. And protected by Forst law in Myanmar.

Aquatic ecosystem is not much playing in important role, but it has strong influence in distribution of variety of animal species especially in rainy season when water ways are functioning as transport system in nature.

For the wider area, mix deciduous forest is dominant in the surrounding area. This type of forest is the home of variety of wildlife. Therefore Shwesettaw is an important wildlife sanctuary for more than a hundred years. Now it becomes an attractive ecotourism site that can threaten wildlife and ecosystem sustainability.

Table 30: Mammal species found in Project site and its vicinity

Sr	Scientific Name	Common Name	Evidence	IUCN	CITES	MWPA	Note
1	Telpa micrura	Eastern Mole	Interview				Abundant
2	Callosciurus sp.	Squirrel	Interview				Abundant
3	Menetes berdmorel	Ground squirrel	Interview				Abundant
4	Hystrix brachura	Porcupine	Interview				Very common
5	Lepus peguensis	Siamese Hare	Interview				Commonly present
6	Muntiacus muntjak	Barking Deer	Interview			SP	Commonly seen
7	Felis chaus	Jungle cat	Interview		Ш		Recently seen

8	Viverricular indica	Small Indian Civet	Interview			СР	Recently seen
9	Panthera pardus	Leopard	Interview		1	СР	Visited 30 years ago
10	Pardofelis nebulosa	Clouded Leopard	Interview	VI	_	СР	Visited 30 years ago
11	Panthera tigris	Tiger	Interview	E	I	СР	Visited 40 yrs ago
12	Cervus unicolar	Hog Deer	Interview	DD		SP	Very rare
13	Manis petadactyla	Pangolin	Interview	LRNT	Ш	СР	Very rare
14	Sus scrofa	Wild pig	Interview				Very rare
15	Canis aureus	Jackle	Interview				Very rare

* Note: E = Endangered species, VL= Vulnerable, DD = Data Deficient, LRNT= Lower Risk - Near Threatened in IUCN Redlist's categories; I = Appendix I:Endangered species,trade in which is normally prohibited, and II = Appendix II:Threatened species, trade in which is controlled by permits. CITES is the convention on International Trade in Endangered Species of Wild Flora and Fauna. CP = Completely Protected Wild Animals,SP = Seasonally Protected Wild Animals as described in the three different Categories of Protected Animals listed in the Notification No. 583/94 issued by Forestry Dept. on October 26, 1994

In the past, a good diversity of large mammals including Thamin (*Cervus eldi*), Gaur (*Bos gaurus*), benteng (*Bos banteng*), serow sambar (*Cervus unicolor*), hog deer (*Axis porcinus*), wild pigs, leopard (*Panthera pardus*), tiger (*Panthera tigris*), clouded leopard (*Neofelis nebulosa*), bear (*Ursus thibetanus* or *U. malayanus*), wild dog (*Cuon alpinus*) and two or more species of primates occurs throughout the region of this low land dry deciduous/indine forests existing in the surrounding environment of the current project site are. Nowadays, due to intrusion of human settlement and expansion of agricultural and development activities, natural forests have degraded and, wild animals have receded to the west where forest-covered hills exist. In terms of large mammals, only muntjac (*Muntiacus muntjak*), jungle cat (*Felis chaus*) and jackle (*Canis aureus*) are known to be encountered recently in nearby area.

5.8 SOCIAL ENVIRONMENT



5.8.1 Overview

The two nearest villages to Minbu Solar Power Plant Project site are Lay Pin and Zee Aing Villages. Lay Pin Village is located 1.27 miles to the south-west of the project site and there are 435 households and a population of 1,592 in this large village. Zee Aing Village is located 3.34 miles to the south-east of the project site and there are 200 households and a population of nearly 1030 in this small village.

There is no rice cultivation in both villages. The staple crops grown in both villages are beans and pulses and sesame. The land plots of about 5 farmers were included in the project area and the company has, as it is known, given the compensation of Ks. 9,200,000 (9.2 million kyats) to three of them because they have legal documents of land-ownership. The other two have not been given the compensation, as they do not have any evidence of land-ownership.

But the compensated three are still not satisfied because, according to their words, they have only got compensation for crops and have not got compensation for their land. Even though the project area belongs to the Ministry of Natural Resources and Environmental Conservation, there is evidence that the farmers have paid taxes for working the land.

The authorities from the company have promised that they are going to review their evidences. Besides the families of those who have lost land, the people from the other villages also hope that their villages will have electricity and enough drinking water and water for domestic use. There are only 5 people who are now working with the project site.

The pieces of the farmland of Zee Aing Village are not included in this project site. There are about 40 villagers from Zee Aing Village working with this project. Zee Aing Village also happily hope that they will have electricity and artesian wells.

There is a good relation between the villagers and the staff of project-company.

5.8.2 Description of the Surrounding Environment

The nearest villages from the sites are Lay Pin and Zee Aing. Lay Pin village is located 1.27 miles to the South-West and Zee Aing village is 3.34 miles to the North-East.

Profile of Laybin Village, Minbu Township, Magway Region

5.8.2.1 Overview of Lay Pin Village



Lay Pin Village



Lay Pin middle school

Lay Pin monastery

Lay Pin Village Profile

Sr	Title	Description
1	Village Name	Lay Pin
2	Number of Households	435
3	Population	1,592
4	Education	1 middle school
5	Health	Midwife 1
6	Economy/Business	Small shop 21 Vehicle 13 Agriculture: Beans(Peanut, Seasame, Green Mount Bean, Pigeon Pea), Fibre
7	Transport	Motorcar 5 Taxi 5 Three wheeler 4 Motorcycle 435
8	Communication	Mobile Phone MPT, MEC, Ooredoo 500 TV 200 Radio 50
9	Social	Football playground 1 Monastery 2
10	Other	Electricity sources: battery, solar, generator Water sources: Tube well, Pool, Rain water
11	Religion	Buddhist

The Population and background history of Laybin Village

Laybin is one of the villages of Minhlagin Village-tract in Minbu Township. When it was first founded about 120 years ago, it was a small village with 25 houses situated on a plot of land near the monastery at the entrance of the village. In 1957, the small village with 50 houses moved to the present place off the motor road as a registered village enlisted at the Ministry of Home Affair. The reason why the village has been named



Laybin village

'Laybin (Four trees)' is that there were 4 white mango trees at that place when it was founded. Currently, there are over 400 houses, and 435 households. It has a population of 1,592. Viewed from astrological point of view, 'lay' stands for '4' in number and 'bin' stands for '5'. The result of adding up the two numbers is '9'. The number '9', known as 'Nawin' (9), can be defined as an auspicious zodiac number. Thus, the name has been used so far.

Education

Most of the residents of Laybin Villager are Myanmar nationals. There is a branch middle school in Laybin Village. Altogether 322 students—138 middle school level students, 132 primary school students and 52 Kindergarten students—are learning under the tutelage of 92 teachers. As one of the school buildings has cracks in its walls caused by an earthquake, students are learning in the shades of trees and in some makeshift buildings.

Those who have passed the middle level (Ninth Grade) at the branch middle school have to go to Minbu High School to continue their education. As Minbu is 18 miles far from Laybin Village, about 15 students have discontinued their education. Two children have no access even to primary education and one to middle education. Those who have passed the middle level can rarely continue their further pursuit of education.

Basic Education School Structure in Myanmar

There are three levels in Basic Education level: primary (elementary), middle (lower secondary) and high (upper secondary).

Level From		То	Years				
Primary	KG (1st Grade)	5 th Grade	5				
Middle	6 th Grade	9 th Grade	4				
High 10 th Grade		11 th Grade	2				
Total number	Total number of years in Basic Education ▶						

Students who have passed the 11th Grade (High School Final class) are to join a university or college of Higher Education.

Student population of Laybin Village Branch Middle School

Sr No.	Level		Standard	No of students
1	Primary School level	а	KG (1 st Grade)	52
		b	2 nd Grade	34
		С	3 rd Grade	35
		d	4 th Grade	25
		е	5 th Grade	38
			Total ▶	184
2	Middle School Level	d	6 th Grade	47
		С	7 th Grade	31
		е	8 th Grade	29
		f	9 th Grade	31
		Total ▶		138
	All levels	All total ▶		322

Health-care

There has not been a rural clinic to provide health-care for the people of Laybin Village. There is a mid-wife under the Department of Rural Health. People often suffer from malaria, bowels disorder, cholera, and paralytic stroke. They have no other diseases. If someone suffers from a serious disease, he/she has to go to the Minbu Hospital for treatment. They use drinking water from wells, lakes and rain water tanks for domestic use and artesian wells. There has not been enough water for the whole year, and so they have to buy water from the owners of artesian wells by paying 500 kyats to 700 kyats for a barrel. Every house has a fly-proof flush toilet. They throw away rubbish in the forest and burn it in their compounds or farm-yards. The villagers have their own houses made of wood or bamboo.

Business



Most of the Laybin villagers earn their living by farming, growing a variety of peas and breeding goats, and swines. Some are shopkeepers and some of them have carrental services. Some grow groundnut, pedi-sein (green bean), pe-sin-ngon (pigeon pea), sesame, shaw-byu or sei-kalama (gum tragacanth) and thanakha (limonia acidissima). In previous years, some went to work at handscooped oil-wells. Some of the young people go to work in Thailand and Malaysia and send back their income

to their families. There are altogether 21 shops including groceries, food-stalls, cafeterias and meal-shops. There are 13 people running carrental service. About 50 families breed cows, goats, swines and hens and there are about 200 farmers. About 14 are carpenters and masons. About 10 are workers at handscooped oil-wells. The village does not produce rice that is bought at 2,400 kyats per pyi.1 They buy good quality fish at 4500 kyats per viss.² When they go to the city, the bus-fare is 1,000 kyats per head/ride and cycle-carrier 4,000 kyats each.



Social and religious Affairs





As it is in the rural area, there are no market, recreation centre, fire brigade and bank. As there is also no library, teachers of Education Department and some villagers are making an attempt to establish a village library. There is a football ground. Most of them are Buddhists. There is a pagoda and two monasteries. They have formed a trustee committee for religious affairs, a rural development committee, Women's Affairs Association and some political parties. There is no police station for village security. The village administrator, heads of hundred households and 10 households take this responsibility. As most Buddhists live in Laybin Village, they celebrate religious festivals

Pyi is a traditional volume measuring unit. There are 8 tin-fuls (condensed milk tin) in a pyi. There are 16 pyi's in a basket. This traditional unit is used for measuring paddy (with husk) or rice.

Viss is a traditional weight measuring unit. There are 100 ticals in a viss. One viss is equal to 3.6 lbs or 1.65 kg.

and pagoda festivals. The village is crowded and busy with guests when the Man Shwe Settaw Pagoda Festival in Minbu takes place.

Transport and Communication

Labin Village is situated on the motor road that links Minbu with Ann. They have no difficulties in communicating with other towns and villages. The roads linking with villages are paved with earth and some with stones. But Minbu-Ann road is tarred. The earth-paved roads and stone-paved roads can be used in all three seasons. Five of the villagers own cars, another five have taxis and four others have three-wheel cycle-rental service. Every household has a motor-cycle. They can have access to other villages and towns by bus lines. It will cost them 1,000 kyats each to Minbu and cycle-carrier will cost 4,000 kyats each. Every house has its own mobile phone. About 200 households have television sets while about 50 listens to the radio. There are 500 mobile phones in the whole village.

Overview

What the villagers desire to have are a village clinic, a village library, electricity and water. Electricity is what they desire most because they have to rely on solar panel power, LED and candle lights.

Profile of Zee Aing Village, Minbu Township, Magway Region

5.8.2.2 Overview of Zee Aing Village





Zee Aing Village

Zee Aing Villager's House







Zee Aing Farm

Zee Aing Village Profile

Sr	Title	Description
1	Village Name	Zee Aing
2	Number of Households	200
3	Population	1030
4	Education	1 primary school
5	Health	-
6	Economy/Business	Small shop 10 Vehicle 17 Agriculture: Beans(Peanut, Green Mount Bean) Livestock: Cow, Goat, Pig
7	Transport	Bus car 1 Taxi 9 Three wheeler 7 Motorcycle 200 Trailergy 1
8	Communication	Mobile Phone MPT, MEC, Ooredoo 500 TV 70 Radio 100
9	Social	Library 1 Monastery 3
10	Other	Electricity sources: battery, solar, generator Water sources: Tube well, Pool, Rain water, Groundwater
11	Religion	Buddhist

1. The Population and background history of Zee Aing Village

Zee Aing Village is situated in Minbu Township of Magway Region and off the Minbu-Ann Motor road. Zee Aing Village was founded over 137 years ago. It has been known as 'Zee Aing' (Plum Tree + Lake) Village because the area is covered with a good deal of plum trees and lakes. There are two villages—Zee Aing and Tegone Villages—in Zee Aing Village Tract. There are 256 households and 200 houses in Zee Aing Village which has a population of 1,030. Those who live in Zee Aing Village are mostly Buddhists.

2. Education

There is a post-primary school in Zee Aing Village under 9 teachers. There is a total student population of 176 including 78 primary level students from First standard to Fourth standard, 82 middle school level students from Fifth standard to Seventh standard and 16 Kindergarten students. Those who pass the Seventh standard have to continue their education by attending the State High School in Hsingaung Village and the State High School in Minbu which is about 12 miles far



from the village. As there are not enough classrooms at the post-primary school in Zee Aing Village, they have been establishing a self-help school building but it has come to a halt. Twelve of the children at the school-going age have no access to school. Fifteen of

them discontinue their middle school education and nine students stop their high school education.

Student population of Laybin Village Post-Primary School

Sr No.	Level		Standard	No of students
1	Primary School level	а	KG (1 st Grade)	16
		b	2 nd Grade	25
		С	3 rd Grade	17
		d	4 th Grade	17
		е	5 th Grade	19
			Total ▶	94
2	Middle School Level	d	6 th Grade	26
		С	7 th Grade	31
		е	8 th Grade	25
		Total ▶		82
	All levels	All total ▶		176

3. Health-care

Zee Aing Village has no rural clinic and no nurse. There is only a auxiliary midwife. When a woman has to give birth to a child, they have to rely on the auxiliary midwife and a local village birth attendant by following the tradition. Those who have difficulties in delivering babies or those who suffer from serious diseases have to go to the Health Department of Hsinggaung Village or Minbu Hospital for treatment. There are a few people who suffer from malaria and no other contagious diseases. They fetch drinking water or water for domestic use from the four artesian wells, 3 lakes or domestic rain water tanks. They have enough drinking water and water for domestic use for all three seasons. Every house has a fly-proof flush toilet. They carry rubbish into the forest and throw it away there. Sometimes, the trash is burnt in their compounds. Zee Aing Village Post-primary School requires one artesian well. The villagers live in their own houses made of wood or bamboo. There is adequate ventilation in their houses that are built in compliance with health-care system.

4. Business

Most of the villagers earn their living by farming. They grow a variety of beans and sesame. About a hundred of the villagers are farmers and about 30 villagers breed goats,

cows and swines within their capacity. Some open their own shops. Ten of them open groceries and food-staff Another business is taxishops. service including 10 taxis. There are 7 three- wheel cycles for rental. About ten are carpenters and masons. Over 100 villagers are casual workers, earning 5,000kyats a day as a daily wage. Farm-hands also earn 5,000 Twenty daily wage kyats a day. earners and 15 earning monthly salaries are involved in solar power project in Minbu.



Enhancing knowledge for village residents

Zee Aing Village has a library on the main street of the village. For establishing the library, Save the Children Fund (SCF), an international Non-Governmental Organiza-tion, raised the initial fund to which Minbu (Sagu) Township Administration contributed MMK 500,000. Despite the emergence of the library, it still needs wellwishers who will donate books on various topics and periodicals.—newspapers, magazines and journals. The library now has around 200 books.

Social and religious affairs



Village library

There are no market, hall, fire brigade and police station as Zee Aing is in a rural area. There are a village library, a day-care centre and a Village Administrator Office in Zee Aing Village all of which are provided by the government. They have formed a religious organization, a Village Development Committee, a Women Affairs Society and there are 2 political parties—NLD and SUDP. The Village security is undertaken by the Village Administrator, heads of one hundred

households, heads of ten households and the village elders. As the villagers of Zee Aing Village are mostly Myanmar Buddhists, there are 3 monasteries, a travellers' rest shed, a Dhammayone (Community hall for religious purposes) and 5 pagodas. Religious festivals and traditions have been preserved and handed down to next generations.

Transport and communication

Zee Aing Village is situated by the road that links Minbu with Ann and that leads to the Shwe Settaw Pagoda in Minbu Township. The village is about 12 miles far from Minbu that is accessible by bus. As there are 9 taxis, 7 three-wheel cycle-careers and a trailer pulled by a small tractor, they can have access to other villages or towns in three seasons. The roads that link villages are the ones paved with earth. But Minbu-Ann road is tarred. Every house in the village has a motor-cycle that helps them access to other places easily. The village takes care of earth roads and government takes care of the tarred road. There are 70 TVs, about 100 radios and over 500 mobile phones as every house has its mobile phone and in some families, each and every member has his or her own mobile phone.



Shwe Settaw - Minbu road



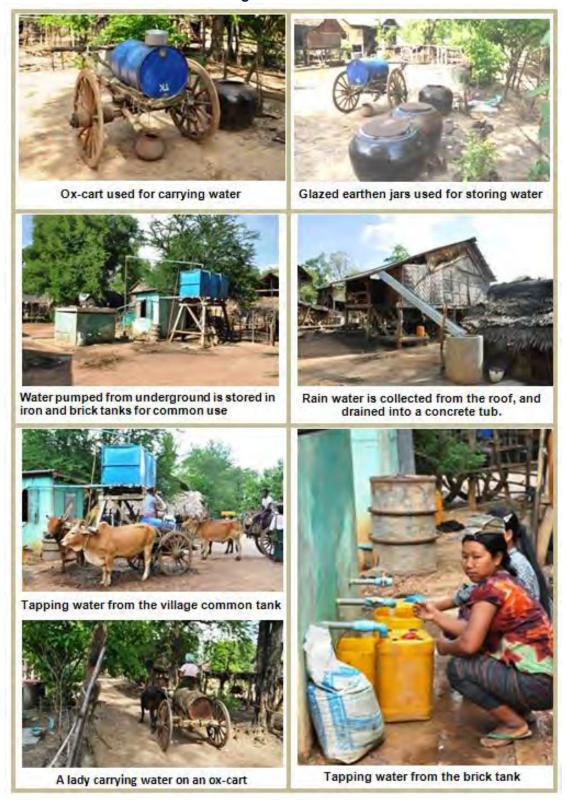
Ox-cart and three-wheel cycle

The suggestions given by the villagers

Most of the people in Zee Aing Village require another artesian well for the whole village to get enough water. They also need a village clinic for their health. They want GEP to help them finish establishing the new school building. They want to have job opportunities

if the solar power factory is implemented. The main requirement for them is electricity supply. If they have electricity, they think they will be able to extend their businesses.

Scenes of water collection in Village





6 POTENTIAL ENVIRONMENTAL IMPACTS AND RISK ASSESSMENT





Polysilicon is produced from metallurgical grade silicon by a chemical purification process, called Siemens process. This process involves distillation of volatile silicon compounds, and their decomposition into silicon at high temperatures.

As with any industrial product there is an environmental impact associated with solar Photovoltaic panels. The main areas of potential concern are:

- The energy required to produce them, particularly the photovoltaic cells
- What happens to them at the end of their lifetime The main component of most PV modules is silicon, which isn't intrinsically harmful, but parts of the manufacturing process do involve toxic chemicals and these need to be carefully controlled and regulated to prevent environmental damage.

A report by the Silicon Valley Toxics Coalition lists a number of potentially damaging chemicals used in the manufacture of PV cells. There are several different types of PV technology and each of them use different processes to manufacture, but some of the common harmful chemicals involved in crystalline PV cell manufacture are:

- Crystalline silicon is made using silane gas, the production of which results in waste silicon tetrachloride which is toxic. It can be recycled into more silane gas but has the potential to cause harm
- Sulphur Hexafluoride is used to clean the reactor used in silicon production. If it
 escaped it would be a very potent greenhouse gas. It can also react with silicon
 to create a range of other compounds.
- A range of other chemicals used for cleaning the silicon and cells

There is also lead and small amounts of aluminium and silver in the electronics. The use of lead-based solder would lead to pollution problems if items are sent to landfill or incineration.

6.2 OVERVIEW

This chapter presents assessments of potential environmental impacts of (construction phase, operation phase and decommission phase) proposed Photovoltaic solar power plant at Mnbu, Magwe region. These environmental impacts exist soil, dust emission, air pollution, water and hydrology, noise and vibration, sewage, solid waste and handling of PV solar panels.

6.3 IMPACT AND RISK ASSESSMENT METHODOLOGY

Impact is defined as change in an environmental parameter, which results from the implementation of the proposed project. It is predicted or measured over a specified period and within a defined area.

6.3.1 Identification of the potential impacts

There are several methods to assist in the identification. These include checklists, networks, map overlays, matrices, networks, computer models and public consultation. Simple and descriptive checklists are used for impact identification.

6.3.2 Impact Assessment

Assessment refers to the interpretation of the significance of anticipated changes relating to the proposed project. Impact interpretation is based upon the systematic application of definition of "significance": E.g., waste-discharge standards (effluent limitation) from particular facilities. The application of professional judgment in the context of assessing impacts is a pivotal role in our work.

Another basis for impact assessment is public input; this input could be received through the conduct of public meetings and interviews with residents in surrounding area of the project site. As the general public can often delineate important environmental resources and values for the particular areas, and these are also considered in impact assessment. The assessment of short and long term potential impacts is made on the basis of information collected from existing sources supplemented by the field data. Impacts are also differentiated as direct or indirect – those that arise directly from the proposed project, and those that arise because of secondary activities induced by the project. Impacts are also categorized in relations with different implementation phases: Pre-construction phase, Construction phase, Operation phase and Abandonment phases.

6.4 PHYSICAL POTENTIAL ENVIRONMENTAL IMPACTS

6.4.1 Negative impacts (Construction Stage)

6.4.1.1 Soil

Proposed solar power plant is to be constructed at 836 Acre of hilly land area. The project civil engineering works need to excavate, fill and cut a large quantities of volume of soil to get a systematic gradient as design. The top soil nutrient layers will be removed and lower soil will be covered. Somewhere soil layers will be mixed. The original soil will be degraded as negative impact to soil. The original soil samples are collected at different location of work site area and its nutrients and heavy metals analysis are recorded as base line data. Designated soil layer also will be degraded by erosion of storm water, stacking of solid wastes, piling of construction materials, spills and improper handling of PV solar panels. Soil along, the streams of surrounding environment which lead from (S2), (S3), (S7),(S10) and (S8) will be degraded as negative impacts.

6.4.1.2 Dust emission

During the construction phase of the project which include such as infrastructures of construction of approach road, sub- station, office buildings, residents and earth work for preparation of gradients, cutting, filling, compacting, and shifting of soil will generate substantial quantities of dust at the construction site. The sources of dust emission at 836 acre wide land will include running of earth moving machineries such as loaders, bulldozers, back holes, road rollers, compacters, water bowser and management vehicles. A large emission of dust will lead to significant impact on workers and surrounding area. Lay Pin village is 1.27 miles distance from proposed site which located at south and Zee Aing village is 3.34 miles distance from proposed site which located at east. Local residents at both of nearest villages will not be impacted emission of dust during construction phase. The above dust emission will be impacted during winter and summer times.

6.4.1.3 Air Pollution

Diesel combustion of earth moving machineries such as loaders, excavators, trucks, dumpers, bulldozers, back holes, compactors, road rollers, graders, diesel generators and management vehicles will contribute dust, CO2, NO2, and fine particulate matters (PM 2.5 and PM 10).

MSR survey team observed and collected samples at proposed site on (10 September 2016). Air quality Haz-scaner machine is installed at the center point of the proposed site. Analytical data of air quality is analyzed and operated by Occupational and Environmental Health Laboratory experts, Ministry Of Health, indicates;

Hydrocarbon HC is 9613 ppm and Methane CH₄ is 17404 ppm.

PM ₁₀ (24 Hr) is (24 ug/m³) which is lower than reference value (50 ug/m³).

PM _{2.5}(24 Hr) is (35.4 ug/m³) which is quite over than reference value.

 NO_2 (1 Hr) is (11953 ug/m³) which is enormously higher than its reference value (200 ug/m³).

SO₂ (24 Hr) is (865.7 ug/m³) which is quite higher than its reference value (20 ug/m³).

O₃ (8 Hr) is (6960 ug/m³) which is very higher than its reference value (100 ug/m³).

CO (1 Hr) is (76.3 ug/m³) which is very lower than its reference value (30000 ug/m³).

VOCS (1Hr) is (88.6 ug/m₃) which is lower than its reference value (400 ug/m³).

Collected data from developer and contractor 13 excavators, 10 bulldozers, 38 dump trucks,1 grader, 21 compactors,11 water bowsers, 1 No 220 V generator and 1 No 63 KV generator are working 24 hours continuously. One hour consumption of these heavy machineries are 340 gallons of diesel fossil oil. This calculation is not including such as small engines and office vehicles. Assumed 8200 gallons of diesel fossil oil is burning and combustion at site.

Emission of carbon particulates (PM 2.5) emit from exhaust of engines is depended on type of fuel and engine.

Such emission and air pollution lead to several environmental impacts including global warming and human health as lungs problem which will lead to immature death.

But the proposed project site is quite far from nearest villages, air pollution may not occur to these villages. Surrounding environment of proposed site will be effected air pollution impact to workers, operators and office staffs. During construction phase, a large quantities of preparation of gradient of earth work will consume diesel fuel oil at proposed site, air pollution will be effected obviously. This impact will be significantly effected during construction phase of the project.

6.4.1.4 Surface Water/Ground water contamination

Concrete foundation process at 230 KV towers, Sub-station construction, office building constructions and construction of quarters and residents will excavate surface earth. Deeply excavated foundation will pass through water layers and water body at ground. Cast in place foundation process needs to use cement and hardener chemicals. These would be take place in ground water till setting time of concrete. Temporary contamination of ground water will occur during concrete construction. The negative impacts during construction phase, especially at rainy season, surface water and ground water will be contaminated by stacking of solid waste, oil spill, improper storage of fuel oil, chemical and hazardous materials, piling of construction materials, handling of PV solar panels, transporting of materials and disordered sewage disposal.

6.4.1.5 Water use

During construction phase of proposed site will required large quantities of water, sourced from underground. The developer has already planned 4 numbers (6) inch diameter sunk tube wells with pump inside the project compound. Tube well No1 is already installed with pump which can deliver 2245 gallons per hour. 600 Ft depth underground water will be supplied for its requirement of water during construction of phase 1. A 33000 gallons capacity of concrete ground tank is constructed near tube well No.1 and delivering the requirement of water volume. Estimated daily usage, one hundred and fifty thousands (150000) gallons of water will be mainly used for spraying and pouring to earth work and approach road way. For next phases, tube well No.2 and No.3 will be installed during construction phase including with each 33000 gallons capacity of concrete ground tanks. Transmission lines construction, sub-station construction, office construction, resident constructions, sanitary and washing purposes for a day will be used 30000 gallons. Tube well No. 4 will be installed and use for office and residents. During installation phase, average usage of water will be 16000 gallons per day for cooling, cleaning and removing dust. Excessive water use and unnecessary use of water may be negatively impact the water source from underground and its sustainability.

6.4.1.6 Hydrology

Inside the project area, originally 12 streams and 3 small streams are flowing at raining season. After construction phase, earth work in excavation, cutting, filling and compacting are completed and earth surface is ready to install PV solar panels and as designated gradient, only five streams will be remain at work site and other streams will be disappeared. Rain fall and catchment area are same to original position that flow rate of remaining five streams will be higher at some streams and lower at some streams. The hydrology and ground water basin will be changed from original and erosion at some out let will be occur at heavy rains.

6.4.1.7 Noise and vibration

Delivering building materials by trucks and such as operating earth moving machines, excavators, loaders, bulldozers, back holes, metal cutters, compressors and concrete mixers will contribute high level of noise and vibration within the construction site and surrounding area. Elevated noise level within the site can affect the workers, and other persons in vicinity of the project site. Crawling type earth moving machineries vibrate heavily to earth surface, hibernated and vegetated animals are moved away from original location.

6.4.1.8 Oil spills to soil and water body

The motor- powered construction machines on site will need to be regularly serviced. This requires continuous oiling to minimize the usual corrosion or wear and tear. Changing spare parts, repairing and removing parts need to clean and wash by oils and lubricants. Oils spilling and contaminating the soil and water may cause on sites are lack of

maintenance to engines, hydraulic cylinders and axles. Vehicles using on site may require to change lubricants regularly. Oil spilling and contaminating the soil and water body is very dangerous and it is not a renewable to environment and very difficult to dispose. The developer needs to supervise the contractors to construct a yard to maintain the machineries in specific areas which designed for this purpose and systematically storage to used oil for recycle purpose.

6.4.1.9 Solid waste generation

During construction phase, large quantities of solid waste from site clearing, tree leaves, roots, cut logs, and other disposed will be generated as a result of the excavation and grading earth level at the site. Construction phase solid waste will consist of rejected parts of pre-casted concrete, solid components, surplus materials, rejected materials, papers, containers, broken bricks, solvent containers, empty paint drums, surplus oil and waste from workers. Such solid waste will be injurious to the environment through blockage of drainage system, choking of water bodies, and negative impact on human and animal health. This may be accentuated by the fact that some of the waste materials contain hazardous substances such as paints, solvent, cement, adhesives, and chemicals. Some of waste materials including plastic containers and plastic bags are not biodegradable and can have long term and cumulative effects on the environment.

6.4.1.10 Handling of PV Solar Panels

The developer will install poly crystalline PV solar panels at racks which are constructed as super structure frame work above pressed pile foundation. PV solar panels will be imported and carried to worksite. There may not storage warehouse at project yard. The developer will stack PV Solar panels at stacking yards S1, S2, and S3 and will be delivered for installation. During construction and operation phase substitution of damage panels will be used from spare stacking at stacking yards. The developer has planned to remove damages of PV panels with safety package. There is no plan to be stored at ware house, buried or incineration at site. The package and damage of solar panels would be handled systematically by expertise persons.

6.4.1.11 Energy consumption

The project will consume fuels to run transport materials and earth work machineries. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability price and sustainability. At the same time, the project will use high consumption of electricity. The electricity will be supplied by government and installed from Mann switch yard near Minbu. 11 kV high tension line is under construction and ranged 17 miles to work site. Existing electricity source is diesel generator. Tentatively, the developer will install 315 kV transformers at construction phase. Hydro power and natural gas are natural resources of the country. In this regard, high consumption of electricity is negatively impacted to natural resources and their sustainability.

6.4.1.12 Extraction and use of building materials

Building materials such as hard core, ballast, bricks, cement, aggregates, rough stones, sand, mild steel, roofing sheets, glazed tiles, and shuttering woods required for construction of the proposed project will be obtained from quarries, hardware shops, sand yards, which extract materials from natural resource bank such as sea shore, rivers, hills, land and forest. Since substantial quantities of these materials will be required for construction of the buildings, the availability and sustainability of such resources at the extraction, the site from which the materials will be extracted may be significantly affected in several ways including erosion, landscape changes, displacement of animals and vegetation, poor visual quality and opening of depression on the surface leading to public health and animals.

6.4.1.13 Traffic Flow

During construction phase heavy machineries will be working at proposed site and only vehicles of office staffs and visitors will use approach road way which is 0.6 miles distance from main road. During construction phase of proposed solar power project is 15 mile distance from Minbu. Existing position of Minbu-Padan- Ann road way is very few traffic flow except Shwesettaw Pagoda festival. Main road, in-front of the proposed project, traffic congestion may not occur by vehicles of construction site and visitors.

6.4.1.14 Risks of accidents and injuries to workers

Because of intensive engineering and construction activities at erection, steel fastening, piling, installation of PV Solar panel and racks, metal grinding and cutting, concrete work, scaffolding, welding, electricity using and other causes, construction workers will be exposed to risks of accidents and injuries. Such cases can result from accidental fall from high level of the building, hand tools, collapse of materials and hazardous material handling.

6.4.1.15 General Occupational Health and Safety Issues.

During construction of the proposed project, it is expected that construction workers are likely to have accidental injuries and hazards due to human and workplace interactions. Because of the intensive engineering and construction activities including erection and installation of PV solar racks, metal grinding and cutting, concrete work, steel erection, piling and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. It's recommended an appropriate approach to ergonomics be sought Personal Protective Equipment (PPE) should be issued to all workers on site. Trainings on Fire Management, First Aid, occupational Health and Safety also be conducted occasionally.

6.4.2 Negative impacts (Operation stage)

The operation phase is expected to continue for approximately 25 to 30 years. Efficiency of PV solar power panels will be drop down after 25 years of installation commenced. During operation phase will be included proper maintenance works of PV panels, racks, electricity installations and soil gradients.

6.4.2.1 Soil

During operation phase, top soil layer will be degraded by spills, erosion of storm water, dumping of solid waste by maintenance and improper handling of damaged PV solar panels. Designated soil layer also will be degraded by erosion of storm water, stacking of solid wastes, piling of construction materials, spills and improper handling of PV solar panels. Soil along, the streams of surrounding environment which lead from (S2), (S3), (S7), (S10) and (S8) will be degraded as negative impacts.

6.4.2.2 Surface Water/Groundwater Contaminations

During raining season, ground water level is higher than winter and summer times. Ground water and surface water will be contaminate absence of proper handling to PV solar panels at regular maintenance. Dumping solid waste are not well taken care, may cause contamination to ground water and surface water sources and also form breeding area of mosquitoes and flies. This may cause human diseases like malaria and cholera.

6.4.2.3 Water use

The developer estimated average 36000 gallons per a day of water will use at fully operated. Annually estimated 5.8 million gallons of water will be used at tube well No.1, 2 and 3. The office and residents will use treated and purified water at tube well No.4. Excessive use of water and unnecessary use of water may be negatively impact the water source.

6.4.2.4 Noise and Vibration

Noise and vibration impact will not occur at operation phase.

6.4.2.5 Solid waste generation

The project is expected to generate enormous of solid waste during its operation phase. The bulk of solid waste generated during the operation of the project will consist of papers, plastic bags, glass, metal, textiles, used containers, organic waste and disposed by workers, kitchen, office rooms, landscaping, cutting grass, trimming trees, annually painting, decoration and maintenance works. Such waste can be injurious to environment through blockage of drainage system, pipes, choking of water body and negative impacts on animal health. Some of these waste material especially the plastic/ polythene are not biodegradable may cause long- term injurious effects to the environment. Even the biodegradable ones such as organic waste may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

6.4.2.6 Handling of PV Solar Panels

The developer will install poly crystalline PV solar panels at racks which are constructed as super structure frame work above pressed pile foundation. PV solar panels will be imported and carried to worksite. There may not storage warehouse at project yard. The developer will stack PV Solar panels at stacking yards S1, S2, and S3 and will be delivered for installation. During construction and operation phase substitution of damage panels will be used from spare stacking at stacking yards. The developer has planned to remove damages of PV panels with safety package. There is no plan to be stored at ware house, buried or incineration at site. The package and damage of solar panels would be handled systematically by expertise persons. Negligence of handling and dispose of damaged PV solar panels, these materials pose serious environmental and public health by gallium arsenide, copper-indium-gallium-diselenide and cadmium telluride. Such as dangerous and harmful elements will be followed through with the rain water and surrounding environment along the streams will be impacted negatively.

6.4.2.7Energy Consumption

During the operation phase, the solar power plant and its infrastructures will use a lot of electrical energy mainly for air conditioners, office lighting, domestic lighting, pumping, treatment plants, purification plants, security lights, and other service facilities. The project will use government supply which is installed from 11- 66 KV switch yard near Minbu.11 KV High Tension line will be installed 15 miles distance from Man sub-station. The developer will be installed 1 Nos, 315 KVA transformers at residential yard which will step down 440V. For back-up source, the developer will use diesel generators. Since electricity generation involves utilization of natural resources such as hydropower, natural gas and diesel fuels. Excessive electricity consumption will strain the resources and negative impact on their sustainability.

6.4.2.8 Traffic Flow

During the operation phase there may not congestion to traffic because only office vehicles and ferry buses will be used the approach road way.

6.4.2.9 Risks of accidents and injuries to workers

Because of intensive engineering and maintenance activities at operation phase, reerection, steel fastening, removing damaged solar panels, installation of PV Solar panels and racks, metal grinding and cutting, concrete work, scaffolding, welding, electricity using and other causes, workers will be exposed to risks of accidents and injuries. Such cases can result from accidental fall from high level of the building, hand tools, collapse of materials and hazardous material handling.

6.4.2.10 General Occupational Health and Safety Issues

During operation of the proposed project, it is expected that construction workers are likely to have accidental injuries and hazards due to human and workplace interactions. Because of the intensive engineering and construction activities including erection and installation of PV solar racks, metal grinding and cutting, concrete work, steel erection, piling and welding among others, construction workers will be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets and collapse of building sections among others. It's recommended an appropriate approach to ergonomics be sought Personal Protective Equipment (PPE) should be issued to all workers on site. Trainings on Fire Management, First Aid, occupational Health and Safety also be conducted occasionally.

6.4.3 Negative impacts (Decommissioning phase)

6.4.3.1 Dust Emission

The sources of dust emission at 836 acre wide land at decommissioning phase will include running of earth moving machineries such as loaders, bulldozers, back holes, road rollers, compacters, water bowser and management vehicles. A large emission of dust will lead to significant impact on workers and surrounding area. The above dust emission will be impacted during winter and summer times.

6.4.3.2 Noise and Vibration

Loads back building materials by trucks and such as operating earth moving machines, excavators, loaders, bulldozers, back holes, metal cutters will contribute high level of noise and vibration within the decommissioning site and surrounding area. Elevated noise level within the site can affect the workers, and other persons in vicinity of the project site. Crawling type earth moving machineries vibrate heavily to earth surface, hibernated animals are moved away from original location.

6.4.3.3 Solid Waste Generation

The project is expected to generate enormous of solid waste during its decommissioning phase. The bulk of solid waste generated during the decommissioning and dismantling of the project will consist of papers, plastic bags, glass, metal, textiles, used containers, organic waste and disposed by workers, kitchen, and office rooms. Such waste can be injurious to environment through blockage of drainage system, pipes, choking of water body and negative impacts on animal health. Some of these waste material especially the plastic/ polythene are not biodegradable may cause long- term injurious effects to the environment. Even the biodegradable ones such as organic waste may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

6.4.3.4 Handling of PV solar panels

During decommissioning phase, the developer will remove all solar panels, aluminum racks, GI channels from soil, concrete structures, electrical installation materials, buildings and other infrastructures. The developer has planned to remove all PV panels with safety package and will carry straight to recycle factory. There is no plan to be stored at ware

house, buried or incineration at site. The package and damage of solar panels would be handled systematically by expertise persons.

6.4.4 Positive impacts (Construction phase)

6.4.4.1 Creation of employment opportunities

Several employment opportunities (250 workers per day) will be created for construction phase of the project. This will be a significant positive Impact to Lay Pin, Thitei villages and Minbu. Engineers, quantity surveyors, quality control technicians, electricians, plumbers, waste water engineers, managers, botanists and many local graduates will be employed.

6.4.4.2 Provision of market for supply of building materials

The project will require supply of large quantities of building materials which will be sourced locally. This provides market for building materials suppliers such as sand, gravel, stones, woods and hardware stores and individual with such materials.

6.4.4.3 Increased business opportunities

Requirement of a large number of project staff members will create a market for various goods and services, leading to several business opportunities for small-scale traders such as food stalls near the construction site.

6.4.4.4 Technology Flow

Several engineers, quantity surveyors, quality controllers, electricians, plumbers, waste water engineers, managers, accountants, and store keepers will learn advanced technology and PV solar panel handling technology.

6.4.4.5 Improved security in the neighboring area

During construction phase, security persons will check and go around the parameter of the project. They will serve 24 hours duty at site, this will lead to improvement of security at surrounding area.

6.4.5 Positive impacts (Operation phase)

6.4.5.1 Creation of employment opportunities

About 100 workers of electrical and civil technicians, managers, caretakers and ordinary workers will be employed and trained for operate this project during the operational phase. Local workers, local graduates will try to get a place at operational phase of this project. This will be a great impact on unemployment problem of graduates residing nearby.

6.4.5.2 Revenue to national and local governments

Through payment of relevant taxes such as properties tax, income tax and other fees to local authorities, revenue department and other related offices. The local and national government will earn for contribution works.

6.4.5.3 CSR Developments

After completion of construction phase and starting operation phase, GEP must contribute surrounding area villages by developing to schools, clinics, roads, bridges and other contribution works. This will lead to improvement of surrounding villages by construction of solar power plant at proposed site area.

6.4.6 Positive impacts (Decommissioning phase)

6.4.6.1 Visual organization

After decommissioning and dismantling of PV solar power project, the developer or next successor must replant the trees and vegetation to be original position of the land. The old project area will be covered with green and improved visual organization.

6.5 SOCIAL POTENTIAL ENVIRONMENTAL IMPACTS

6.5.1 National Level

Domestic lighting:	Potential positive impact				
	The new solar power plant will be able to contribute to supply of power to residential quarters. More houses will be lit.				

Industrial growth:	Potential positive impact		
	Implementation of the solar power plant will contribute to national industrial growth.		

National economic development:	Potential positive impact		
	Increasing the generation of electricity is a necessity at this time of heightening the momentum of efforts for development of the economy. Implementation of this project is appropriate at this time and occasion.		

6.5.2 Regional level

Employment opportunities:	Potential positive impact
	Some of the local residents will be temporarily employed during the preparatory stage. The current project has four phases, up to 800 labourers will be required during the peak of the project construction. Installation of solar panels will need a great deal of labour. However, during the operation stage, less labour will be needed—100 workers including engineers, technicians, office staffs and ordinary workers will be working at the project.

Lighting for the neighbourhood:	Potential positive impact				
	The implementation of the solar power plant may have spinning effects on the neighboring areas. The neighbouring settlements can enjoy electricity at reasonable rates.				
Smooth transportation:	Potential positive impact				
	Depending on the local administrative officials and the private economic organizations working in the region, it will become necessary to improve or upgrade roads, facilitating the travel of local people.				
Regional business growth:	Potential positive impact				
Regional business growth:	Potential positive impact In consideration of the implementation of the solar power project and other projects like the Minbu-Ann-Sittwe rail road project, it is expected that the area is poised to develop further, and electricity supply may play a role in this process. For example, the number of shops will be increasing near the proposed Solar Power Plant.				
Regional business growth: Exposure:	In consideration of the implementation of the solar power project and other projects like the Minbu-Ann-Sittwe rail road project, it is expected that the area is poised to develop further, and electricity supply may play a role in this process. For example, the number of shops will be increasing near the proposed Solar Power				

6.5.3 Potential negative impacts

9.3.1 Individual losses:	Potential negative impact		
	It is conditional only. Currently, the chosen site has been well out of the farmlands which the villagers are working.		

9.3.2 Livelihood:	Potential negative impact		
9.3.2 Livelinood:	The solar panels, once installed, will last for about 30 years, and be replaced after 30 years' time. At that time, if the discarded things are not properly disposed of, the soil and water can be contaminated and the livelihoods of the local people will be harmed.		

6.6 BIOLOGICAL POTENTIAL ENVIRONMENTAL IMPACTS

6.6.1 Methodology

Methods in identification and assessment of biological impacts and mitigation includes checklists, map overlays, interview with local knowledgeable persons, local public consultation and judgments based on information collected from existing sources supplemented by the field data.

6.6.2 Potential Impacts:

Most of the development projects can cause undesirable impact on terrestrial ecosystem. This land's forest cover is not closed type with thick trees and plants; it is open and dry type with scattering trees, but rich with abundant wildlife, if it can be kept in actual ecosystem. However, this area has been populated since last 50 years.

In terms of aquatic impact, this area cannot have visible change in aquatic ecosystem, rather change of drainage.

6.6.2.1 Loss of wildlife and wildlife habitat

As the vegetation is becoming less and less agricultural expansion and timber and fuel wood harvesting throughout last 50 years, wildlife have declined since late 1970s. Increased wildlife trade at Musae-Rulli market made the problem worse. Fragmentation of the forested area is one of the main causes of wildlife decline. This could block the migration activities of some wildlife including birds. It has long been known that habitat destruction is a major factor responsible for the decline of wildlife populations.

6.6.2.2 Destruction of vegetation

Conversion of landscape from forest land to industrial compound. This level size of removal of vegetation has an impact to the ecosystem's functioning of the fragile ecosystem of such dry forest. Vegetation has many essential roles in the ecosystem. Primarily it is the first level in the terrestrial food chain upon which all organism depend. Secondly vegetation provides habitat and cover for organisms, as well as providing stability of soils with its root systems.

Habitat loss forces moveable animal to migrate to nearby habitable tree-covered areas, unmovable organisms and slow moving creatures are terminated.

The following kinds of trees (with a total number of 4,255) were found by Forestry Department, Magwe Division in the project site in July 2013.

အုပ္စု (၁)	အင္ၾကင္း	Shorea siamensis (Kurz) Miz			
	သစ္ယာ	Shorea obtuse Wall			
	зъċ	Dipterocarpus tuberculatus Roxb			
	သစ္ေစး	Melanorrhoea nsitata Wall			
	ကုကို [®]	Albizia lebbek (L.) Benth			
	ေႏွာ	Adina cordifolia Hook.f.			
	ယင္းမာ	Chukrasia tabuleris A. Juss			
	ပ်ဥ္းမ	Lagerstroemia reginae Roxb.			
	േയാന്ലനപ്പ്	Terminalia alata (Heyme) Roth			
	ဖန္ခါး	Terminalia chebula Retz.			
	နဘဲ	Lannea coromondelica (Houth) Merr.			

အုပ္စု (၄)	33: 1	Bombax insigne Wall.				
ႀကိဳ႕		Schleichera aleosa (Lour) Oken				
	တယ္	Diospyros burmanica Kurz				
	ဖလန္(ဖလံ)	Bauhinia racemosa lam				
	သနပ္	Cordia dichotoma Forst.				
	ရွား	Acacia catechu Willd.				
	သစ္ပုပ္	Tetrameles rudiflora R.Br.				
	သစ္ဆြဲလြဲ	Schrebera swietenioides Roxb.				
	နီ ပေဆး	Morinda tinctoria Roxb.				
	ကၽြန္းဖို	Premna pyramidata Wall.				
	လြန္(လြန္မ)	Buchanania lanzan Spreng.				
ဇီးျဖဴ		Emblica officinalis Gaertn.				
	တေရာ္	Grewia tiliifolia Vahl				
	(လိမ္) လိန္	Terminalia pyrifolia Kurz				

6.6.2.3 Disturbance of aquatic organism

Lack of vegetation and rearrange-ment of natural drainage system will dry out run off water fast. Most of the natural water ways are transformed to be new drainage system. This will result decline of fish an amphibian by reducing the mobility and distribution.



6.6.2.4 Erosion and sedimentation



Absence of trees and vegetation cover both inside and outside of the project site, erosion of surface layer of the land and sedimentation along the water ways occur throughout the area.

6.6.2.5 Disruptions to ecological succession

Removal of the forest cover to this extent of 836 acre has strong impact on ecosystem

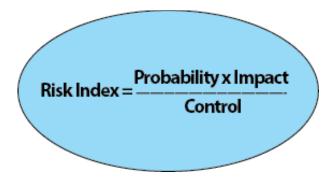
integrity and their interlinking function with physic-chemical factors and biological elements through food chain food web and chemical exchange along the biogeochemical cycles.

Potential toxic effects to plants and animals as a result of air- or water-pollutant discharges or waste-disposal activities of industries will also have negative impact on surrounding ecological function.

6.7 RISK ASSESSMENT

Risk is analyzed by estimating the likelihood of the event occurring and the consequences or impact of the event if it does occur as well as the amount of control one has over the event

Probabilit occurrer	•	Seriousness of Impact		Degree of Control	
Almost certain	8	Major	8	None	1
Likely	6	High	6	Low	1.5
Moderate	4	Moderate	4	Moderate	2
Unlikely	2	Low	2	High	2.5



Risk Index		
Low Risk	2-12	
Moderate Risk	13-18	
Significant Risk	19-36	
High Risk	37-64	

6.7.1 Construction Phase

Impact	Probability of occurrence	Seriousness of Impact	Degree of Control	Risk Index	RISK LEVEL
Soil	8	8	2.5	26	Significant Risk
Dust Emission	8	6	2.5	19	Significant Risk
Water	8	6	2.5	19	Significant Risk
Air pollution	8	6	2	24	Significant Risk
Noise & Vibration	8	6	2	24	Significant Risk
Solid waste	8	6	2	24	Significant Risk
Traffic Flow	8	4	2	16	Significant Risk
Risk of Accident	4	8	2	16	Significant Risk
Visual Quality	6	4	1.5	16	Significant Risk
Social Impact	8	8	2	32	Significant Risk
Flora	8	6	1.5	32	Significant Risk
Fauna	8	6	1.5	32	Significant Risk

6.7.2 Operation Phase

Impact	Probability of occurrence	Seriousness of Impact	Degree of Control	Risk Index	RISK LEVEL
Soil	2	4	2.5	3	Low Risk
Dust Emission	2	4	2.5	3	Low Risk
Water	2	4	2.5	3	Low Risk
Air pollution	2	2	2	2	Low Risk
Noise & Vibration	2	2	2	2	Low Risk
Solid waste	2	2	2	2	Low Risk
Traffic Flow	2	2	2	2	Low Risk
Risk of Accident	2	2	2	2	Low Risk
Visual Quality	8	8	1	64	High Risk
Social Impact	8	6	2	24	Significant Risk
Flora	8	6	1.5	32	Significant Risk
Fauna	8	6	2.5	32	Significant Risk

6.7.3 Decommissioning Phase

Impact	Probabil ity of occurre nce	Seriousnes s of Impact	Degree of Control	Risk Index	RISK LEVEL
Soil	8	4	2.5	13	Moderate Risk
Dust Emission	8	4	2.5	13	Moderate Risk
Water	8	4	2.5	13	Moderate Risk
Air pollution	8	4	2	16	Moderate Risk
Noise & Vibration	8	4	2	16	Moderate Risk
Solid waste	8	8	2	32	Significant Risk
Traffic Flow	8	4	2	16	Moderate Risk
Risk of Accident	8	8	2	32	Significant Risk
Visual Quality	6	4	1.5	16	Moderate Risk
Social Impact	8	4	2	16	Moderate Risk
Flora	6	4	1.5	16	Moderate Risk
Fauna	6	4	1.5	16	Moderate Risk

Summary of Risk Assessment for Construction, Operation and Decommissioning Phases

Impact	Construction Phase	Operation Phase	Decommissioning Phase
Soil	Significant Risk	Low Risk	Moderate Risk
Dust Emission	Significant Risk	Low Risk	Moderate Risk
Water	Significant Risk	Low Risk	Moderate Risk
Air pollution	Significant Risk	Low Risk	Moderate Risk
Noise & Vibration	Significant Risk	Low Risk	Moderate Risk
Solid waste	Significant Risk	Low Risk	Significant Risk
Traffic Flow	Significant Risk	Low Risk	Moderate Risk
Risk of Accident	Significant Risk	Low Risk	Significant Risk
Visual Quality	Significant Risk	High Risk	Moderate Risk
Social Impact	Significant Risk	Significant Risk	Moderate Risk
Flora	Significant Risk	Significant Risk	Moderate Risk
Fauna	Significant Risk	Significant Risk	Moderate Risk



7 MITIGATION MEASURES AND MONITORING

This chapter outlines the necessary mitigation measures that will be adopted to prevent or minimized significant negative environmental impacts associated with the activities of the project during Preparation Phase, Construction Phase, Operation Phase and Decommissioning Phase.

7.1 PHYSICAL MITIGATION MEASURES

7.1.1 Soil erosion

At the rainy season of during preparation phase, construction phase and operation phase, soil erosion will be occur at surface water exit (S3), (S2),(S7),(S10) and (S8). To avoid erosion along exits of five streams the developer should be monitored randomly at site and construction of sand traps, stilling basins and taming works will be mitigate. Monitoring to proper drainage gradient and provision of soil erosion and conservation structures will be mitigate.

During construction phase 1, soil erosion after heavy rain at outlet to (S8) has seen. Eroded soil sediment outside of boundary of (S8) has seen.





Eroded at (S8) outlet

7.1.2 Dust emission

Dust emission during preparation phase, construction phase and operation phase will be minimized through restricted speed control of earth moving machines, transport buses and traffic within the project site. Pouring water on road ways at site and excavated area cutting area, filling area and compacting area will reduce rising of dust in dry season. The contractor should install a wash deck at the exit way of the site to remove mud from vehicles which may become dust around the site and along the main road. Trucks need to install proper covers when carrying sand, river shingles and cement to avoid falling down along the main road and emission of particulates.

7.1.3 Air Pollution

Diesel combustion of earth moving machineries such as loaders, excavators, trucks, dumpers, bulldozers, back holes, compactors, road rollers, graders, diesel generators and management vehicles will contribute dust, CO_2 , NO_2 , and fine particulate matters ($PM_{2.5}$ and PM_{10}).

MSR survey team observed and collected samples at proposed site. Air quality Hazscaner machine is installed at the center point of the proposed site. Analytical data of air quality Haz-scaner analyzed and operated by Occupational and Environmental Health Laboratory experts, Ministry Of Health, and the results indicates;

Hydrocarbon HC is 9613 ppm and Methane CH₄ is 17404 ppm.

PM₁₀ (24 Hr) is (24 ug/m³) which is lower than reference value (50 ug/m³).

PM_{2.5}(24 Hr) is (35.4 ug/m³) which is quite over than reference value.

 NO_2 (1 Hr) is (11953 ug/m³) which is enormously higher than its reference value (200 ug/m³).

SO₂ (24 Hr) is (865.7 ug/m³) which is quite higher than its reference value (20 ug/m³).

O₃ (8 Hr) is (6960 ug/m³) which is very higher than its reference value (100 ug/m³).

CO (1 Hr) is (76.3 ug/m³) which is very lower than its reference value (30000 ug/m³).

VOCS (1Hr) is (88.6 ug/m³) which is lower than its reference value (400 ug/m³).

Harmful substances and gas such as PM_{2.5}, NO₂, SO₂ and O₃ are very higher than reference value. These indicated emission of carbon particular content from exhausts and largely diesel fuels are burning around the site. Such emission and air pollution lead to several environmental impacts including global warming and human health as lungs problem, heart attack, asthma and irritate respiratory system which will lead to immature death

But the proposed project site is quite far from nearest villages, air pollution may not occur to these villages. Surrounding environment of proposed site will be effected air pollution impact to workers, operators and office staffs. During construction phase, a large quantity of preparation of gradient of earth work will consume diesel fuel oil at proposed site, air pollution will be effected obviously. This impact will be effected during construction phase of the project.

Collected data from developer and contractor, they have used 8200 gallons of diesel fuel for running of earth moving machineries which consumed 24 hours during construction phase of designated grading earth work.

The existing base line analytical report of air quality is enormously higher than ECD standard but impact of air pollution is only temporary impact during preparing of earth work. This impact will not become as a cumulative impact to environment.

During preparing of earth work, provision of personal protect equipment (PPE) such as nose masks to workers, regular maintenance of machineries, educate to workers to understand working at the surrounding of hazards, educate not to smoke, monitoring to blue and black smoke from engine exhausts to engine tuning will be mitigate the impact of air pollution. Developer should install and record monthly air quality tests during earth work and installation of PV solar panels.

7.1.4 Noise and Vibration

Only during construction phase, noise and vibration impact will be minimized by construction machineries like as machines, excavators, loaders, dumpers, concrete mixers, vibrators and metal cuttings. To reduce the impact of noise and vibration, construction machineries should be maintain properly. Prohibition of working at night shift and limited working hours will mitigate noise and vibration impact during construction phase only.

7.1.5 Surface water/Groundwater contamination

Concrete foundation process at 230 KV towers, Sub-station construction, office building constructions and construction of quarters and residents will excavate surface earth. Deeply excavated foundation will pass through water layers and water body at ground. Cast in place foundation process needs to use cement and hardener chemicals. These would be take place in ground water till setting time of concrete. Temporary contamination of ground water will occur during concrete construction. The negative impacts during construction phase, especially at rainy season, surface water and ground water will be

contaminated by stacking of solid waste, oil spill, improper storage of fuel oil, chemical and hazardous materials, piling of construction materials, handling of PV solar panels, transporting of materials and disordered sewage disposal.

7.1.6 Water Usage

Developer and contractors shall ensure that the water is used efficiently at the site. To avoid unnecessary usage and leakage at taps, pipes and toilets, the developer and contractors should install automatic taps and hydrants. Pouring water on road ways, excavation, filling, cutting and compacting area should be minimized. Using tube well water at construction phase will be 150000 gallons of underground water. During rainy season of construction phase rain water should collect and use for concrete curing works and washing purpose. At operation phase, estimated 36000 gallons of water will use daily at fully operated.

7.1.7 Hydrology and Minimization of rain water flow

During rainy season, to control soil erosion and land slide at site, it is needed to control the velocity of rain water. It should be made ensure that levelling the drains can be minimized at construction phase. Construction of concrete drains at steep levels and proper gradient at temporary drain can control the velocity of rain water and unnecessary erosion. To mitigate unnecessary erosion and land slide, developer needs to construct sedimentation basins, sand traps and taming at where outlet of (S3, S2, S7, S10 and S8).

7.1.8 Handling of PV Solar Panels

The developer will install poly crystalline PV solar panels at racks which are constructed as super structure frame work above pressed pile foundation. PV solar panels will be imported and carried to worksite. There may not storage warehouse at project yard. The developer will stack PV Solar panels at stacking yards S1, S2, and S3 and will be delivered for installation. During construction and operation phase substitution of damage panels will be used from spare stacking at stacking yards. The developer has planned to remove damages of PV panels with safety package. There is no plan to be stored at ware house, buried or incineration at site. The package and damage of solar panels would be handled systematically by expertise persons.

7.1.9 Sewage Disposal

The developer proposed to install simple septic tank system toilets at office, residents and other infrastructure buildings. During site cleaning phase, construction phase and operation phase of proposed solar power project, temporary offices, permanent offices, residents, quarters for workers, clinic, garage, canteen, dining rooms such infrastructure will be constructed with necessary toilets and bath rooms. At Construction phase sewage of 700 workers will be generate at various location of work site and at operation phase sewage of 100 workers will be generate at office yard and residents yard. Developer will construct septic tanks with systematic buffer walls, settling tank and soak pits. Irrigated area is very wide, low rainfall, high evaporation and arid region the sewage function will be going smoothly. Inspection to septic tanks, smell, planted grass and turf will be monitored yearly.

7.1.10 Energy Consumption

The contractors and developer shall ensure proper use of electricity at site yard during construction and operation phase. Construction machineries should maintain regularly to mitigate fuel consumption. Unnecessary use and proper planning for transportation will reduce energy consumption.

7.1.11 Efficient Usage of raw materials and minimization of construction waste

The developer and contractors can mitigate negative impacts on Minbu Solar Power Plant (MSPP) by efficient usage of amount of construction materials. It should be ensured that materials are not extracted or purchased in excessive quantities. Contractors should order for what will be required through accurate quantities accordance with estimate. Unnecessary stacking at site should be avoided. Developer and contractors need to manage and order to purchase and stack only estimated amount of materials will mitigate raw materials which are product of natural resources.

7.1.12 Minimization of solid wastes

There may be so many quantities of solid waste such as municipal wastes, industrial wastes and hazardous wastes at site preparation phase, construction phase and operation phase. Developer and contractors need to ensure the purchase of materials and ensure calculation and estimation of materials which are to be delivered to site to minimized industrial waste. Recycling, reuse and refurbishment of solid waste will reduce the amount of construction waste other than disposed. Waste bins and skips should be placed for domestic waste at specific places. The developer should put in place an efficient waste management scheme that will prevent the accumulation of uncontrolled waste, as well as an efficient collection and off- site disposal. During construction phase, the contractors need to educate workers for proper disposal of municipal waste, industrial waste and hazardous waste. After the completion and operation phase, the developer needs to educate and create trainings to workers and office staffs for proper disposal of domestic waste which will be incinerated and buried.

7.1.13 Energy consumption

The contractors and developer shall ensure proper use of electricity at site yard during construction and operation phase. Construction machineries should maintain regularly to mitigate fuel consumption. Unnecessary use and proper planning for transportation will reduce energy consumption.

7.1.14 Traffic Flow

Proper planning of transportation of heavy machineries and construction materials will reduce unnecessary traffic congestion. During construction and operation phase, assignment of a staff at the entrance of project site will mitigate disturbance of traffic flow during Shwesettaw Pagoda festival. Installing road signs, caution signs and traffic signal lights will mitigate traffic congestion and help a smooth flow of traffic around proposed site during construction phase. The developer has planned car parking spaces at the entrance of office compound. At operation phase, office vehicles and workers ferry will be entered at site that there may be not traffic congestion.

7.2 BIOLOGICAL MITIGATION MEASURES

The removal of trees and land leveling over whole project site cause negative impact on wildlife and ecosystem of the forested area in the landscape. However this area is the scrub indine forest where only little timber trees are fit.

Replantation in the available land in closer area, if possible, will earn the reputation of the company, as in many cases, a large-scale solar power project can provide funding for

mitigation actions throughout the life time of the power plant. Recommended mitigation measures to minimize the negative impact to the biological environment are listed below.

- All the marginal and common lands available in the nearby area should be brought into a plantation program giving priority to native species for good green cover.
- Biological mitigation measures which were suggested for impacts to vegetation is providing the implementation of revalidation programs elsewhere outside of the project site which store top soil for reapplication. Replacing or restoring the vegetation is the most critical of all mitigation activities if the environmental impacts to the biota are to be minimized
- Community Forestry (people's committee at village level) should be placed in the center of redevelopment efforts so as to provide protection of common property resources, local employment, and local people's participation (including women).
- Raising public awareness upon presence of healthy ecosystems where trees and wildlife including micro-organisms and invertebrates should be present to maintain food-chains, food-webs, and biogeochemical cycles balanced should be strengthened assisting with an environmental education program in Magwe region.
- As a large-scale solar power project, management should have separate budget to provide CSR and mitigating activities of negative impacts of Solar Power.

7.3 SOCIAL MITIGATION MEASURES

Measures to mitigate negative social impact of the project are recommended as follows:

- 1. As this solar project is the first and foremost project in Myanmar, the party concerned should meet the local people and give educative talk to let them know that they should not be worried about it because it will have the least effects on the environment.
- 2. In order to help Lay Pin villagers, as their village is closest to the project, they should have more job opportunities to work for the village. In order that to happen, the administrator of the village, NLD party leaders and village elders should form a team to help the villagers know about job vacancies in consultation with the project developer.
- 3. During the period of the project implementation, arrangements should be systematically made by the company in order that relations with the community of Lay Pin and Zee Aing villages would be smooth and good.
- 4. Compensation for land of Lay Pin village should be systematically reviewed and negotiations with the land-owners should be held.
- 5. Only if the company is on friendly terms with the villages, difficulties that could come up in the future will be overcome. Activities related to social activities for the villagers should be constantly done.
- 6. As a big electricity-generation project is about to come into being near them, the first priority of providing electricity to them should be included in the agendas of CSR activities.
- 7. During the project, as the trees, bushes and groves that cover over 800 acres of forest area have been felled and cleared, the surrounding area of the open field, that can be seen should systematically be reinstalled with lush green plants by

- creating greening nurseries so that it will alleviate the worries of people in the neighbourhood.
- 8. As the project site is located near the road that leads to the ancient Shwesettaw Pagoda—its festival is famous and long, which may extend to two months, the company should study how they could contribute to the community so that villagers can take part in the festival conveniently. During the festival, almost all the residents of the villages leave the village to visit or sell products/snacks at the festival.
- 9. The project developer should take necessary steps to give compensations to the farmers not only for the crops but also for the land taken away. The project developer may discuss with the regional and local authorities and other stakeholders how to compensate the farmers who do not have land ownership certificate, Form 7, but whose land has been confiscated.
- 10. Community members want to have electricity installed, tube wells sunk, and school buildings constructed as part of the developer's CSR activities or as donations to the communities concerned. The developer may organize meetings with local authorities, local elders and community members and tell them which would be their priorities if it cannot fulfil all their wishes. The meetings should be inclusive and participatory.

In terms of further ongoing consultations, the GEP shall have a liaison officer or officers who will deal with the national regional, district, township and ward/village-tract authorities as well as local elders and community members. Mechanisms should have been developed for the company officials to inform the government officials and local people of their plans and for the local people to inform the company officials of their wishes, desires and complaints and grievances.



8. CUMULATIVE IMPACT ASSESSMENT





Cumulative impact are the sum of total environmental impacts from the proposed project and associated infrastructure, in combination with other past, present, or likely (imminent) future projects or activities. The successive and incremental impacts of a particular project are also included in the cumulative impact.

One of the effects of solar PV project is solar reflections known as Glint and Glare. Solar panels are designed to absorb sunlight and produce electricity. However, they can also reflect it and cause solar reflections affecting drivers, residents, and other receptors. Although the impact of the first phase (200 acre) of solar PV project to the surrounding environment might be small or negligible, the combined or cumulative effects of all the four phases of development project with 836 acre wide may have a greater **Glint and Glare** impact.



9. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

9.1 Physical Environmental Management and Monitoring Plan (Construction Phase)

Environmental impact	Proposed mitigation and aspects for monitoring	Responsibility for Mitigation monitoring and maintenance during construction	Monitoring means at Phase	Recommended frequency of monitoring
Soil erosion	Control earthworks and compact loose soils	Contractor/ Developer	Construction	Daily
	Install drainage structures property	Contractor/ Developer	Construction	Daily
	Ensure management of excavation activities/ cutting and filling	Contractor/ Developer	Construction	Daily
	Control activities especially during the rainy season	Contractor/ Developer	Construction	Daily
	 Provide soil erosion control and conservation structures where necessary 	Contractor/ Developer	Construction	Daily
	 Record efficiency of erosion control measures at S(3), S(2), S(7), S(8) and S(10) and take necessary action 	Contractor/ Developer	Construction	Daily at rainy season/ Monthly at dry season
Dust Emission	Control speed and operation of construction vehicles	Contractor/ Developer	Construction	Daily



	Cover trucks properly carrying construction materials	Contractor/ Developer	Construction	Daily
	Prohibit the idling of vehicles	Contractor/ Developer	Construction	Daily
	Spray water on cross and main roads	Contractor/ Developer	Construction	Daily
	Ensure regular maintenance of construction plants and equipment	Contractor/ Developer	Construction	Weekly
Air pollution				
	 Engage sensitive workers Provide masks and PPE workers to understand about hazardous gas emission 	Contractor/ Developer	Construction	Daily
Noise pollution	Sensitizate drivers of construction machinery	Contractor/ Developer	Construction	Daily
	Restrict construction activities to day time	Contractor/ Developer	Construction	Daily
Hydrology	Construct and install drainage structure properly	Contractor/ Developer	Construction	Daily at Rainy Season/ Monthly at dry season
	 Install concrete drains and drops to break the impact of water flowing to the drains Gradient of drainage 	Contractor / Developer	Construction	Daily at Rainy Season/ Monthly at dry season



Water resources	 Construct sedimentation basin sand traps, and tame at outlet of S3, S2, S7, S8 and S10 	Contractor/ Developer	Construction	Daily at Rainy Season/ Monthly at dry season
	 Stack and pile materials systematically 	Contractor/ Developer	Construction	Weekly
	Dispose solid waste at stacking yard	Contractor/ Developer	Construction	Weekly
	Neutralize oil spill and hazardous chemical spills	Contractor/ Developer	Construction	Daily
	 Dispose solid waste regularly at plant 	Contractor/ Developer	Construction	Weekly
Water usage	 Record water volume requirement at purification Plant 	Contractor/ Developer	Construction	Weekly
	 Pump and deliver required volume per day at each tube well Manage unnecessary wastage and leakage 	Contractor/ Developer	Construction	Weekly
Handling of PV solar Panels	 Loading /unloading systematically Installation systematically Removing and stack systematically Package systematically Provide training to workers stack yard S1,S2, S3 Provide protective gears 	Contractor/ Developer	Construction	Daily



Oil spill	 Designated pavement at workshop and maintenance yard recycle Proper storage, handling and disposal of new oil and used oil wastes 	Contractor/ Developer	Construction	Monthly
	Maintenance of equipment to avoid leakage	Contractor/ Developer	Construction	Weekly
	 Action to emergency response to leakage of oil and hydraulic lubricants 	Contractor/ Developer	Construction	Daily
Sewage	 Regular maintenance of sewage septic tanks Observation of smell Check Groundwater at rainy season Observation of ground near septic tank 	Contractor/ Developer	Construction	Randomly
Solid waste and	Ensure purchase of materials	Contractor/ Developer	Construction	Weekly
construction waste	Provide waste bins/skips	Contractor/ Developer	Construction	Weekly
	Sorting different types of waste	Contractor/ Developer	Construction	Weekly
	Do recycling	Contractor/ Developer	Construction	Weekly
	Disposal off-site	Contractor/ Developer	Construction	Weekly
	Dispose hazardous waste properly	Contractor/ Developer	Construction	Weekly



	Pay special attention be to the sanitary facilities	Contractor/ Developer	Construction	Weekly
	Disposed of garbage periodically and at approved dump sites	Contractor/ Developer	Construction	Monthly
Security	 Provide security guards and facilities during the project construction 	Contractor/ Developer	Construction/ Operation	Daily
	 Check and inspect parameter fencing of the plant 	Contractor/ Developer	Operation	Daily
	Check and inspect sub- station yard	Contractor/ Developer	Operation	Daily
Road Safety and traffic control	 Enforce speed limits for all vehicles accessing at site and off-site. 	Contractor/ Developer	Construction	Daily
	 Provide billboard and traffic signs around the site to notify or stakeholders of the development 	Contractor/ Developer	Construction	Daily
	Assign a staff to control traffic during Shwe-settaw Pagoda Festival	Contractor/ Developer	Construction	Daily
Public health and Occupational	Train worker on occupational health and safety	Contractor/ Developer	Construction	Weekly
safety	 Provide full protective gear and workmen's compensation cover in addition to the right tools and operational instructions and manuals (body protection, 	Contractor/ Developer	Construction	Weekly



	protective cloths, safety helmet)			
	 Adopt waste management system to ensure proper solid waste disposal and collection facilities (masks, gloves) 	Contractor/ Developer	Construction	Daily
	Ensure waste water management	Contractor/ Developer	Construction	Monthly
	 Design septic tank to be as provided in the plan 	Contractor/ Developer	Construction	Randomly
Fire safety	Install fire fighting equipment	Contractor/ Developer	Construction	Monthly
	Conduct fire fighting training	Contractor/ Developer	Construction	Monthly
	Perform drills on emergency response	Contractor/ Developer	Construction	Monthly
	Educate workers on fire risks and fire drills	Contractor/ Developer	Construction	Monthly



9.2 Biological and Social Management Plan (ESMP) during Construction Phase

Aspect / Issue	Potential Impact / Risk	Mitigation Measures	Monitoring Action and parameters	Responsibility
Biodiversity				
Clearing of areas for installation of the scaling solar infrastructure may have impacts on the existing modified habitat	Loss of vegetation (tree species) and natural habitats for small mammals, birds and insects.	 Clearing of vegetation should only be confined to areas where the solar infrastructure will be installed to minimize loss of vegetation and wildlife habitats. The construction workers should be provided with guides and extents of areas to be cleared and site clearing works should be monitored. Areas within and around the broader project area where biodiversity growth can be promoted and sustained to offset the loss of vegetation and wildlife habitats at the project site should be identified (enhancing sustainability and growth of biodiversity). 	Visual inspection of clearing activities.	Contractor/ Developer
Land Use				
Changing land use from forestry development to solar farm for power	Reduction in potential forest lands.	Sustainability and regrowth of biodiversity in other areas that have been degraded should be promoted to compensate for reduction in potential forest land arising from the change in land use at the project	Monitoring changes in biodiversity at the identified site	Contractor/ Developer



generation.		site		
Landscape and	Visual Amenity			
Clearing of vegetation and installation of solar PV modules.	Visual intrusion and disruption of the aesthetics.	 Low visual reflective solar modules with anti- reflective coating (ARC) that reduces reflectance from the solar PV modules should be used; Low level solar module mount design system (2-3 meters) that will not disrupt the aesthetic view of the project /surrounding areas should be used on site: A perimeter buffer of trees and grass vegetation along the project site boundaries should be left to screen sensitive viewing areas General cleanliness and good housekeeping at the site should promoted be at all times. 	Monitoring existing vegetation screening at the site and ensuring that it is appropriately maintained without providing shades onto the solar PV modules and visual inspection of cleanliness and housekeeping	Contractor/ Developer
Occupation Hea	Ith and Safety			
Occupational health and safety of workers working on site.	Reduced occupational health and safety among workers	 A health and safety policy shall be developed and implemented by the contractor to guide construction and operations of the facility. All construction activities should be conducted in accordance with provisions of the local legislation and international best practices (General EHS 	Risks identification and implementation of management measures conducted prior to commencement works	Contractor



		Guidelines: Occupational Health and Safety); Safety rules should be enforced and complied with by workers, contractors and those coming to site: Personal Protective Clothing (PPE) should be issued and used as required by the various classes of the workers on project site; Barrier tapes and caution signs should be erected in all potential hazardous areas to prevent injury or loss of life among construction workers; No unauthorized person should be allowed on site including workers without appropriate PPE.		
Socio-economic	;			
Construction sites have been known to promote risky sexual behavior.	Risky sexual behavior among the population, especially among migrant workers, leading to escalation of new STIs including HIV/AIDS in the local population and among the workforce.	 Developing an HIV/AIDS Policy by the developer to be adhered to during the construction and operation phases of the project. Sensitization programs on preventing the spread of STIs and HIV/AIDS for project workers including contractors and suppliers. Provision of condoms (including female condoms) in places 	Record of sensitization / education programs undertaken including number of people sensitized /trained on STI and HIV/AIDS.	Developer



		where they can be easily accessed such as toilets. • Education programs on fighting stigma of those infected with HIV/AIDS		
Construction of the solar PV plants	Capacity building and technology transfer to local contractors, skilled manpower and unskilled workers.	 Local contractors, skilled specialists and unskilled workers should be used to benefit from up-to-date technology and skills transfer during construction and operation of the solar plant. Appropriate training should be provided to all local contractors, skilled manpower and unskilled workers to enhance expected project benefits. 	Skills training for locals with assistance from local learning and construction institutions. Number of local people trained.	Contractor/ Developer
	Employment opportunities created for both skilled and non-skilled labor and. Multiplier opportunities for employment in support sectors.	The contractor, where possible, should employ members of the local communities and local experts to maximize on the benefits of employment opportunities.	Record of employment, annual reports on solar plants operators.	Developer/ Contractor
	Project contribution to the local and national economy through its multiplier effects	Procurement of services from local contractors and locally produced raw materials during the construction phase should be done, where possible, to maximize benefits for the local economy	Specific chapters in annual reports on solar plant operators	



9.3 Environmental Management and Monitoring Plan (Operation Phase)

Environmental impact	Proposed mitigation and aspects for monitoring	Responsibility for Mitigation monitoring and maintenance during operation	Monitoring means At Phase	Recommended frequency of monitoring
Soil erosion	Control activities especially during the rainy season	Developer	Operation	Monthly
	Provide soil erosion control and conservation structures where necessary	Developer	Operation	Monthly
	• Ensure efficiency of erosion control measures at S(3), S(2), S(7), S(8) and S(10)	Developer	Operation	Monthly
Dust Emission	Spray water on cross and main roads	Developer	Operation	Daily
	Maintain plants and equipment regularly	Developer	Operation	Monthly
Air pollution	Install air quality monitoring device	Developer	Operation	Yearly
Hydrology	Construct and install drainage structure properly	Developer	Operation	Rainy Season
	 Install concrete drains and drops to break the impact of water flowing to the drains Gradient of drainage 	Developer	Operation	Rainy Season



Water resources	 Construct Sedimentation basin sand traps, and tame at outlet of S3, S2, S7, S8 and S10 	Developer	Operation	Rainy Season
	 Stack and pile materials systematically 	Developer	Operation	Monthly
	Dispose solid waste at stacking yard	Developer	Operation	Daily
	 Neutralize oil spill and hazardous spills 	Developer	Operation	Monthly
	 Disposal solid waste at plant regularly 	Developer	Operation	Weekly
Water usage	 Record water volume requirement at purification plant 	Developer	Operation	Weekly
	 Pump and deliver required volume per day Manage unnecessary wastage and leakage 	- Developer	Operation	Daily
Handling of PV solar Panels	 Loading / unload systematically Install systematically Remove and stack systematically pack systematically Train workers Stack yard S1,S2, S3 Provide protective gears 	Developer	Operation	Daily



Oil spill	 Assisgn designated pavement at workshop Do recycling Store, handle and dispose of new oil and used oil wastes properly 	Developer	Operation	Monthly
	 Maintiain equipment to avoid leakage 	Developer	Operation	Randomly
Sewage	 Maintain sewage septic tanks regularly Observe smell Check groundwater during rainy season 	Developer	Operation	Yearly / Randomly
Solid waste and construction waste	 Ensure purchase of materials 	Developer	Operation	Weekly
	Provide Wwaste bins/skips	Developer	Operation	Weekly
	Sort different types of waste	Developer	Operation	Weekly
	Do recycling	Developer	Operation	Weekly
	Disposal off-site	Developer	Operation	Weekly
	Dispose hazardous waste properly	Developer	Operation	Weekly
	 Pay special attention to sanitary facilities 	Developer	Operation	Weekly
	 Disposed of garbage periodically and at approved dump sites 	Developer	Operation	Monthly
Security	 Provide security guards and facilities during the project operation 	Developer	Operation	Daily



	Check and inspec parameter fencing of plant	Developer	Operation	Daily
	Check and inspect sub- station yard	Developer	Operation	Daily
	 Check and inspect 230 KV tower base 	Developer	Operation	Daily
Road Safety and traffic control	 Provide billboard and traffic signs around the site to notify stakeholders of the development 	Developer	Operation	Weekly
Public health and Occupational	Train workers on occupational health and safety	Developer	Operation	Weekly
safety	 Provide full protective gear and workmen's compensation cover in addition to the right tools and operational instructions and manuals (body protection, protective cloths, safety helmet) 	Developer	Operation	Weekly
	 Adopt waste management system to ensure proper solid waste disposal and collection facilities (masks, gloves) 	Developer	Operation	Daily
	Ensure proper wastewater management	Developer	Operation	Monthly
	 Design septic tank to be as provided in the plan 	Developer	Operation	Monthly



Fire safety	Install fire fighting equipment	Developer	Operation	Monthly
	Provide firefighting training	Developer	Operation	Yearly/occasionally
	 Perform drills on emergency response 	Developer	Operation	Yearly/occasionally
	 Educate workers on fire risks 	Developer	Operation	Yearly/occasionally
	 Check and inspect parameter road and intersection ways 	Developer	Operation	Weekly
	Observe ground tanks	Developer	Operation	Weekly

9.4 Social Management Plan (ESMP) during Operation Phase

Aspect / Issue	Potential Impact / Risk	Mitigation Measures	Monitoring Action and parameters	Responsibility
Communication	1			
Operations of the solar plants	Electromagnetic field interfering with communication	Electromagnetic compatibility (EMC) certified inverters should be used on the project to prevent electromagnetic fields interfering with communication.	Equipment operations checklists and testing protocols	Contractor/ Developer
Community Hea	alth, Safety and Security			
Operations of the solar plants	Risks of electric shock, thermal burn, exposure to EMF and several other hazards for unauthorised personnel trespassing the site	Security fence should be installed around the entire facility to control access and keep out unauthorized personnel at designated areas	Inspection of the premises and installed fencing around the project site	Contractor/ Developer



Operation of the solar PV plants.	Risk of accidents involving members of the public	 The project site should be enclosed within a security perimeter and no unauthorized persons should be allowed entry/access to the site. Caution signs should also be placed around the site to prevent occurrence of accidents. Reasonable steps should be taken in the provision of security and in particular the use of force and establish appropriate conduct towards workers and affected communities. A grievance mechanism should be put in place for the affected A channel should be established for the communities to express concerns about the security arrangements and acts of security personnel. 	Security surveillance and community engagement to sensitize concerned members of the community on their health, safety and security.	Contractor/ Developer
Lack of or inadequate good water supply and sanitation facilities on site.	Risk of water borne diseases due to lack of potable water and sanitation facilities	Safe and clean water and good sanitation facilities should be provided to workers to prevent an outbreak of waterborne diseases among them which can also affect the surrounding communities.	Safe and clean drinking water is provided on site. Operable sanitation facilities provided on site.	Contractor/ Developer
Installation of solar PV modules.	Visual intrusion and disruption of the aesthetics.	 Use of low visual reflective solar modules with anti- reflective coating (ARC) that reduces reflectance from the solar PV modules; Use of low level solar module mount design system (2 - 3 metres) that will not disrupt the aesthetic view of the project /surrounding areas: Maintaining a perimeter buffer of trees and grass vegetation along the boundaries to screen sensitive viewing areas in the vicinity of the site. 	Monitoring existing vegetation screening the site is appropriately maintained without providing	Contractor/ Developer



Occupation Hea	alth and Safety		shades onto the solar PV modules.	
Occupational health and safety of workers working on site.	Reduced occupational health and safety among workers	 A health and safety policy shall be established to guide operations of the facility. All construction activities should be conducted in accordance with provisions of the national legislation and international best practices (General EHS Guidelines: Occupational Health and Safety); Safety rules should be enforced and complied with by workers, contractors and those coming to site; Personal Protective Clothing (PPE) should be issued and used as required by the various classes of the workers on project site; Barrier tapes and caution signs should be erected in all potential hazardous areas to prevent injury or loss of life among workers; No unauthorized person should be allowed on site including workers without appropriate PPE 	Risks identification and implementation of management measures conducted prior to commencement works.	Developer
Socio-economic	and technology transfer	<u> </u>		
	Capacity building and technology transfer to local contractors, skilled manpower and unskilled workers.	 Local contractors, skilled specialists and unskilled workers should be used to benefit from modern technology and skills transfer during operation of the solar plants. Appropriate training should be provided to all local contractors, skilled manpower and unskilled workers to enhance expected project benefits. 	Skills training for locals with assistance from local learning and construction institutions. Number of local people trained.	Developer



opportunities created for both skilled and non-skilled labour.	The contractor, where possible, should employ members of the local communities and local experts to maximize on the benefits of employment opportunities for the local residents	Record of employment, annual reports on IDC / Solar Plants Operators.	Contractor/ Developer
the local and national economy through its multiplier	Procurement of services from local contractors and locally produced raw materials during the operation phase should be done, where possible, to maximise the benefits on the local economy	Annual reports on IDC / Solar Plant Operators	Contractor/ Developer



9.5 Emergency Response Plan for Disasters—which may include fire hazards and earthquakes

General Plan

- 1. To prepare emergency kits including first aids kits, water and food as a contingency plan
- 2. To allocate and designate the safe zones
- 3. To give training on first aids
- 4. To perform drills from time to time in response to natural disasters including a fire disaster/hazard and an earthquake
- 5. Assign trained persons assigned to lead the respective groups to safe zones
- 6. To identify focal persons for communication and for restoring links during and following the disaster
- 7. To communicate responsible persons to start the mobilization
- 8. To develop standard operating procedures (SOPs) in responding to disasters in which roles and responsibilities of each person/employee are clearly defined

Initial Stage of the Emergency Response

- 1. The assigned people have to lead the respective group of people to the safe zones
- 2. Check the number of people in each group
- 3. To bring the emergency box, which may include first aid kits, water and dry food, torch lights, dry batteries and a radio together with the group
- 4. To contact assigned focal persons for further instruction and for restoring links during or following the disaster
- 5. The trained medical person has to check health conditions of the respective group and take necessary measures to prevent the possible outbreak of a disease/epidemic
- 6. To collect updated information via radio, wireless communication devices, phone and television broadcasts
- 7. If the Government announces to evacuate the area, the assigned person has to lead the team to the government emergency safe place if different from the agreed safe zones.
- 8. Keep contact with the other groups and focal persons responsible for communication

Prevention measures in the Solar Power Plant Compound

- 1. Hazardous places are to be clearly marked
- 2. Exit ways will be clearly marked; necessary drills performed for each and every one to be able to move to safe zones
- 3. Response drills shall include how to keep constant contact with respective focal persons and among groups
- 4. Response measures are to be made clear to all the persons concerned should the disaster causes injuries to people
- 5. Response measures may include but not limit to working out logistics and transportation plans as well as taking injured people to health personnel or health facilities
- 6. The last group to move from the hazardous area has to work with the management group and check the number people from each groups
- 7. If the government releases evacuation instruction, the groups has to move to the government allocated safe places if different from designated safe zones of the project



10. ENVIRONMENTAL MANAGEMENT PLAN AND ESTIMATE BUDGET

10.1 Environment Management Plan and Estimate budget

Sr No	Impact	Mitigation	Monitoring To	Responsible Body	Content of work	Estimated amount of cost for mitigation and monitoring (MMK per year)
1	Soil					
	Soil erosion	 Improvement and maintenance of rainwater drainage Provision of conservation structure, Landscaping 	 Drains, Water ways, Vegetation covered plants Concrete Aprons, concrete drains Deformation by erosion 	O&M Contractor who is hired by Developer	Task work	30,000,000
2	Air					
	Dust emission	Pouring water ,wetting of dusty places/areaPlanting at rest area	 Amount of dust, visit surrounding as wind direction Road side tree leaves 	O& M Contractor who is hired by Developer	Task work	10,000,000
3	Water					
	Surface water runoff	 Landscaping Velocity of runoff by concrete drain and drops Sedimentation basins, sand traps Taming outlet 	 To measure amount of rain water Systematic surface drains and cascades concrete drain 	O&M Contractor who is hired by Developer	Task work	10,000,000



	Water usage	Rainwater storageCapacity of purified waterTube wells	 Water amount used at rainy season Drainage and Grading Design Water amount used at winter and summer 	Developer	Task work	10,000,000
	Groundwater contamination	 Proper disposal of solid waste, educate workers Handling of oils and chemicals Solid waste management Proper maintenance to sewage 	 Improperly disposing and dumping solid waste Efficient collection and off-site disposal Incidences of spills Observation smell 	Developer	Task work	12,000,000
4	Sewage					
	Sewage	Regular maintenance of septic tanks	Observation smell from sewage	Developer	Task work	10,000,000
5	Solid waste					
		 Dust bins/skips Educate workers and office staffs Efficient solid waste management handling Sorting type of waste 	 Checking Mosquitoes and flies Moving to off-site Final disposal Record daily work done of garbage trucks and volume of solid waste 	Developer	Task work	10,000,000
6	Climate					
	Natural Haz- ards	 Planting more greens at rest area Control paved area as least as possible Participated in Tree Replant Program by Central 	 Record number of trees and greens area Record paved area 	Developer	Task work	18,000,000 Already compensated to Central Dry Zone Green Committee Additional 10,000,000 estimated to be spent



Dry Zone Green	on landscaping at
Committee	project site
GEP(Myanmar)	
undertakes to follow and	
abide by the	
Enviromental	
Conservation Law and	
follow Enviromental	
Management and	
Monitoring Plan as	
necessary	



11. PUBLIC CONSULTATION AND DISCLOSURE

11.1 METHODOLOGY AND APPROACH



The two nearest villages to Minbu Solar Power Plant Project site are Lay Pin and Zee Aing Villages. Lay Pin Village is located 1.27 miles to the south-west of the project site and there are 435 households and a population of 1,592 in this large village. Zee Aing Village is located 3.34 miles to the south-east of the project site and there are 190 households and a population of nearly 800 in this small village.

There is no nice cultivation in either village. The staple crops grown in both villages are beans and pulses and sesame. The land plots of about 5 farmers were included in the project area and the company has, as it is known, given the compensation of.9,200,000 kyat (9.2 million kyat) to three of them because they have legal documents of land ownership. We were told that that the other two have not been given compensations, as they do not have any evidence of land-ownership such as Form 7.

But the compensated three are still not satisfied because, according to what they said, they have only got compensations for their crops and have not received the same for their land. The project area belongs to the Ministry of Natural Resources and Environmental Conservation; the farmers have documents that certify that they paid taxes for working the land.

The authorities from the company have promised that they are going to review their evidences. Besides the families of those who have lost land, the people from the other villages also hope that their villages will have electricity and enough drinking water and water for domestic use. There are only 5 people from Lay Pin Village who are now working with the project site. The villagers want more of their people employed and they want to be informed about vacancies for the people. They complained to the effect that they missed some information about have job vacancies for the project. The company officials suggested that if the people meet their requirements, they can be given jobs.

The pieces of the farmland of Zee Aing Village are not included in this project site. There are about 40 villagers from Zee Aing Village working with this project. Zee Aing Village populace eagerly hopes that they will have electricity and tube wells.

There is a good relationship between the villagers and the staff of project developer. Villagers would like to have electricity, tube wells and a new school building as part of the company's social corporate responsibility or as donations towards their communities.

11.2 SUMMARY OF CONSULTATIONS AND ACTIVITIES UNDERTAKEN

Public consultations at Lay Pin village, Minbu for solar power project



Lay Pin village

A public consultation was held at the Lay Pin Village, Min Hla Kyin Village-tract, Minbu Township, at 9:00 am on September 12, 2016. The meeting attracted great attention from the regional and local authorities, political party members and the general public. Farmers whose land has been taken for the project also showed up. The discussion went on for almost two hours and a half. All the participants showed enthusiasm and the discussions were very lively. Myanmar Survey Research EIA / ESIA team members explained the purpose of their visit while representatives of the project discussed matters relating to the project and responded to questions and concerned raised by the participants. The consultation came to an end at 11:30 am.

Present on the occasion were U Kyaw Swan Yee, member of parliament from Minbu Township Constituency-1, Magwe Region Parliament; U Lin Naing Oo, general manager of GEP (Myanmar) Company, authorities from the village-tract, local elders, the headmaster and teachers from Lay Pin primary school and community members from Lay Pin and neighboring villages as well as MSR EIA/ESIA survey team members. There were 68 participants in total.

(1) U Kyaw Swan Yee Member of Parliament, Minbu Township, Constituency No (1) Regional Parliament, Magwe Region

I come here to learn about the Solar Power Project and want to coordinate the negotiation between the people and the company. I come to know something about the good and bad effects of this project. I'll co-operate and I want to listen to the voices of people. I have a plan to go on a visit to the project site. I'm pleased to know that the company representatives were also present here. I've known that the project is to generate electric power, to sell it again to the government and to provide electricity for the region. Because of the implementation of the project and other causes, there have been forest depletion and climate change. For this reason, flash-floods may take place very often. I'd like to urge the



developer to conserve forests and grow new trees and plants. Villagers should frankly present what they feel.

We trust the solar power company, that is implementing the project, will fulfil the requirements that the local residents present. As a member of the government, we will help as much as we can. I've known that the ruins caused by earthquake will be repaired and restored by the government. I'd like to conclude my closing speech by saying that we'll co-ordinate with both of you—the company and the villagers.

(2) U Lin Naing Oo Solar Power Project, General Manager GEP Myanmar Company

The project was started in 2013. Its implementation was started only after submitting the proposal to the regional and national governments. In implementing the project, EIA and SIA are the first things to be done and so MSR Company was hired to do them. The electric power generated through the solar panels will be sold to the government. Currently, we have to buy electric power from the government to carry out our project. After generating the power, we're going to sell it to the government. We'll also provide electricity for the nearby villages through which power lines pass. The young people of the village may come and work with the project. We'll need about 200 employees. The jobs that they are given will depend on their educational qualification. This Solar Power Project has the least impact on the environment. We'll contribute to the electricity requirement of our country and benefit the region. We'll reserve 2% of the profit to assume corporate social responsibility (CSR) activities and use them where there is any requirement. We want to co-operate with the local residents. This project will produce renewable energy and will be the biggest project in Southeast-Asia.

(3) U Tin Than Leader (EIA/SIA) MSR Company

We are going to collect data on the natural environment. For the time being, the government gives permission only if EIA/SIA surveys are first done and findings submitted to it. So the EIA/SIA survey must be implemented by a third party company and MSR is now here to carry it out. We will study flora and fauna in this region. If there is any impact on the environment, we need to co-operate with each other to produce good result. So we have come here to hold discussions. Public meetings and individual discussions play an important role in carrying out EIA/SIA assessments. I want the villagers to frankly discuss and put forward their thoughts and opinions.

(4) U Myint Swe Engineer, EIA/SIA Team MSR Company

Energy is used to generate electricity. By using this energy and the operation of the engine, SO_2 gas comes out. The gas harms men as well as animals. The government uses hydropower in order to reduce the SO_2 emission. The generation of electrical power through hydropower still has negative impact on the natural environment. Building dams still has a similar impact on people. So Solar Power Project is the one which has the least impact on the environment. If the project is successful, the project will generate 220 megawatts of electricity. Electricity will be generated through powerful solar panels. It is not a factory that will produce solar panels as the villagers might have thought. We are going to compile facts such as the possibility of negative impacts on the water, soil and air in the record. Solar power cannot harm birds and other animals in its neighborhood.

(5) U Aung Lin Databank Manager, EIA/SIA Team MSR Company

I used to be a school teacher. Now I'm working with MSR. In this project, MSR has already carried out the portion of social impact assessment. We have finished conducting the survey of economic, educational, health and religious situations. When we met and discussed the project implementation, we were told that three men whose pieces of land were confiscated were yet to be compensated.

(6) U Kyaw Win Age: 55 Pyawbwe Village, Min Hla Kyin Village-tract Minbu Township

There are five villages in our village-tract—Min HlaKyin, Lay Pin, Pyawbwe, Kyaukpe' and Ye'chodwin villages. This project developer needs to support our village. I would request the company that other villages like Lay Pin should be helped to develop.

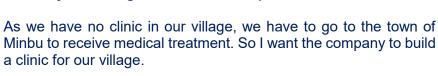


(7) U Tet Toe
Age: 43
USDP-Representative
Lay Pin Village, Minbu Township

I want to know why the persons whose plots of land had been confiscated were given only compensation for crops and not given compensation for the land. These three men have land ownership certificate Form 7. Compensation should also be given for their land.



(8) U Kyaw Than
Age: 73
Village-elder
Lay Pin Village, Minbu Township





(9) U Myint Toe Naing
Age: 42
NLD, Secretary
Lay Pin Village, Minbu Township

If this project requires workers, a notice should be stuck on the noticeboards in the village. As the villages do not get the information, they do not apply for jobs. So if there are job opportunities, I would like the project developer to inform the villages.



(10) U HsanTun Headmaster Basic Education Sub-middle School, Lay Pin Village, Minbu Township



The school building collapsed because of the earthquake. There are not enough classrooms. So we need a school building. For the time being, we have to use places like under the shady trees and make-shift classrooms, including the headmaster's office, for teaching. We also need a tube well because we have to buy water for the use of the students and the teachers. If we have a tube well, we can also supply water to the day nursery. As there is not enough furniture, we request the project developer to donate them.

(11) U Myint Khaing Age: 41 Lay Pin Village



We are in the dry zone and as our village has no electricity, water is also difficult. For this reason, when the project can generate electricity, we'd like the company to assist our village in getting electricity.

Zee Aing village



A public consultation for Minbu Solar Power Plant was held at U Mya Thein's residence in Zee Aing Village, Zee Aing Village-tract, Minbu Township, of Magwe Region at 12:00 noonon 12 September 2016. The consultation was over at 1:30 pm. It was attended by 38 participants including some farmers from The Kone Village in Zee Aing Village-tract.

(1) Name : U Aung Thu Hein

Position : Engineer

Organization : GEP-Solar Power Project

Our project is to generate electricity using solar beams that shine on solar panels. The tenure of executing the project will be about 4 years. The electricity generated will be fed into the national grid. We are selling electricity to the government. Corporate Social Responsibility (CSR) activities will be mainly conducted in Zee Aing and Lay Pin villages as both are very close to the project site. You will also see villages in our neighbourhood developed. We are trying to make sure that this project have the least impact on the environment. I trust our project will have least negative impact on the environment and not like other forms of electric power generation projects. During the implementation stage, we are trying to use electric power from the government's 11 KV power grid. When the project is completed, Zee Aing Village will have electricity from the solar power project.

(2) Name : U Tin Than Position : Team Leader

Organization : MSR (EIA/SIA Team)

We come here to conduct EIA/SIA survey for the solar power project. In accordance with the economic growth of the most countries in the world, there have been damages of natural environment and natural resources because of the activities carried out for the economic growth. Nowadays, business enterprises have been trying to have the least impact on the environment by using solar power plants. If there is less and less impact on the environment, humans will survive for a long time. In our country, if only when EIA/SIA survey findings are submitted, development projects are approved. According to the survey report, the project is given permission only after considering whether there will be a negative impact on the environment or not. That is why our company, as a third party, comes here to conduct EIA/SIA survey. I would like to invite all of you to present your opinions.

(3) Name : U Myint Swe Position : Engineer

Organization : MSR (EIA/SIA Team)

Our team is responsible for collecting data on water, soil and air in making EIA/SIA assessments for this current solar power project. Using an energy to generate electricity produces SO₂. For this reason, that process pollutes the environment. Those sources of energy may be depleted at some time in future. Depletion of energy means the impact on men and animals. Deforestation and building dams cause floods and other forms of natural disasters. As solar power has no impact or least impact on the natural environment, it has become more and more common in generating power. This project will generate 220 megawatts of electricity. According to the survey, the flow of water current is considered to be going the same way. We have to take samples of water, soil and air and study them. The project will have the least impact on men and the natural environment.

(4) Name : U Aung Lin

Position : Databank Manager Organization : MSR (EIA/SIA)

It is our responsibility to conduct social impact assessment known as SIA for this project. We have met people and discussed socio-economic, health and educational situations of this village. There will be absolutely no impact on the physical environments such as religious buildings, religious land, graveyards, etc. because of this project. I want to suggest that CSR activities should be assumed to forge good relations between the project developer and the villagers. We need to discuss matters. We come to know that local residents have to go to Seikhaung Village and the town of Minbu town receiving medical treatment as there is no clinic in this village. So we find that medical facilities are also lacking here. The local people have presented the fact that they need a school building which can be used as a middle school.

(5) Name : Daw Pyone

Aged : 63 Position : Farmer

Zee Aing Village, Minbu Township, Magwe Region

The solar power project site is located near our village. So I want to suggest that if the project needs workers for the project, the company should give priorities to our villagers in recruiting people.

(6) Name : U Win Aung

Aged : 62

Position : Village-elder

Zee Aing Village, Minbu Township, Magwe Region

Earth-holes have been dug by the project developer in the areas of our farmland in order to erect electric lamp posts. We want to know if the company is going to do something about it in order to compensate the farmland owners. I think indemnity or compensation should be given.

(7) Name : U Aung Kyaw

Aged : 95

Position : Village-elder

Minbu Township, Magwe Region

Even though there has been an increase in houses and population in our village, our village has no electricity and no water supply. There is no clinic for health care. The population is increasing, it's still difficult for us to have access to health facilities. For this reason, I'd like to suggest the project developer to help solve those difficulties.

(8) Name : Aung Ko Min

Aged : 34

Department : Basic Post-Primary School Zee Aing Village Position : Headmaster, Basic Post-Primary School

Zee Aing Village, Minbu Township, Magwe Region

When I first came to this village in 2010, I found that classrooms were not safe and tables and other school furniture were not sufficient. Now, the insufficiency in terms of school furniture has been overcome to a certain extent as the villagers and I have made a concerted effort. But the self-help school building has not yet been completed. The vacancies for teachers have been filled to some extent due to the appointment of some teachers. There is still need to mend the current KG wing and school fences. We need a deep tube well for the school because the drinking water and the water for domestic use for students and teachers has to be fetched from the village monastery. For this reason, I'd like to



suggest the developer to help the school through CSR activities or through other means such as monetary donation.

11.3 KEY INFORMANT INTERVIEWS WITH KEY STAKEHOLDERS

In addition to holding two public consultations at Lay Pin and Zee Aung villages, the survey team members conducted key informant interviews with key stakeholders which include 5 government personnel, 9 village-tract administers and farmers from Lay Pin Village and 7 village-tract administers, farmers and community members from Zee Aing Villages.

Government personnel

(1) Name : U Nyi Nyi Win

Age : 45

Department: General Administrative Department

Position : Township Administrator Residence : Minbu Town, Magwe Region

Phone Number: 09-5037823

There has not been any public consultation for solar power project before. It should be done by directly submitting a proposal to the Regional Government. Any necessary help will be given. It is better to do everything by meeting the public. I have helped 3 farmers get compensations as their farm-land was confiscated for this project. It was done to have a good



relationship between the company and the public. It was a sort of compensation for crops. As the big trees had been felled, there remained only small trees. There will be no impact on the environment because of the project. I believe that if the project is successful, it will be beneficial to the region and the country.

(2) Name : U Soe Myint

Age : 57

Department : Minbu District, Red Cross Society, District Officer

Position : A staff member of Myanmar Economic Bank

Residence : Minbu Town, Magwe Region

Phone Number: 09-401527678



I have heard about the solar power project before. Its aim is to generate electricity. It is good. If we have electricity, it will be beneficial to the local residents and the country. The region will develop and more businesses can be carried out. And then artisan wells can be dug to get plenty of water. We have no paddy land and so, the possible impact is that other plantations will be taken away. I am grateful to you for coming to conduct the survey of this project. We welcome you because we will be able to know the real answer, the realty as basic needs. Regarding health, so far as our

Red Cross Brigade has learnt, there used to because of malaria in this region. But it is no longer here.

(3) Name : U Sein Shwe Min

Age : 48 Department : -

Position : Minbu District Secretary, USDP
Residence : Ye Poke Village, Minbu Township

Phone Number: 09-401524435

I don't know much about the solar power project. The project has started since the time of USDP Government. I think there will be no negative impact of the project on the environment. Local residents will have employment opportunities. To generate electricity through hydro power, building dams may cause embankments break and there may be flooding. Local residents and people may not be worried in generating solar power. But there will be some troubles because farm lands were confiscated. It will be convenient if the farmers, who have worked long on the farmlands, are given compensations or financial support. As farmers have limited



knowledge regarding legal matters, they did not try to get land ownership form 7. So they have lost chances of being compensated for their land. That is why the company or the government should help solve their problems. If there is a good relationship between the company and the local residents, its business will run well. Even when the corporate social responsibilities (CSR) are assumed, the farmers do not have the idea that they are having such opportunities. To be clear, giving compensations to individuals should be appropriate. But companies, being associated with authorities tend to ignore local residents. So I want to suggest the developer to have good public relations to be on good terms with the locals.

(4) Name : U Tun Tun

Age : 50

Department: Fire Brigade

Position : Head of Township Fire Services Department

Residence : Minbu Town, Magwe Region Phone Number : 09-36093565, 09-440841500

I have been in this position for one year. My birth place is Paungde, Bago Region. The Solar Project area is 15miles far from the town of Minbu. In carrying out this project, the project area must be kept separate from farmlands by firebreaks. The breadth of the firebreak should be between 50ft and 100ft. Automatic fire extinguishers must be installed at the project site. The control system must be used. Further suggestions will be given only after the survey and before the project is finished. Forest fires break out in summer in this region. Forest fire is caused by hunting, burning a place to expand farmlands, and burning a place to grow more



grass. Whether a factory or a project is big or small, railroads need to be built as it is set up near the forest. If we want to get electricity installed, durable cables must be used to avoid wire shocks. To put out fire immediately when it breaks out, we must keep a pool or a tank fully filled with water. When the project is over, necessary suggestions can be made after studying it thoroughly.

(5) Name : U Kyaw Swan Yi

Age : 39 Department : -

Position : Member of Parliament, Regional Parliament, Magwe

Region, Minbu Constituency No.1

Residence : Gatkyiyat, Minbu Town, Magwe Region

Phone Number: 09-401573893

I am interested in this project as I am a native of Minbu. I have lived in Minbu since my childhood. I am also trying to know every detail of this project. I have already told the Township Administrative Officer about it. I have a plan to get a school built, and a well and a pond dug for Le' Bin village. I have heard that those from the village whose farmlands were confiscated have got compensations. When the project is completed, we will have electric lights. As the trees had been felled for this project, we should consider reforestation. We need to seek effective ways to bring benefits to local residents and reforestation plan for greening the land again. Farmers have incurred losses due to the



differences between the maps and the ground. As for me, I am standing on the side of truth and helping farmers. Our country has advantages to have survey research companies. We now have more transparency and more consultation with the public. Consequently, people will have benefits. I am going to meet a representative of the project developer and discuss with him. I'll advise him to assume corporate social responsibilities (CSR) for nearby villages as well.

Lay Pin Village

(1) Name : U Myint Toe Naing (a) U Toe Toe

Age : 42 Occupation : Trader

Position : Chairman, village NLD

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-401636036

I have lived in Lay Pin Village for years. I was born in this village. I still have no detailed information about the solar power project. What I know is the project will generate electricity. As farmlands are included in this project area, there are six farmers whose farmlands have been confiscated. Three of them have Form 7 with their names as owners and another three have no Form 7. Those who have Form 7 and whose farmlands have been confiscated are U Myint Swe, U Thein Han and U Win Nyunt and those who have no Form 7 are U HpoTahsoke, U Tin Aung Win one another one, which I couldn't recall his name. Those with Form 7 got compensations. But we did not know how much they have got exactly. Three persons get jobs in this project. If workers are



required for the project, a notice should be stuck on the board saying there are job vacancies. Young people will get jobs if they do like this. It is proper to undertake this project if local residents get jobs, and get compensations for what they have lost. In our village, water is scarce in summer. People have to buy and use water at a price of Ks.500 to Ks.700 a barrel. Water is scarce from March to June. Currently, electricity is generated through the use of solar panels, battery light bulbs and generators. If electricity can be generated through the solar power project, our village should also be provided with electricity. As our village does not have a rural clinic, a rural clinic should be built for us.

(2) Name : Daw San Mu

Age : 46

Department : Health Department

Position : Nurse

Residence : Lay PinVillage, Min HlaKyin Village-tract, Magwe Region

Phone Number: 09-259440896

I have lived in this village for a long time. Lay Pin Village has a population of 1,592 including 750 males. The villages included in Min HlaKyin Village-tract. There are altogether 5 villages in Min HlaKyin Village-tract. The tract has 389 houses and 435 households. Common diseases in this area are diarrhoea and dengue hemorrhage but there is no malaria. If someone falls ill, they have to go to Minbu Hospital. It takes about nearly an hour to reach there by car. Water is scarce in summer in this village. We have to pay a lot to buy a barrel of water. Deep wells can be dug there. Water is found at a depth of 600 feet. There are 4



deep wells in the village but there is no electricity. If we have electricity, more deep wells can be dug to get more water. We want to have electricity. If the project is

successful to generate electricity, our village should be provided with water and electricity and a clinic.

(3) Name : U Min Aung

Age : 42

Occupation : Farmer, Live stocks Breeder, Salesman

Position : Shopkeeper

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-5348100

I have lived in this village for a long time. I have known a little about the solar power project. I haven't known detailed facts about it yet. I know electricity is to be generated. This village and the project site are about 2 miles far from each other. The main business of this village is agriculture. They grow pe'seinngon (pigeon pea), mye'pe' (groundnut) and pe'tisein (green gram). Half of the households in this village (about 200 persons) grow them. Shophyu (hseikalama)bin (plant) (gun tragacanth) is also grown as a long-term plant. There are about 50 farmers who grow gun tragacanth. The secondary business of the village is livestock



breeding. We breed chickens, cows, and goats. There are 50 goat breeders and a few cow breeders. Goat and cow breeders have over 50 goats or cows each on average. I want to ask the project developer to help us to have electricity and a clinic. If so, the villagers will be happy to have this kind of development and will be grateful to you.

(4) Name : U Tet Toe

Age : 43 Occupation : Farmers

Position : USDP, Chairman of Ward and Village

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-256140580

I have lived in this village for 22years. I am single. I do not know detailed facts about the solar power project. I know that the company is from Thailand and it has taken 836 acres of land. The lands of three farmers who have Form 7 and another three who don't have Form 7 have been confiscated as their pieces of land falling the project area. The three Form 7 holders got compensations only after being investigated for 9 months. We think the compensation given by the company is not fair and square. The Form 7 holders are U Thein Han, U Myint Swe and U



Win Nyunt. Those who don't have Form 7 are U HpoTasoke (a) U Myo Min Oo and Daw Ma Thidar, U Tin Aung's wife. I don't know the name of another one.

(5) Name : U HsanTun

Age : 28

Occupation : Teacher, Department of Education
Position : Headmaster, Sub-basic Middle School

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-259045030

My birth place is in Natmauk Township. I have been in this village for a short time. So I do not exactly know about the solar power project. I have only as much knowledge as common people have said about it. The project is to generate electricity. There are altogether 12 teachers in the school. There are 324 students. At the day care nursery, there is a teacher appointed with the village funds. It is difficult to teach students as a school building collapsed with its cracked walls because of the recent earthquake. The



school has also to buy water for its use. As the project developer took away the farmland of local residents, some farmers became unemployed. They need to get compensations for their confiscated land. And then we want the company to help us have electricity and supply water and to donate a deep well for the school. Currently, people have to buy water at 500kyat a barrel (large metal barrel). I think it is a good project as it contributes to the generation of electricity in Myanmar.

(6) Name : U Thein Han

Age : 56

Occupation : Farmer, grocery seller

Position : Shopkeeper

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-256140578

I have lived in this village for 30 years. There are 5 members in my family. Formerly, I did farming on 4.76 acres of my farmland which falls in the project area. I had been working on this land for over 25 years. According to the season, I grow hnan (sesame) and pe-sin-ngon(pigeon pea). An acre of sesame yields 10 baskets. An acre of pigeon pea yields between 12 baskets and 15 baskets. A basket of sesame fetches over 50,000 kyat. A basket of pigeon pea fetches 50,000 kyat. We have an annual income of 5,500,000 (5.5 million kyat). If the production cost is deducted, the net income is 4,000,000 (4



million kyat). I got 2,500,000 (2.5 million kyat) as compensation for my confiscated farmland. It is not the compensation for land but for crops. It has been known that the government compensated 1,200,000 (1.2 million kyat) for land compensation. As I have Form 7 for my ownership, I need to be given compensation for land.

(7) Name : U Than Zaw Naing

Age : 45 Occupation : Store

Position : Store-keeper

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-401639574



I have lived in this village for about 15 years. I know the solar power project roughly. I know it is to generate electricity. If the project is successful to generate electricity and helps our village earn electricity, deep wells can be dug. In this forest areas, there are barking deer (gyi), deer (thamin), rabbits (yone), monitor lizards (hput), variegated ground lizard (badat), snake (mway), jungle fowl (tokyet), partridge (kha), quail (ngown), barn swallow (mo-swe-hngat), common myna (zayet) and dove. They have

disappeared now. The project developer needs to return something good for the local residents. I want to ask the company to provide electricity, enough water and a clinic for our village. If the company does them for us, we will be very happy.

(8) Name : U Myint Shwe

Age : 61 Occupation : Farmer Position : Head

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-442461901

I have 7.35 acres of farmland of which 3.18 acres is included in the project area, and was confiscated. On the remaining 4 acres of land, we grow pe-sin-ngon (pigeon pea), hnan (sesame), and pedisein (green gram). I got 2,500,000 (2.5 million kyat) as compensation crops for all 3.18 acres of land confiscated on 3 March 2016. In continuing agriculture on the remaining land, I need to hire labourers. I also grew shaw-phyu (gum tragacanth). We have grown 100 plants. My former business was to drill oil. But we lost and we stopped. I know that at the end of the project,



electricity will be generated. If our village has electricity, deep wells can be dug. We will have the opportunity to use electrical appliances. And then I also want to get compensation for my land. My health is not good. I am receiving medical treatment for diabetes. I find it difficult to earn money. For this reason, compensation for land should be appropriately given to us. In former days, I annually got 4,000,000 (4 million kyat) from agriculture. Now, I have lost half due to my illness. My income is not sufficient. As I have Form 7 for all my own land, I deserve to be given compensation.

(9) Name Venerable U Sopaka

Age **52**

Occupation **Buddhist Monk**

Position Presiding Monk (Labhasiddhi Monastery)

Lay Pin Village, Minbu Township, Magwe Region Residence

I don't know much about this electricity-generating project. I have been presiding at this monastery for a long time. I feel happy to hear that we will have electricity through this project. I think this region will also be provided with electricity. There are many people who stay at my monastery during the Shwesettaw Pagoda festival. That is because my monastery is on the way to the pagoda. There are many difficulties for the pilgrims as we have no electricity. So if the project is successful we want to have electricity. There is no conflict between the locals and the



company staff. Not only for this village, but also for neighbouring village, electricity should be provided. We are very happy to know that the project has emerged.

(10) Name Venerable U Vayama

> Age aged 45, vassa 25 (Buddhist monkhood)

Buddhist Monk Occupation

Position **Presiding Monk (Ywa-U Monastery)**

Residence Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-401560104

I have been presiding this monastery since 2002. I have heard of this project. If the project is implemented, there will be electricity. I think the locals will get jobs in this project. In this way, I think the project benefits the region as well as the country. As our monastery has no electricity, we need it. If we have electricity, we can dig tube wells and get plenty of water. I know that the farmland of the local residents were confiscated in carrying out this project. I feel unhappy when they do not get compensations for their land. So the company should give appropriate compensations to those who lost their land. For the regional development, we should do something great to develop villages. If both sides are convenient, the project will be especially great.



(11) Name : U Aye Cho

Age : 41

Department: Village-tract Administration

Position : Administrator, Min HlaKyin Village-tract, MinbuTownship

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-451668608

I have not known about the solar power project in detail. As some pieces of farmland, included in the project area, were confiscated, three of them have been given compensation. It was merely a compensation for crops. I have submitted the claim to get compensation for the land. We hope to get compensation for the land. As our village has no electricity, it is very difficult for us to get drinking water and water for domestic use. The project developer is to help meet those needs. My own younger brother U Tin Aung Win and wife



Daw Ma Thidar own three acres of farmland that are included in the project area. But they have no Form 7 to show their ownership, and they get no compensation. But they are the ones who had worked on those pieces of land for over 20 years. As U Tin Aung Win died last year, there remained the wife-Daw Ma Thidar and three children. The eldest child is 12, the middle one 10 and the youngest 7. As she could not run business well, she went to Thailand to work there. So the education and the livelihood for the remaining children, the company should give compensation for their land. I think they have worked on the farmland since their ancestors' time even though they have no Form 7 and they should be given compensation.

(12) Name : U Win Zaw

Age : 46 Occupation : Farmer

Position : Casual worker

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-256080020



I have lived in this village for 26 years. I got married to a woman in this village. Formerly, I have no idea of generating electricity through solar panels. I have come to know about it very recently. I know that a solar power plant is to be built. It is beneficial for our region if the project provides electricity for the region and the country. If it is not like that, the only result is the loss of land of our local residents. It is known that the environment where there are solar panels becomes more heated. So it may have negative impact on the environment. The project is welcome if there is no negative effect on the locals and that the company will give compensations to the

locals who have lost their land. I want to suggest that compensations should be given to all those whose land has been lost.

(13) Name : Daw Aye Aye Mon

Age : 38

Occupation : Shopkeeper

Position : -

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-401536573

I do not exactly know much about the solar power project, and I know about it very roughly. As the farmland has been confiscated in the implementation of the project, the cow and goat pastures and farming land become smaller than before. As the trees have been felled, the temperatures may rise in this environment. I think the standard of living may be higher in our region if we have electricity because the project will be able to generate electricity. The conservation of forest is required. It can be said there may



be disastrous impacts due to the climate change caused by forest depletion. Most of the villagers basically are farmers and livestock breeders. If their business is good, our shops sell well. So the farmers businesses need to be successful. We want the project developer to help us to have electricity, water and health care facilities.

(14) Name : Daw San San Wai

Age : 49

Occupation : Farming Position : Housewife

Residence : Lay Pin Village, Minbu Township, Magwe Region

Phone Number: 09-259688587

I know this project. As my 5.96 acres of farmland were included in the project area, they were confiscated. I only got compensation for only 1.70 acres out of 5.96 acres I lost to the project. I have not got any compensation for the remaining farmland yet. Formerly, I grew hnan (sesame), pe-sin-ngon (pigeon pea) and pedisein (green gram) on those farmlands. I have no land to grow now. If I want to grow them now, I have to grow those crops on other people's land. When my land was confiscated, I shifted my business from growing plants to scooping oil from holes manually. But I stopped doing it as I lost my business. I failed to make money. I borrowed one million



kyat with interest from others and tried again in agriculture. I am always worried about paying back the debts. For this reason, I want to get compensation for all of my confiscated farmland. If the project is successful in generating electricity, we want to have it for our village. If so, we can use water and electrical appliances. I want the project to be successful. We want the company to fulfil the needs of local residents and to give full compensation for confiscated land.

Zee Aing Village

(1) Name : U Aye Kyin

Age : 50 Occupation : Farmer

Position : Village-tract Administrator

Residence : Zee Aing Village, Zee Aing Village-tract, Minbu Township,

Phone Number: 09401633676

I was born in this village and have grown up here as well. I know the project is to be carried out soon. The project has two sectors. The first phase covers 700 acres and the second phase covers about 800 acres. If the project is successful, I hope electricity will be generated and the region will have electricity. The project should have very little impact on the environment. I have heard that compensations were given to those whose land was confiscated. My son and other villagers are happy to get jobs in the project. The project personnel and villagers have good relationship and the villagers may provide help to the company. I want the company to give



assistance we need. We have no clinic in our village. We've already shown the place where a clinic can be built.

(2) Name : U Mya Thein

Age : 61

Occupation : Shopkeeper

Position : NLD, Ward and Village Chairman

Residence : Zee Aing Village, Minbu Township, Magwe Region

Phone Number : 09789092003



I was born in this village and have grown up here. I know that this project is going to be implemented. I have opened a food stall and a café in this project area and my daughters are running them. My son is now a policeman. If this project is successful, I hope our village is to have electricity, a rural clinic and a deep tube well. They have extended their welcome to our demands. I wish the relationship between the project and the

villagers to be good. We are also ready to give help as much as we can.

(3) Name : Daw Ei Ei Sein

Age : 34

Occupation : School Teacher

Position : J A T (Junior Assistant Teacher)

Basic Education Primary School (Post Primary), Zee Aing

Village

Residence : Zee Aing Village, Minbu Township, Magwe Region

I know that the project is being implemented. In the past I thought that the project would produce solar panels. I was worried about the fact that if the by-products of the solar panel production might affect the farmland in its vicinity and local residents. I was also worried about the climate change caused by forest depletion due to the solar power project. We had also anxiety that environment might be affected by using chemicals and energy.



Later I have come to understand that the project is not to produce solar panels. This project is to generate electricity through solar panels. So I have been told like that and I am

less worried now. Our school fetches water for domestic use from the monastery. I want to make a request that a deep tube well be provided if electricity is generated. If so, drinking water and water for domestic use for students and teachers will be available. If the company can do it, I would be very happy.

(4) Name : U Kyaw Mya

Age : 70

Occupation : A retired school teacher

Position

Residence : Zee Aing Village, Minbu Township, Magwe Region

Phone Number: 09792152850



I have lived in this village for 45 years. I know that the project is to generate electricity through solar panels. It is a good idea to implement this project. It can be beneficial for both the State and citizens. I know Zee Aing Village will be provided with electricity. My two sons are now working with this project. It is known that lamp posts are being erected to extract electricity from the national grid and use it in the project. A self-help school building is being constructed. Three rooms of the school are still to be completed and are in need of help. When the building is finished, we are going to apply for upgrading it to a

middle school branch. So we want to get help from the project developer.

(5) Name : U Win Htay

Age : 45 Occupation : Farmer

Position : A party member of USDP

Residence : Zee Aing Village, Minbu Township, Magwe Region

Phone Number: 09-797323014



I have not exactly known about this project. I know that solar power plant is to be built. As villagers get jobs when the project is implemented, I feel happy. As the project will not have bad effect on us, we have no worries. But one thing is to face difficulties in finding labour for agriculture. The wages have become higher. As workers cannot be found in our village, we have to find them from other villages. As the project is to generate electricity, our village should be provided with electricity if the project is successful.

(6) Name : U San Win Maung

Age : 24 Occupation : Farmer

Position : Secretary, Ward and Village Committee, NLD

Residence : Zee Aing Village, Minbu Township,

Phone Number: 09-256578981, 09-975652145

I was born here. I have known about this project for long. I know it is the solar power project. As trees have been felled to implement the project, the villagers find it difficult to seek firewood because of the forest depletion. I am worried that we will have a higher temperature. If the temperature of the area is higher, we all are anxious about whether it will affect the agricultural work of the farmers working near the project. I also want to know if there is any climate change. I want the



company to provide electricity, water and a clinic. And then there should be a meet to share information with locals about the project in detail and explain them if there is any negative impact on the environment.

(7) Name : U Zaw Moe

Age : 40

Occupation : GEP Solar power project

Position : Labourer

Residence : Zee Aing Village, Minbu Township,

Phone Number: 09-259013098

I was born in Zee Aing Village. I have known about this project for 3 years. I am an ordinary staff member. My monthly salary is100,000 kyat. It is good for the local villagers to get jobs because of the implementation of this project. It will be better if our villages are provided with electricity. Because of the project implementation, I think there will not be bad effects on the environment. It is also known that the company is going to assume its CSR activities. I want to ask the company to provide electricity, to complete the unfinished school building, to establish a rural clinic and to give jobs to young people of the village.



11.4 RESULTS OF CONSULTATIONS

- 1. Lay Pin village is closer to the project area and the site is formerly the place where people collected firewood and grew beans and pulses and sesame.
- 2. Three farmland-owners from Lay Pin village were given compensations. U Win Nyunt got 4,200,000 kyats his 5.96 acres of land was included in the project area.
- 3. The company gave U Myint Shwe 2,500,000 kyat for his 2.18 acres of land as compensation.
- 4. The company gave U Thein Han Ks. 2,500,000 kyat for his 4.76 acres of land as compensation.
- 5. Lay Pin Village-tract Administrator said the other two—U Myo Min Oo and Daw Hla Thidar—did not get any compensation as they could not show the evidences of land-ownership.
- 6. The compensated three were not satisfied because they said they were not paid compensation for their land.
- 7. There are only 5 people from Lay Pin village who are working at the project site. The villagers want to be informed more about job vacancies for the project.
- 8. No land of Zee Aing Villagers is included in this project area.
- 9. About 40 villagers from Zee Aing Village are now working with the solar project.
- 10. Although there is a good relationship between Zee Aing Villagers and authorities concerned from the project, Lay Pin village Administrator and the project officials are not on good terms.
- 11. It is found that Lay Pin villagers want to work at the project site but they are not very friendly with the project site personnel.
- 12. A school building of Lay Pin Basic Education Sub-middle School collapsed on 24 August 2016 because of an earthquake. The school children are attending their classes in the make-shift classrooms or under the shade of a tree.
- 13. It is found that the students of Lay Pin Sub-middle School have to buy drinking water from commercial water sellers.
- 14. Lay Pin is the village where there is a scarcity of water and not enough deep tube wells.
- 15. As there is no electricity in either villages, the villagers from both villages have to use their own solar power and battery-powered LED lights as their main sources of energy for lighting.
- 16. This project shall have no impact on the economic life of either villages.
- 17. Some of the villagers are worried if there may be increasing heat in the area of villages because of this project and that intense heat may have the impact on the cultivation of crops.
- 18. All are feeling happy that there will be more job opportunities with the implementation of the project and with its completion.
- 19. Local residents want the company to be more transparent about advertising jobs related to the project. They want the company to put job announcements in their villages—Lay Pin and Zee Aing—which are closest to the project area.
- 20. A representative of the project developer stated that those who meet the job requirements, especially educational qualifications, can be employed at the project.
- 21. Farmers whose land have been taken away by the project want to be compensated for their land in addition to their crops grown.
- 22. Key stakeholders including local authorities, local elders and farmers feel that confiscated land, with or without Form 7, should be compensated.

- 23. A part from those two villages, community members from other small villages such as Min Hla Kyin, Ye'chodwin, Kyaukpe' and Pyawbwe' hope theirs will also be developed because of the project.
- 24. Community members want to have electricity installed, tube wells sunk, and school buildings constructed as part of the developer's CSR activities or as donations to the communities concerned.



12. References

- Forest Dept. (2013). The Report on Finishing of Field Survey Activities at 700-acre Priority Land Site (1) Minbu (Saku) Township where a Solar Power Plant (50 MW) is to be built by AVA Capital Trading Ltd and Green Earth Power Thailand. Forest Department, Minbu Township, Magwe Division.
- 2. Budsabong, K., Saksit, S. and U Tin Than (1998). **Carnivores of Mainland South East Asia.** WWF Thailand Project Office, Paholyothin Rd., Bangkhaen, Bangkok 10220.
- 3. John Parr and U Tin Than (2011). **A guide to large mammals of Myanmar.** WWF Thailand Project Office, Paholyothin Rd., Bangkhaen, Bangkok 10220.
- 4. Turney, D. and Fthenakis, V. (2011). **Environmental Impacts from the installation and operation of Large-scale solar power plants.** Renewable and Sustainable energy Reviews. Journal homepage:www.elsevier.com/locate/rser
- 5. Canter, Larry W. (2010). **Environmental Impact Assessment.** 2nd Edition, London, New York, Toronto.
- 6. McShea, W.J., M. Aung, D. Poszig, C.Wemmer, and S. Monfort. (2001). Forage, Habitat use, and sexual segregation by a tropical deer (*Cervua eldi thamin*) in a dipterocarp forest. Journel of Mammalogy 82:849 858.
- 7. Shirley, G.S. (1955). **Manual of Silviculture**. Printing and Stay., Rangoon, Burma.
- 8. CHHIBBER, H.L. (1934). THE GEOLOGY OF BURMA. MACMILLAN AND CO. LTD., ST. MARTIN'S STREET, LONDON. 1934.
- Department of Geological Engineering (2010), THE GEO-DISASTER MITIGATION MEASURES IN MYANMAR, Department of Geological Engineering, Gadjah Mada University
- 10. UN-Habitat Myanmar, Manual on Earthquake
- 11. Thuya Aung Bo (2016). **Electricity and Rural Electrification Development Plan:** (Status and Directions), Ministry of Electricity and Energy
- 12. NEPS (2015). **HYDROLOGY REPORT FOR PROPOSED MINBU SOLAR POWER PLANT AREA.** National Engineering & Planning Services Co., Ltd. Yangon
- 13. NOVA Asia (2016). **INFORMATION MEMORANDUM: 220 MW (DC) MINBU SOLAR POWER PROJECT.** NOVA Asia Company Limited

Section 13: Appendix

13.1 Soil analytical data sheet

1000	9 20	Parent S	Moisture	pil	ec.		Tes	ture -		Organic	Human.	Total	1400			Exchange	able Cati	ides		Available	Natricet
Se No.	Sample plot	inches	%	123	MONTH.	Sand %	Sit	Clay	Total	Carbon %	%	N %	CEC	Q"	Mg"	Na*	K"	10"	Al***	7	K _i O
1	GEP - 50-1	0-12	1.52	625	0.03	59.35	25.15	1435	98.85	1.20	2.87	0.12	9.08	8.11	0.68	Not detected	9.38	Not detected	Not detected		14,01
2	GEP-50-2	0-10	5.44	7.96	0.09	31.60	38.40	27.20	97.20	3.01	5.18	0.15	29.12	25.34	3.52	Not detected	0.26	Not detected	Not detected	0.83 (0)	12.05
3	GEP - 50-2	10-25	3.79	9.26	0.09	40.50	36,30	21.25	98.05	1		0.15					0.23	1		0.96 (0)	10.60
4	GEP - 5Q-2	25-42	3.25	9.44	0.09	45.90	33.25	19.70	98.85			0.13					0.19			0.39 (0)	8.68
5	GEP-SQ-3	0-10	3.83	6.63	0.30	43.30	23.50	31.40	98.20	2.08	1.58	0.11	21.76	1938	2.06	Not detected	0.31	Not detected	Not detected	0.68 (0)	14.34
	GEP-50-4	0-10	5.05	7.91	0.12	39.20	25.45	33.55	98.20	2.79	4.81	0,13	31.10	26.66	4.21	Not detected	0.23	Not detected	Not detected	1,27 (0)	10.70
7	GEP-5Q-4	10-25	4.75	8,36	0.10	50.60	24.20	22.85	97.65			0.13			1000		0.29			1.46 (0)	13.85
	GEP-5Q-5	0-5	1.91	6.56	0.03	48,15	36.50	12.75	97.40	2.12	3.65	0.16	12.56	19.36	1.36	Not detected	0.34	Not detected	Not detected	0.66 (0)	15.90
	GEP-5Q-5	5-15	2.77	5.49	0.03	51.50	30.50	16.30	98.30	1000		0.11			1000		0.33	1		0.12 (8)	15.43

13.2 Soil interpretation of results

DEPARTMENT OF AGRICULTURE (LAND USE) SOIL INTERPREATATION OF RESULTS

Division - 44076 MSR EIA Co.,Ltd (Minbu Solar Plant Project) Sheet No. 1
Township - 462076 Sr No. S 1-9/15-16

	Sample	Depth in		EC		Organic	Total	one	Availabl	e Nutrients
Sr No.	plot	inches	Sed : Water 1:2.5	Soil: Water Texture		Carbon	N	CEC	P	K ₂ O
1	GEP - SQ-1	0-12	Slightly acid	Very low	Sandy loam	Low	Low	Low	Low	Medium
2	GEP - SQ-2	0-10	Moderately alkaline	Very low	Clay loam	Medium	Low	High	Low	Medium
3	GEP - SQ-2	10-25	Extremely alkaline	Very low	Loam		Low		Low	Medium
4	GEP - SQ-2	25-42	Extremely alkaline	Very low	Loam		Low		Low	Low
5	GEP - SQ-3	0-10	Near Neutral	Low	Clay loam	Medium	Low	Medium	Low	Medium
6	GEP - SQ-4	0-10	Moderately alkaline	Very low	Clay loam	Medium	Low	High	Low	Medium
7	GEP - SQ-4	10-25	Moderately alkaline	Very low	Sady clay loam		Low		Low	Medium
8	GEP - SQ-5	0-5	Slightly acid	Very low	Loam	Medium	Low	Low	Low	Medium
9	GEP - SQ-5	5-15	Moderately acid	Very low	Loam	1.00m	Low		Low	Medium

ောင်ဝင်းဟ လက်ထောက်ညွှန်ကြားရေးမှုး ဆိတ်ခွဲနေတာဝန်ခံ မြောသုံးချရေးဌာနခွဲ

13.3 Soil water extraction analytical data sheet

DEPARTMENT OF AGRICULTURE (LAND USE) SOIL WATER EXTRACTION ANALYTICAL DATA SHEET

Division - υσοχε MSR EIA Co.,Ltd (Minbu Solar Plant Project)
Τονακδήρ - υξειχε

Sheet No. 1 Sr No. S 1-9/15-16

		Depth		ANIONS	ne/190ge			CATION	(Sactifies		12.7	EC	202	RSC	TDS
Sr.no	Sample	in inches	co.3	HCO's	CT	80'4	Ca**	Mg**	Na"	K'	pH	milar	SAR	may1Ngm	56
1	GEP - SQ-1	0-12	Not detected	0.09	0.19	0.12	0.04	Not detected	0.01	0.03	6.25	0.03	0.09	0.05	0.012
2	GEP - SQ-2	0-10	Not detected	0.28	0.15	Not detected	0.33	Not detected	0.003	0.01	7.96	0.09	0.01		0.03
3	GEP - SQ-2	10-25	Not detected	0.46	0.23	0.58	0.4	Not detected	Not detected	0,004	9.26	0.09	Not detected	0.06	0.03
4	GEP - SQ-2	25-42	Not detected	0.41	0.23	0.22	0.33	0.11	Not detected	0.002	9.44	0.09	Not detected	Not detected	0.03
5	GEP - SQ-3	0-10	Not detected	0.09	0.34	0.09	0.11	Not detected	Not detected	0.01	6.63	0.30	Not detected	Not detected	0.11
6	GEP-SQ-4	0-10	Not detected	0.46	0.15	0.14	0.33	0.04	Not detected	0.01	7.91	0.12	Not detected	0.09	0.04
7	GEP - SQ-4	10-25	Not detected	0.46	0.23	0.14	0.33	6,04	0.004	0.01	8.36	0.10	10.0	0.09	0.04
8	GEP - SQ-5	0-5	Not detected	0.14	0.15	0.09	0.15	Not detected	0.01	0.02	6.56	0.03	0.02	Not detected	0.01
9	GEP - SQ-5	5-15	Not detected	0.18	0.27	0.25	0.04	0.04	Not detected	0.02	5.49	0.03	Not detected	0.1	10.0

သင်္ခသေး လက်ထောက်ညှှ နိုင်ငံလည်း ထိုက်ခဲ့သန်သင်္ကသည် မိ

13.4 Soil water extraction interpretation of results

DEPARTMENT OF AGRICULTURE (LAND USE) SOIL WATER EXTRACTION INTERPRETATION OF RESULTS

Division - μεσχε MSR EIA Co.,Ltd (Minbu Solar Plant Project)
Τοwnship - φδεοχε

Sheet No. 1 Sr No.S 1-9/15-16

Sr.no	Sample	Depth in inches	pH	EC	TDS	SAR	RSC	Dorminant Salts
1	GEP - SQ-1	0-12	Slightly acid	Very low	Low	Low	Low	CaCl ₂
2	GEP - SQ-2	0-10	Moderately alkaline	Very low	Low	Low	Not detected	Ca(HCO ₃) ₂
3	GEP - SQ-2	10-25	Extremely alkaline	Very low	Low	Not detected	Low	Ca(SO ₄) ₂
4	GEP - SQ-2	25-42	Extremely alkaline	Very low	Low	Not detected	Not detected	Ca(HCO ₃) ₂
5	GEP - SQ-3	0-10	Near Neutral	Low	Medium	Not detected	Not detected	CaCl ₂
6	GEP - SQ-4	0-10	Moderately alkaline	Very low	Low	Not detected	Low	Ca(HCO ₃) ₂
7	GEP - SQ-4	10-25	Moderately alkaline	Very low	Low	Low	Low	Ca(HCO ₃) ₂
8	GEP - SQ-5	0-5	Slightly acid	Very low	Low	Low	Not detected	CaCl ₂
9	GEP - SQ-5	5-15	Moderately acid	Very low	Low	Not detected	Low	CaCl ₂ , MgCl



13.5 Soil test 1

The Government of the Republic of the Union of Myanmar Ministry of Agriculture, Livestock and Irrigation Department of Agriculture Plant Protection Division Pesticide Analytical Laboratory

e-mail: ppmas.moai @mptmail.net.mm

Tel : 640344, 644214, 644213,

Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS HM -304 / 2016

Description of consignments / lot : Soil Sample (No.1 Top Soil 0 –12 ")
Name of owner and address : Myanmar Survey Research Company Limited.

Original of sample : Minbu Township

Designation of Sample : Soil Sample (No.1 Top Soil 0 –12 ")

Laboratory registration No : HM- 304 / 2016

The sample was taken by : Myanmar Survey Research Company Limited.

Date of sampling : 20-9-2016
Place of Sampling : Minbu Township
Date of analysis : 6-10-2016

Remarks on the condition of the sample : Sample is packed in Plastic Bag.

RESULTS

Herewith it is certified that the heavy metal content in the sample commodity (based on the samples submitted by Myanmar Survey Research Company Limited.) are as follow;

Heavy Metal Contaminants	Laboratory Finding (ppm)	Maximum Permitted Level (ppm)
Lead (Pb)	11.15	85
Arsenic (As)	ND	29
Cadmium (Cd)	ND	0.8

NB: The results are valid only for the quantities the sample represented.

Date: 6- 10- 2016 Note: ND – Not Detected ppm: parts per million

(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

(Assistant Director)
Head of Laboratory
Pesticide Analytical Laboratoy
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

^{*}Source of reference standard: FAO Soil Bulletin 65 & guidelines used in Netherland.

13.6 Soil test 2

The Government of the Republic of the Union of Myanmar Ministry of Agriculture, Livestock and Irrigation Department of Agriculture Plant Protection Division Pesticide Analytical Laboratory

e-mail : ppmas.moai @mptmail.net.mm

Tel : 640344, 644214, 644213,

Fax : 95-1-644019

CERTIFICATE OF HEAVY METAL ANALYSIS HM -305/2016

Description of consignments / lot Name of owner and address

: Soil Sample (No.2 Top Soil 0 –12") : Myanmar Survey Research Company Limited.

Original of sample

: Minbu Township

Designation of Sample Laboratory registration No

: Soil Sample (No.2 Top Soil 0-12")

The sample was taken by

: HM- 305 / 2016 : Myanmar Survey Research Company Limited.

Date of sampling Place of Sampling

: 20-9-2016 : Minbu Township : 6-10-2016

Date of analysis
Remarks on the condition of the sample

: Sample is packed in Plastic Bag.

RESULTS:

Herewith it is certified that the heavy metal content in the sample commodity (based on the samples submitted by Myanmar Survey Research Company Limited.) are as follow;

Heavy Metal Contaminants	Laboratory Finding (ppm)	Maximum Permitted Level (ppm)
Lead (Pb)	4.65	85
Arsenic (As)	ND	29
Cadmium (Cd)	ND	0.8

NB: The results are valid only for the quantities the sample represented.

Date: 6-10- 2016 Note: ND – Not Detected ppm: parts per million

(Analytical Chemist)
Pesticide Analytical Laboratory
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

(Assistant Director)
Head of Laboratory
Pesticide Analytical Laboratoy
Plant Protection Division
Department of Agriculture
Yangon, Myanmar

^{*}Source of reference standard: FAO Soil Bulletin 65 & guidelines used in Netherland.

13.7 Air lab test 1



No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Sample Name:	41-	Received Date:	8.2.2016		
	Air	Reported Date:	8.2.2016		
Address:	Minbu solar plant project ၊ မတွေးတိုင်းဒေသကြီး၊ မင်းဘူးမြို့။				

Air					
Site Name / Time and Date to start	PM ₁₀ (24 Hr) µg/m ³	PM _{2.5} (24 Hr) µg/m ³	NO ₂ (1 Hr) µg/m ³	SO ₂ (24 Hr)	
ବୁର୍ତ୍ତିକ୍ତର୍ଭିକ୍ତେ (6.2.2016) 3:59 Hrs (6.2.2016) 3:59 Hrs	93,772	64.489	60.812	375.582	

Instruments Hazscanner

Reference

PM₁₀ (24 Hr) Value

 $\mu g/m^3$ 50 25 $\mu g/m^3$ PM₂₅ (24 Hr) NO₂ (1 Hr) 200 μg/m³ SO₂ (24 Hr) $\mu g/m^3$ 20

Signed by

Dr.Kyi Lwin Oo **Deputy Diretor**

Occupational and Environmental Health Division

G40/ID/EPA5_project /Minbu solar plant project (6-2-2016)

13.8 Air lab test 2



No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Sample Name:	A1-	Received Date:	8.2.2016		
	Air	Reported Date: 8.2.2016			
Address:	Minbu solar plant project ၊ မကွေးတိုင်းခေသကြီး၊ မင်းဘူးမြို့။				

Air		
Site Name / Time and Date to start	HC ppm	CH ₄
ရှင်လင်းဆောင်ရေ (6.2.2016) 3:59 Hrs to (7.2.2016) 3:59 Hrs	0	21060.7

Instruments

Hazscanner

Signed by

Dr.Kyi Lwin Oo Deputy Dirctor

Occupational and Environmental Health

Division

G40/0/FPA5_project /Minbo solor plant project (6-2-2016)

13.9 Air lab test 3

Occupational and Environmental Health Laboratory

No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Address:	Minbu solar plant project ၊ မကွေးတိုင်းဒေသကြီး၊ မင်းဘူးမြို့။			
Sample Name:	Air	Reported Date:	8.2.2016	
Comple Name	**-	Received Date:	8.2.2016	

Air				
Site Name / Time and Date to start	CO (1 Hr)	O ₃ (8 Hr) µg/m ²	VOCS(1 Hr)	
ရှင်လက်ဆောင်ရေ (6.2.2016) 3.59 Hrs to (7.2.2016) 3.59 Hrs	145.838	1567.706	133.936	

Hazscanner

Reference

CO (1Hr)

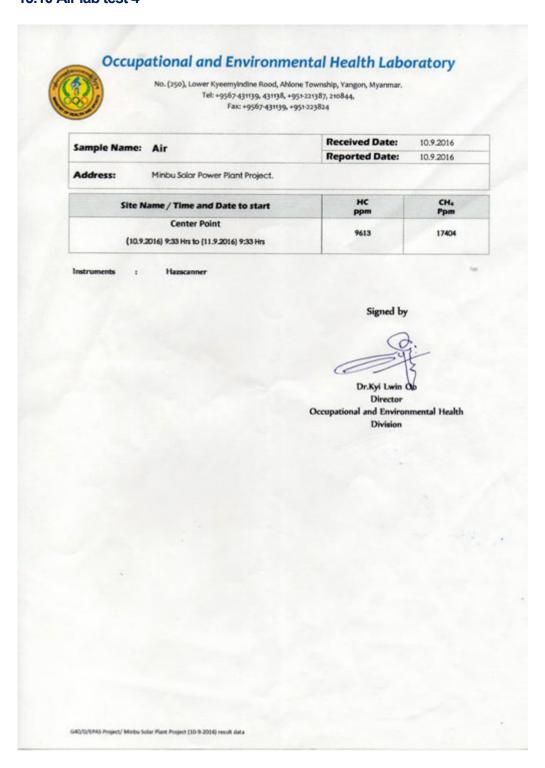
30000 μg/m³ $\mu g/m^3$ O₃ (8Hr) 100 VOCS (1Hr) μg/m³ 400

Signed by

Dr.Kyi Lwin Oo **Deputy Dirctor** Occupational and Environmental Health Division

G40/D/EPAS_project /Minbu solar plant project (G-2-2016)

13.10 Air lab test 4



13.11 Air lab test 5

Occupational and Environmental Health Laboratory

No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Sample Name:	Air	Received Date:	
Jampie Hame. A	A"	Reported Date:	10.9.2016
Address:	Minbu Solar Power Plant Project		

Site Name / Time and Date to start	PM ₁₀ (24 Hr) µg/m ³	PM _{2.5} (24 Hr) µg/m ³	NO ₂ (1 Hr) µg/m³	SO ₂ (24 Hr) µg/m ³
Center Point				
(10.9.2016) 9:33 Hrs to (11.9.2016) 9:33 Hrs	24	35.4	11953	865.7

mace dimensa		T Taxascarinings		
Reference				
Value		PM10 (24 Hr)	50	µg/m³
	1	PM2.5 (24 Hr)	25	pg/m³
		NO2 (I Hr)	200	µg/m³
		SO2 (24 Hr)	20	mer/m ³

Signed by

Director
Occupational and Environmental Health
Division

G4Q/D/TPAS Project/ Minbu Solar Plant Project (10-9-2016) result data

13.12 Air lab test 6



13.13 Drinking water lab test



Occupational And Environmental Health Laboratory

No.(250/A), Lower Kyeemyindine Road, Ahlone Township, Yangon, Myanmar. Tel:+9567-431139, 431138, +951-221387, 210844 Fax:+9567-431139, +951-223824

	Ref:	10 2000	R	lesult	
Analyte	Value	Unit	အဝီဓိတွင်း	လက်ထက်တွင်း	Method
Color	15	TCU	1	1	Spectrophotometer
Turbidity	5	NTU	0.1	0.1	Spectrophotometer
Arsenic	50	ppb	12	0	Atomic Absorption Spectrophotometer (Graphite Furnace Method)
Copper	2	ppm	0	0	Spectrophotometer
COD	200	ppm	0	2	Standard Method of Waste Water Analysis
Dissolved Oxygen	11	ppm	3.8	4.6	Standard Method of Waste Water Analysis
Electro Conductivity	1500	μmhos/cm	640	980	Standard Method of Waste Water Analysis
Phenol	1	ppm	0	0	Spectrophotometer
Zinc	3	ppm	0	0	Spectrophotometer
Magnesium	150	ppm	35	37	Spectrophotometer
Mercury	0.01	ppm	0	0	Trace; O Metalizer
Phosphate	0-70	ppm	0	0	Spectrophotometer
Fluoride	1.5	ppm	0.16	0.17	Spectrophotometer
Lead	10	ppb	0	0.4	Atomic Absorption Spectrophotomete (Graphite Furnace Method)
Nitrate	50	ppm	0	0	Spectrophotometer
Manganese	0.4	ppm	0.008	0.007	Spectrophotometer
Chloride	250	ppm	4	4	Spectrophotometer
Hardness	500	ppm as CaCO ₃	212	290	Spectrophotometer
Iron	1	ppm	0	0.3	Spectrophotometer
Oil & Grease	10	ppm	3.27	1.27	Standard Method of Waste Water Analysis
рН	6.5 - 8.5		7.9	7.4	pH meter
Sulphate	250	ppm	2	138	Spectrophotometer
Total Dissolved Solid	1000	ppm	310	410	Spectrophotometer
Chlorine (Residual)	4	ppm	0	0	Spectrophotometer

Tested by

Checked by

Dr. Kyi Lwin Oo

OH (Lab)
Daw Ohnmar Ha
MLT(1)

Laboratory Officer

Deputy Director
Occupational and Environmental Health Division

C-6/D/KTDL(2015)/Lab Result(2015)

13.14 Groundwater lab test 1



Occupational and Environmental Health Laboratory

No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Address:	Minbu Solar Power Plant Project.		
Site Name:	(510)		
		0138/2016	
Sample Name:	Surface water / Ground water	Reported Date:	22-9-2016
		Received Date:	10-9-2016

Analyte	Ref: Value	Unit	Result	Method
Arsenic	50	ppb	0	Atomic Absorption Spectrophotometer
Chloride	250	ppm	4.7	Spectrophotometer
Chlorine (Residual)	4	ppm	0.23	Spectrophotometer
Color	15	TCU	20	Spectrophotometer
Copper	2	ppm	0.17	Spectrophotometer
Dissolved Oxygen	11	ppm	6	Standard Method of Waste Water Analysis
Electro Conductivity	1500	μmhos/cm	100	Standard Method of Waste Water Analysis
Fluoride	1.5	ppm	0	Spectrophotometer
Hardness	500	ppm as CaCO ₃	73	Spectrophotometer
Iron	1	ppm	5.0	Spectrophotometer
Lead	10	ppb	0	Atomic Absorption Spectrophotometer
Nitrate	50	ppm	23	Spectrophotometer
Manganese	0.4	ppm	0.26	Spectrophotometer
Magnesium	150	ppm	15	Spectrophotometer
Mercury	1	ppb	0	Inductively Couple Plasma-Optical Emission Spectroscopy
Oil & Grease	10	ppm	6.42	Standard Method of Waste Water Analysis
Phenol	1	ppm	0.85	Spectrophotometer
pH	6.5 - 8.5		7.6	pH meter
Sulphate	250	ppm	25	Spectrophotometer
Total Dissolved Solid	1000	ppm	50	Spectrophotometer
Turbidity	5	NTU	5	Spectrophotometer
Zinc	3	ppm	4.3	Spectrophotometer

Tested by

OH (Lab)

Checked by

Laboratory Officer

Dr. Kyi Lwin Oo Director Occupational and Environmental Health

Division

Signed by

G40/0/Lab result/Minbu Solar Power Plant Project (10-9-2016)

13.15 Groundwater lab test 2



Occupational and Environmental Health Laboratory

No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431136, +951-221387, 210844, Fax: +9567-431139, +951-223824

		Received Date: 10-9-2016				
	Surface water / Ground water	Reported Date:	22-9-2016			
		Reg no:	0135/2016			
Site Name:	(S2)					
Address:	Minbu Solar Power Plant Project.					

Analyte	Ref: Value	Unit	Result	Method			
Arsenic	50	ppb	1.174	Atomic Absorption Spectrophotometer			
Chloride	250	ppm	6.7	Spectrophotometer			
Chlorine (Residual)	4	ppm	0.54	Spectrophotometer			
Color	15	TCU	5	Spectrophotometer			
Copper	2	ppm	0.01	Spectrophotometer			
Dissolved Oxygen	11	ppm	7	Standard Method of Waste Water Analysis			
Electro Conductivity	1500	μmhos/cm	720	Standard Method of Waste Water Analysis			
Fluoride	1.5	ppm	0.82	Spectrophotometer			
Hardness	500	ppm as CaCO ₃	276	. Spectrophotometer			
Iron	1	ppm	0.6	Spectrophotometer			
Lead	10	ppb	0	Atomic Absorption Spectrophotometer			
Nitrate	50	ppm	5	Spectrophotometer			
Manganese	0.4	ppm	1.09	Spectrophotometer			
Magnesium	150	ppm	128	Spectrophotometer			
Mercury	1	ppb	0	Inductively Couple Plasma-Optical Emission Spectroscopy			
Oil & Grease	10	ppm	4.73	Standard Method of Waste Water Analysis			
Phenol	1	ppm	0.41	Spectrophotometer			
pH	6.5 - 8.5	-	7.1	pH meter			
Sulphate	250	ppm	2	Spectrophotometer			
Total Dissolved Solid	1000	ppm	410	Spectrophotometer			
Turbidity	5	NTU	1	Spectrophotometer			
Zinc	3	ppm	0.09	Spectrophotometer			

Tested by

Checked by

OH (Lab)

Laboratory Officer

Dr. Kyi Lwin Oo Director

Occupational and Environmental Health Division

Signed by

G40/D/Lab result/Minbu Solar Power Plant Project (10-9-2016)

13.16 Groundwater lab test 3



Occupational and Environmental Health Laboratory

No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Site Name:		Received Date:	10-9-2016
Sample Name:	Surface water / Ground water	Reported Date:	22-9-2016
		Reg no:	0137/2016
Site Name:	(57)		
Address:	Minbu Solar Power Plant Project.		

Analyte	Ref: Value	Unit	Result	Method
Arsenic	50	ppb	0	Atomic Absorption Spectrophotometer
Chloride	250	ppm	0.2	Spectrophotometer
Chlorine (Residual)	4	ppm	0.02	Spectrophotometer
Color	15	TCU	1	Spectrophotometer
Copper	2	ppm	0.07	Spectrophotometer
Dissolved Oxygen	11	ppm	7	Standard Method of Waste Water Analysis
Electro Conductivity	1500	μmhos/cm	320	Standard Method of Waste Water Analysis
Fluoride	1.5	ppm	0.09	Spectrophotometer
Hardness	500	ppm as CaCO ₃	138	Spectrophotometer
Iron	1	ppm	0.3	Spectrophotometer
Lead	10	ppb	0	Atomic Absorption Spectrophotometer
Nitrate	50	ppm	4	Spectrophotometer
Manganese	0.4	ppm	0.08	Spectrophotometer
Magnesium	150	ppm	86	Spectrophotometer
Mercury	1	ppb	0	Inductively Couple Plasma-Optical Emission Spectroscopy
Oil & Grease	10	ppm	7.75	Standard Method of Waste Water Analysis
Phenol	1	ppm	0	Spectrophotometer
pH	6.5 - 8.5	-	7.4	pH meter
Sulphate	250	ppm	2	Spectrophotometer
Total Dissolved Solid	1000	ppm	150	Spectrophotometer
Turbidity	5	NTU	1	Spectrophotometer
Zinc	3	ppm	0 .	Spectrophotometer

Tested by

Checked by

Signed by

OH (Lab)

Laboratory Officer

Dr. Kyi Lwin Oo Director Occupational and Environmental Health Division

G40/D/Lab result/Minbu Solar Power Plant Project (10-9-2016)

13.17 Groundwater lab test 4



Occupational and Environmental Health Laboratory

No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Address:	Minbu Solar Power Plant Project.		
Site Name:	(53)		
		Reg no:	0136/2016
Site Name:	Surface water / Ground water	Reported Date:	22-9-2016
		Received Date:	10-9-2016

Analyte	Ref: Value	Unit	Result	Method
Arsenic	50	ppb	0	Atomic Absorption Spectrophotometer
Chloride	250	ppm	1.6	Spectrophotometer
Chlorine (Residual)	4	ppm	0.06	Spectrophotometer
Color	15	TCU	10	Spectrophotometer
Copper	2	ppm	0.04	Spectrophotometer
Dissolved Oxygen	11	ppm	8	Standard Method of Waste Water Analysis
Electro Conductivity	1500	μmhos/cm	510	Standard Method of Waste Water Analysis
Fluoride	1.5	ppm	0	Spectrophotometer
Hardness	500	ppm as CaCO ₃	259	Spectrophotometer
Iron	1	ppm	1.1	Spectrophotometer
Lead	10	ppb	0	Atomic Absorption Spectrophotometer
Nitrate	50	ppm	8	Spectrophotometer
Manganese	0.4	ppm	0.11	Spectrophotometer
Magnesium	150	ppm	84	Spectrophotometer
Mercury	1	ppb	0	Inductively Couple Plasma-Optical Emission Spectroscopy
Oil & Grease	10	ppm	8.32	Standard Method of Waste Water Analysis
Phenol	1	ppm	0	Spectrophotometer
pH	6.5 - 8.5		7.3	pH meter
Sulphate	250	ppm	7	Spectrophotometer
Total Dissolved Solid	1000	ppm	260	Spectrophotometer
Turbidity	5	NTU	1	Spectrophotometer
Zinc	3	ppm	0	Spectrophotometer

Tested by

Checked by

Laboratory Officer

Signed by

Dr. Kyi Lwin Oo Director

Occupational and Environmental Health Division

G40/D/Lab result/Minbu Solar Power Plant Project (10-9-2016

13.18 Sound test



No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

		Received Date:	8.2,2016
Sample Name:	Sound	Reported Date:	8.2.2016
Address:	Minbu solar plant project i e	တွေးတိုင်းဒေသကြီး၊ မင်းဘူးမြို့၊	

		L _{eq} in dBA	L _{max} in dBA			
Site Name / Time and Date to start	Day	Night	Total	Day	Night	Total
ရှင်လင်းတောင်ရေ့ (6.2.2016) 4:00cm to (7.2.2016) 3:00pm	53.322	35.203	51.320	32.789	25.460	30.249

Signed by

Dr.Kyi Lwin Oo Deputy Dirctor Occupational and Environmental Health Division

G40/0/FPA5_project /Minbu solar plant project (6-2-2016)

13.19 Noise test





No. (250), Lower Kyeemyindine Rood, Ahlone Township, Yangon, Myanmar. Tel: +9567-431139, 431138, +951-221387, 210844, Fax: +9567-431139, +951-223824

Sample Name:	Noise	Received Date:	10.9.2016		
Jumple Hume.	HOISE	Reported Date: 10.9.2016			
Address:	Minbu Solar Power Plant Project.				

Quality of Ambient noise by sample	sites						
Site Name / Time and Date to start	-	Leq in dBA	1	L _{max} in dBA			
site Name / Time and Date to start	Day	Night	Total	Day	Night	Total	
Center Point (10.9.2016) 9:33 Hrs to (11.9.2016) 9:33 Hrs	37.4	32	36.1	22.3	22.2	22.2	

Signed by

Dr.Kyi Lwin Oli Director Occupational and Environmental Health Division

G40/D/EPAS Project/ Minbu Solar Plant Project (\$0-9-2016) result data

13.20 Earthquake data



DEPARTMENT OF METEOROLOGY AND HYDROLOGY (DMH)
NATIONAL EARTHQUAKE DATA CENTER (NEDC)
REGION AND DIVISION
EARTHQUAKE CATALOG
MAGWAY REGION(2013-2016)

No.			Date/Ti	ime(UTC)			Eni	enter	-	-				
_	Date	Month	Year	Hours	Minute	Second		and the last owner when th	N	lagnit	ude S	cale (M)	
1	3	4	2013		-	Second	Latitute (N)	Longitude (E)	<4.0	<5.0	66.0	770	<8.0	Class
2	3	-	-	12	35	48	19.31	95.56					10.0	
3	- 3	4	2013	23	30	23	19.32		-		5.5			Moderate
-	4	4	2013	15	17	36		95.77		4.7				Slight
4	11	4	2013	3	47	30	19.36	95.67			5.4			Moderate
5	8	8	2013		-	4	19.35	95.7			5.5	-		
6	22	- 3		- 0	0	26	20.565	94.091		40	3.3	-	-	Moderate
7		3	2014	8	35	35	21.91		-	4.9				Slight
-	17	11	2014	4	34	20		94.28		4.3				Slight
8							20.78	94.32			5.4			Moderate
9	7	3	2016		2015	No earthqu	lake events rec	orded in Magway	region	nl				Moderate
10	27			3	14	27	20.74	94.74	T		-	-	-	
_	-21		2016	4	20	53	21.48		-	4.8	-			Slight
1	1	. 8	2016	10	1	8		94.53		4.9				Slight
2	24	8	2016	10	24	-	21.29	94.92	1		5.3		-	
-				101	34	55	20.9	94.63				5.0	-	Moderate
										-1		6.8		Strong

^{* 2016} earthquake events recorded in Magway region is only until August.

Hia Saw
Deputy Director
National Farthquake Data Center(NEDC)
Nay Pyi Taw

13.21 Department of Meteorology and Hydrology Data 1

2016 0.6 0.8 0.7 0.9 1.2 1.2 1.2 1.2



STATION: MINBU

23.20.46

			MONTH	CT MIC	The AAILED	SPEED	(mpn) a	1 [06:30]	nrs m.s.	1		_
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	0.9	1.0	0.8	0.8	0.9	0.8	1.1	1.0	1.0	0.3	0.4	1.0
2015	0.8	0.9	1.0	0.7	0.9	1.2	1.0	1.0	0.9	0.7	0.2	0.5

MONTHLY MEAN WIND SPEED(mph) at (09:30)hrs M.S.T YEAR JAN FEB MAR APR MAY JUN JUL AUG SEP ОСТ NOV DEC 2013 1.1 1.2 1.3 1.2 1.3 1.2 0.9 8.0 0.9 1.1 1.0 1.2 1.2 1.2 1.1 2015 1.2 1.1 1.1 1.0 1.2 1.1 1.1 2016 1.1 1.3 1.2 1.2 1.3 1.2 1.2 1.2

MONTHLY MEAN WIND SPEED(mph) at (12:30)hrs M.S.T YEAR JAN FEB MAR MAY JUN JUL APR AUG SEP OCT NOV DEC 1.2 1.2 1.2 2013 1.2 1.3 1.2 1.2 1.2 1.0 1.0 1.0 1.0 2015 1.1 1.2 1.2 1.2 1.1 1.2 1.1 1.2 1.2 1.3 1.2 1.2 1.2 1.2 1.2 2016 1.2 1.2 1.2 1.2 1.2

			MONTH	LY ME	AN WINE	SPEED	(mph) a	t (18:30)	hrs M.S.	T		
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	1.0	0.7	1.4	1.2	1.5	1.1	1.0	1.2	1.0	0.9	0.3	0.5
2015	0.3	0.8	1.0	1.4	1.4	1.0	0.5	0.7	0.6	0.5	0.4	0.2
2016	0.4	0.8	0.8	1.3	1.2	0.8	0.8	0.8				



13.22 Department of Meteorology and Hydrology Data 2



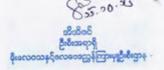
STATION : MINBU

2000				MONTH	LY WIN	D DIREC	TION A	T (06:30)	hrs M.S	.T		
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	SE	SE	SE	NW	NW	NE	NW	NW	NW	NE	SE	SE
2015	SE	SE	SE	NE	NE	. NE	NW	N	NE	SE	SE	SE
2016	SE	E	w	E	NE	NE	NE	NE				

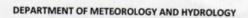
				MONTH	LY WIN	D DIREC	TION A	T (09:30)	hrs M.S	I		
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	SE	SE	SE	SE	NE	N	NE	NW	NE	NE	SE	SE
2015	SE	SE	SE	NE	NE	NE	NW	NW	NE	SE	SE	SE
2016	SE	SE	SE	NE	NW	NW	NE	NW				11

MONTHLY WIND DIRECTION AT (12:30)hrs M.S.T YEAR JAN FEB MAR MAY JUN JUL AUG SEP ОСТ NOV DEC 2013 SE SE SE SE NE NE NE NE NE E SE SE SE NE NE NW NE NE SE SE 2016 SE SE NE NE

				MONTH	LY ME	AN WINE	DIREC	TION at	(18:30)h	rs M.S.T		
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	NW	SE	NW	w	SE	E	SE	NE	NE	SE	E	SE
2015	SE	SE	SE	SE	NE	NE	NW	NE	NE	E	SE	SE
2016	SE	SE	SE	NW	NW	NW	NE	NE				



13.23 Department of Meteorology and Hydrology Data 3



STATION: MINBU

MONTHLY RAINFALL (mm)

				MONT	LT KAI	NEALL	mm)					
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ОСТ	NOV	DEC
2013	0	0	0	7	51	114	105	95	223	272	0	4
2015	58	0	0	0	56	113	304	140	105	226	0	4
2016	0	0	0	0	61	240	221	132				

1mm=0.04inch

MONTHLY MEAN MAXIMUM TEMPERATURE (°C)

								24				
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	29.7	36.6	40.1	41.9	37.2	34.7	33.1	32.5	33.1	31.5	31.6	25.9
2015	28.8	34.1	39.5	40.7	40.2	35.9	31.8	33.7	34.0	32.4	31.3	26.7
2016	27.2	34.8	36.7	42.2	37.7	32.9	31.8	32.5				

MONTHLY MEAN MINIMUM TEMPERATURE (°C)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC
2013	13.1	18.0	21.0	23.0	22.3	23.0	23.1	24.6	25.2	23.5	20.8	15.4
2015	14.2	12.5	17.0	21.0	24.0	23.4	22.8	22.5	22.3	19.6	17.4	12.2
2016	9.5	14.0	18.1	21.3	20.7	19.2	20.7	20.9				



13.24 Ecology Laboratory Result Document 1



ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း **Ecological Laboratory**



စိမ်းလန်းအစီရဖြစ် ဖြိုးတိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

Reference Number/ 0030405: EL-R / 662

Date / 040: 18 January, 2016

Laboratory Analysis Report / පාරේලි චර්ගෙකු පාර්යාදේර්ග

စို့သူအမည် Name of Sender:

နမူနာအမည် Sample Name: ပင်းဘုစ စီးဆိုင်ရွာ (အဝိဗ်တွင်းစရ)

နမူနာ အမှတ်စဉ် Sample I.D. 01264

ရွှေကျန်ကြီး တောက်လုပ်ရေး

c8δeo Address: 09421163612

နမူနာ ရောက်ရှိသည့် အရိန်

ಕಿಗಿಕು ಕಿಗೆಯನ್ನು ಆಕ್ಸೆ

နမူနာ စရာက်ရှိသည့် စနဲ့ခွဲ

1:30 pm

(This laboratory analysis report is based solely on the sample sub-(ကြားတို့စစ်တေးမှုအစီရှင်စံတသည် စယုံသူမှုနီတောင်ခဲ့သည့်နှုနှုနားကိုသာအခြေစံတားဆောည်။)

Test Results obioxobarob soolo

eδ Sr.	သည်သသွေး Quality	cooquogró Quantity	နည်းလဉ် Method	écoobyologoli Orinking Standard	gijoq čeji: Effluent Standard	yoʻsqrif Remarks
0	950408fz (pH)	7.8	pH meters	6.5 - 8.5	5.5 - 9.0	Normal
J	തരെ താുന് (Hardness)	137.64 mg/L	EDTA Titration Method (volumetric analysis)	<60 mg/L		Hard
9	ကလိုရိုစ် (Chloride)	37.86 mg/L	Mohr's method (volumetric analysis)	<250 mg/L	id talke gradual	Normal
9	လွှစ်စီးဘိန်း (Conductivity)	0.6 mS/cm	Consort Multi-parameters Conductivity meter	<2.5 mS/cm		Normal
9	စိန်တတ် (Arsenic)	0 mg/L	Lovibond Arsenic test kit code.no -400700	<0.01 mg/L	<0.2mg/L	Normal
	ອຊາກກິກຊີພູ (Turbidity)	39 FAU	Lovibond SpectroDirect Method No. 385	<10 FAU		Turbid
9	rnchaරීගරි (Cadmlum)	<0.01 mg/L	AAS, Shimadzu AA-6200 Cd (228.8 nm)	< 0.005 mg/L		
	ကြေးနီ သတ္တုဓာတ် (Copper)	0.01 mg/L	AAS, Shimadzu AA-6200 Cu (324.8 nm)	< 2 mg/L	an Auto de chair S. may	Normal
e	သံ သတ္တုဓာတ် (Iron)	<0.1 mg/L	AAS, Shimadzu AA-6200 Pb (248.3 nm)	<0.2 mg/L	< 3 mg/L	Normal
00	ම ගනුමරා (Lead)	<0.4 mg/L	AAS, Shimadzu AA-6200 Pb (283.3 nm)	< 0.01 mg/L	< 0.1 mg/L	(b) SUMS pri
00	အိန် သတ္တုဓာတ် (Aluminium)	0.01 mg/l	Lovibond SpectroDirect Method No. 40	<0.2 mg/L	STEROST VINE NO	Normal
ဈ	දිගාෆ්ර්යාර් (Potassium)	4.2 mg/L	Lovibond SpectroDirect Method No. 340	<20 mg/L		Normal
90	နိုက်ထြံတိ (Nitrite)	<0.01 mg/L	Lovibond SpectroDirect Method No. 270	<0.5 mg/L		Normal
09	သွပ် သတ္တုမိတ် (Zinc)	0.21 mg/L	Lovibond SpectroDirect Method I lo. 400	< 3 mg/L	<5	Normal
29	မဂ္ဂနီစ် (Manganese)	<0.2 mg/L	Lovibond SpectroDirect Method No. 240	<0.5 mg/L	<2 mg/L	Normal

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13.25 Ecology Laboratory Result Document 2

Explanations

pH ª

The pH of drinking water should be between 6.5 and 8.5.

28 330 (VARIORE 82

Ship Strafffene seus

Classification	Hardness in mg/L
Soft	0-60
Moderately hard	61-120
Hard	121-180
Very hard	≥ 181

District Report and State of the

Date State State Colors

Turbidity t

Maximum allowable limit for turbidity is 10 FAU (FAU=NTU) and desirable limit is 5.

Arsenic *

Arsenic standard for drinking water at 0.010 parts per million (10 parts per billion = 10 ppb) to protect consumers served by public water systems from the effects of long-term, chronic exposure to arsenic. 13 255 25

Aluminium a

Legal limit for drinking water of WHO is 0.2 ppm aluminum.

Potassium ^c

Legal limit for drinking water is 20 mg/L

Iron b

Drinking water may not contain more than 200 ppb = 0.2 mg/L of iron.

A BESSELL

Nitrite b

Recommended limit is 0.5 mg/L

Chloride a

The SMCL (suggested maximum contaminant level) for chloride is 250 mg/L which is due strictly to the objectionable salty taste produced in drinking water.

The WHO standard of zinc in drinking water is 3 mg/L.

Lead ab

The WHO standard limit for Lead in drinking water is less than 0.01 mg/L. US FDA standard limit of Lead in foods is less than 23 ppb.

a WHO Standard for Drinking Water (1993)

d USGS Water-Quality Information

h Ell Chandard for Drinking Water

e Michigan Water Quality Standards(Rule 64)

DODGE STATES TANGET Herbreit Verslands (Bassler) Said Stabulgers

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Description (C)

part Collection Great 11, 1, 2, 2016

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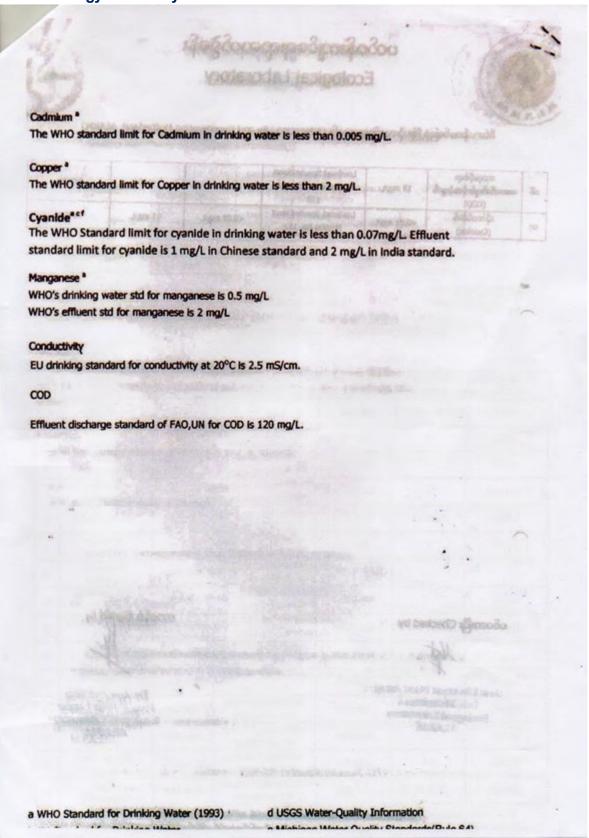
-commentation

13.26 Ecology Laboratory Result Document 3 ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း **Ecological Laboratory** စိမ်းလန်းအစီမြော့် မြီးတိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM) ဓာတုဆိုင်ရာ Lovibond SpectroDirect က်ထီဂျင်လိုအပ်ရက် Method No. 130, 131, <120 (CCCD) 132 ထိုင်ယမ်နိက် Lovibond SpectroDirect <0.01 mg/L <0.07 mg/L <1 mg/L with a develop against the marganess to be Administration and the sandon of the sandon CONSUMBRRY E photons Us စစ်ဆေးပြီး Checked by တာဝန်စံ Signed by Daw Lin Myat Myat Aung Lab. Technician I Dr. Aye Aye Win **Ecological Laboratory** Project Team Leader Ecological Laboratory ALARM ALARM

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ကာ ကာကာကိုတက်သည်။ လာတစ်စစ်အတွင် အမြောက်အမဟုပ်ရှိ တစ်စိတ်တစ်စို့ ဖြတ်လာလုပ်ချိတ်။ စိတ္တနာရှင်း ပြောလုပ်ရန်)

13.27 Ecology Laboratory Result Document 4



13.28 Ecology Laboratory Result Tube Well 2 Document 1



ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း Tube Weld (2) Ecological Laboratory

စိမ်းလန်းအမိမြေ၌ မြီးတိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

Reference Number/ တအမှတ်: EL-R / 0876

Date / G&Q: 6 May, 2016

Laboratory Analysis Report /တတ်ခွဲစစ်ဆေးမှုအစီအရင်စံတ

Sample Profiles psopoo6

နမူနာအမည် /Sample Name	အဝီစီတွင်းစရ	φφρασφοδ/ Sample ID	16	47
နေရာ (ရှို့နယ်) Location (Township)	မင်းဘူခြေ့နယ်၊ ဇီးအိုင်ရွာ	လတ္တီတွစ် Latitude		
နေရာ (တိုင်း/ပြည်နယ်) Location (Division/State)	မကွေးတိုင်း	လောင်ဂျီတွစ် Longitude		
ပေးပို့သူအမည် Sender Name	ရွှေကျွန်းကြီး ဆောက်လုပ်ရေး	နမူနာတောက်ယူရိန် (နေ့ နာရီ)	22 4 2016	
အခွဲအစည်းOrganisation		Sampling Time (Date, Time)	23.4.2016	
ဆက်သွယ်ရန် Contact	09421163612	နှပူနာစရာက်ရှိရှိန် (ဝနှ၊ နာရီ) Arriving Time (Date, Time)	26.4.2016	4:30 pm

(This laboratory analysis report is based solely on the sample submitted by the customer) (ဤဘတ်ခွဲစစ်ဆေးမှုအစီရင်စံစာသည် ပေးပို့သူမှုပို့ဆောင်ခဲ့သည့်နှမှုနာကိုသာအခြေခံထားပါသည်။)

Analysis Results စစ်းသစ်ချက်အခြေ

οδ Sr.	အရည်အလွေးညွှန်းကိန်း Quality Parameter	qrosss	a@Results	අණුවේ Method	စ်သတ်မှတ်ရက် Drinking Standard	စွန့်ဝရစ်နှန်း Effluent Standard	မှတ်ချက် Remarks
0	ရဉ်ဝန်ကိန်း (pH)	1	7.9	pH meters	6.5 - 8.5	6.0 - 9.0*	Normal
J	ဝနာက်ကိုမှ (Turbidity)	< 5	FAU	LovibondSpectroDirect Method No. 385	≤10 FAU	NG	Clear
9	ပျော်ဝင်အနည်များ (Total dissolved solids)	~	mg/L	Consort Multi-parameters Conductivity meter	NG	≤2000 mg/i *	-
9	ဆိုင်းကြွအနယ် (TSS)	~	mg/L	Oven-drying method	NG	≤50 mg/L *	
9	လျှစ်စီကောိန်း (Conductivity)	0.3	mS/cm	Consort Multi-parameters Conductivity meter	≤2.5 mS/cm	NG	Normal
1	အမေးအသွက် (Hardness)	82.93	mg/L	EDTA Titration Method (volumetric analysis)	≤60 mg/L	NG	
	အမေးအသွက် (Hardness)	~	mg/L	LovibondSpectroDirect Method No. 200	≤60 mg/L	NG	Moderately Hard
9	සෞාෆික්දැරි දෙරිරර්මු (Dissolved Oxygen)	~	mg/L	Jenway Dissolved Oxygen Meter (Model 970)	≥ 3 mg/L	NG	
•	စီဝဆိုင်ရာအောက်ဆီခွင်းပိုအပ်ခွက် (BOD ₅)	~	mg/L	Estimated by Eco-Lab with Jenway Dissolved Oxygen Meter (Model 970)	≤ 3 mg/L	≤ 50 mg/L *	
9	ဓာတုဆိုင်ရာအောက်ဆီချင်လိုအပ်ချက် (COD)	~	mg/L	LovibondSpectroDirect Method No. 130, 131, 132	NG	s 250 mg/L *	
00	ကလိုရိုဒ် (Chloride)	33.41	mg/L	Argento Metric method (volumetric analysis)	≤ 250 mg/L	NG	Normal
	ကလိုရိုဒ် (Chloride)	~	mg/L	LovibondSpectroDirect Method No. 90	≤ 250 mg/L	NG	Normal

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107, 2nd Floor, Building A, Highway Complex (Sinmalite), Kamayut, Yangon. Tel: 0973076412
Website: http://www.ecolabmyanmar.org Email: info@ecolabmyanmar.org

13.29 Ecology Laboratory Result Tube Well 2 Document 2

ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း Ecological Laboratory

စိမ်းလန်းအစိစ်ဖြစ် ရှိစာဂိုးတာကိရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

eδ Sr.	အရည်အသွေးညွှန်းကိန်း Quality Parameter	qrobase	@Results	နည်းစဉ် Method	စ်သတ်မှတ်ရက် Drinking Standard	gijoqëqiji Effluent Standard	မှတ်ချက် Remarks
00	ကလိုရင်း (Chlorine total residual)	~	mg/L	LovibondSpectroDirect Method No. 100	NG	≤ 0.2 mg/L *	
oJ	ကလိုရင်း (Free Chlorine)	~	mg/L	LowbondSpectroDirect Method No. 100	NG	NG	-
90	ထိုင်ယမ်နိုက် (Free Cyanide)	< 0.01	mg/L	LovibondSpectroDirect Method No. 157	s 0.07 mg/L	≤ 0.1 mg/L *	Normal
og	နိတ်ထြိုင် နိတ်ထရိုကွင် (Nitrate-Nitrogen)	~	mg/L	LovibondSpectroDirect Method No. 265,267	≤ 10 mg/L	NG	
9	දිරුවිකුර (Nitrite)	< 0.01	mg/L	LovibondSpectroDirect Method No. 270	≤ 0.5 mg/L	NG	Normal
90	ဖော့ဝဇိတ် (Ortho- Phosphate)	~	mg/L	LovibondSpectroDirect Method No. 320,321	NG	NG	*
oq	ဒါန်သတ္တုဓာတ် (Aluminium)	0.02	mg/L	LovibondSpectroDirect Method No. 40	≤ 0.2 mg/L	NG	Normal
00	စိန်တတ် (Arsenic)	0	mg/L	Lovibond Arsenic test kit code.no -400700	≤ 0.01 mg/L	≤ 0.1 mg/L *	
	စိန်တတ် (Arsenic)	~	mg/L	AAS, Shimadzu AA-6200 As (193.7 nm)	≤ 10 mg/L	≤ 100 mg/L *	Normal
90	ကတ်ဝဓီယမ် (Cadmium)	~	mg/L	AAS, Shimadzu AA-6200 Cd (228.8 nm)	≤ 0.005 mg/L	≤ 0.1 mg/L *	
o	ကြေးနီ သတ္တုဓာတ် (Copper)	~	mg/L	AAS, Shimadzu AA-6200 Cu (324.8 nm)	≤ 0.05 mg/L	≤ 0.5 mg/L *	
Jo	ාර්යාලාූගෙන් (Iron)	~	mg/L	LovibondSpectroDirect Method No. 220	≤ 0.2 mg/L	≤ 3.5 mg/L *	
	ා්යාලාූගෙන් (Iron)	~	mg/L	AAS, Shimadzu AA-6200 Fe (248.3 nm)	≤ 0.2 mg/L	≤ 3.5 mg/L *	
u	මගලාමන් (Lead)	~	mg/L	AAS, Shirmadzu AA-6200 Pb (283.3 nm)	≤ 0.01 mg/L	≤ 0.1 mg/L *	
R	မဂ္ဂနိစ် (Manganese)	0.36	mg/L	LovibondSpectroDirect Method No. 240	≤ 0.5 mg/L	≤ 2 mg/L	Normal
J9	ဝိုတက်ဗီယမ် (Potassium)	1.8	mg/L	LovibondSpectroDirect Method No. 340	≤ 20 mg/L	NG	Normal
æ	သွပ် သတ္တုမါတ် (Zinc)	0.15	mg/L	LovibondSpectroDirect Method No. 400		≤2 mg/L*	Normal

* Myanmar Emission Guideline 2015

NG=No Guideline

ND=Not Detected

စမ်းသပ်ပြီး Tested by

စစ်ဆေးပြီး Checked by

တာဝန်ခံApproved by

Daw May Mynt Khine Lab. Technician II Ecological Laboratory ALARM Daw Lin Myat Myat Anng Lab. Technician I Ecological Laboratory ALARM Tr. Aye Aye Win Project Team Leader Ecological Laboratory ALARM

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107, 2nd Floor, Building A, Highway Complex (Sinmalite), Kamayut, Yangon. Tel: 0973076412
Website: http://www.ecolabrmyanmar.org Email: info@ecolabrmyanmar.org

13.30 Ecology Laboratory Result Tube Well 2 Document 3



ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း **Ecological Laboratory**



စိမ်းလန်းအစီစဖြစ့်ဖြစ်ပိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

Explanations

1. pH =9

The WHO drinking water standard of pH should be between 6.5 and 8.5. The effluent limit of Myanmar emission guideline for pH is 5.0 - 9.0

2. Turbidity c

Maximum allowable limit for turbidity is 10 FAU (FAU=NTU) and desirable limit is 5.

3. Total dissolved solid (TDS) 9

Allowable effluent standard of Myanmar for total dissolved solid (TDS) in waste water is 2000 mg/L.

Total Suspended Solid (TSS) ⁹

Maximum allowable effluent standard for suspended solid in Myanmar is 30 ppm (mg/L).

5. Conductivity b

EU drinking standard for conductivity at 20°C is 2.5 mS/cm.

6. Hardness d

There is no drinking or emission guideline for hardness in water. The preferable water quality is soft and the table shows the explanation.

Classification	Hardness in mg/L			
Soft	0-60			
Moderately hard	61-120			
Hard	121-180			
Very hard	≥ 181			

7. Dissolved Oxygen e

Generally, the dissolved oxygen(DO) content should be more than 3.0 mg/L. DO of rivers and streams water should be ≥ 6.0 mg/L and that of surface waters (e.g., Lake) should be ≥ 5.0 mg/L.

8. BOD (Biological Oxygen Demand) cg

Myanmar standard limit for BOD of waste water to discharge was 50 mg/L. Although it is not mentioned for BOD of drinking water, the suggested limit for drinking water was ≤ 3 mg/L.

9. COD (Chemical Oxygen Demand) 9

Myanmar effluent standard for COD is 250 mg/L.

10. Chloride c

The SMCL (suggested maximum contaminant level) for chloride is 250 mg/L which is due strictly to the objectionable salty taste produced in drinking water.

Allowable waste effluent standard of Myanmar for chlorine (total residual) in waste water is 0.2 mg/L. There is no drinking and effluent guidelines for free chlorine.

b EU Standard for Drinking Water

c Other Standards

a WHO Standard for Drinking Water (1993) d USGS Water-Quality Information

e Michigan Water Quality Standards(Rule 64)

f India General Standard for Discharge...

g Myanmar Emission Guideline (2015 December 29)

h US EPA Standards

13.31 Ecology Laboratory Result Tube Well 2 Document 4



ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း Ecological Laboratory



စိစ်လန်းအစီမြေခွဲ့ဖြဲ့တိုးတက်မျေးသသင်း (Advancing Life and Regenerating Motherland, ALARM)

13. Cyanide^{a g}

The WHO Standard limit for cyanide in drinking water is less than 0.07 mg/L. Effluent standard limit for cyanide is 0.1 mg/L in Myanmar emission guideline.

14. Nitrate-Nitrogen h

The US EPA Drinking Standard limit for nitrate-nitrogen is less than 10mg/L.

15. Nitrite

EU Recommended limit for drinking standard is 0.5 mg/L.

16. Phosphate

There is no guidelines for ortho-phosphate in both drinking and effluent waters.

17. Aluminium ab

EU and WHO standard limit for drinking water is 0.2 ppm(mg/L) aluminum.

18. Arsenic *9

Arsenic concentration of WHO drinking water standard is at 0.010 parts per million (10 parts per billion = 10 ppb) and the Myanmar emission guideline value is 0.1 ppm (100 ppb).

19. Cadmium ag

The WHO drinking standard limit is 0.005 mg/L and the Myanmar effluent limit is 0.1 mg/L.

20. Copper 19

The India drinking standard limit is 0.05 mg/L and the Myanmar effluent limit is 0.5 mg/L.

21. Iron bg

The EU drinking standard limit is 0.2 mg/L and the Myanmar effluent limit is 3.5 mg/L.

22. Lead a g

The WHO drinking standard limit is 0.01 mg/L and the Myanmar effluent limit is 0.1 mg/L.

23. Manganese ^a

WHO drinking water standard limit is 0.5 mg/L and WHO's effluent standard limit is 2 mg/L.

24. Potassium ^c

Legal limit for drinking water is 20 mg/L

25. Zinc a

The Myanmar effluent limit is 2 mg/L.

a WHO Standard for Drinking Water (1993)

b EU Standard for Drinking Water

c Other Standards

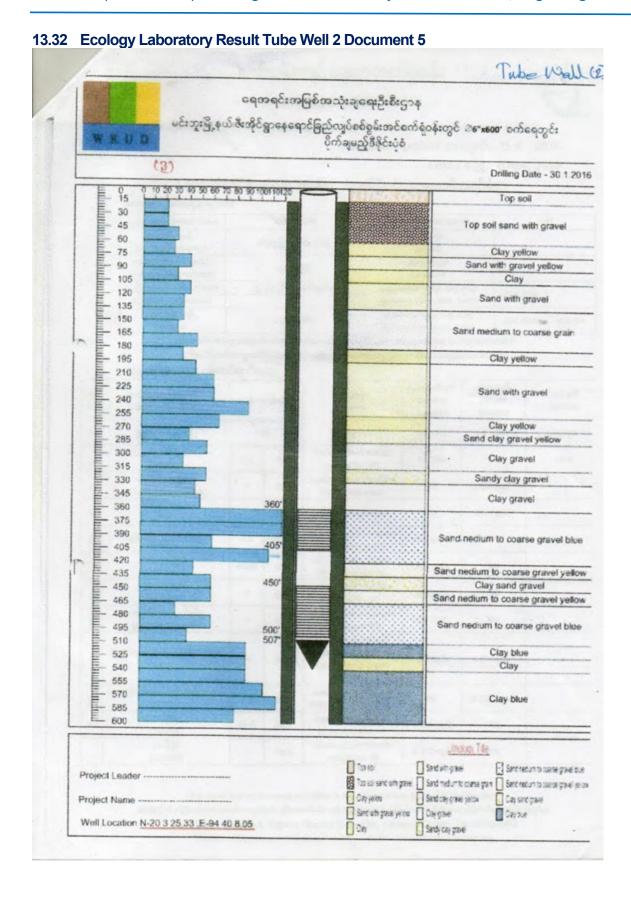
d USGS Water-Quality Information

e Michigan Water Quality Standards(Rule 64)

f India General Standard for Discharge...

g Myenmar Emission Guideline (2015 December 29)

h US EPA Standards



13.33 Ecology Laboratory Result Tube Well 3 Document 1



စိမ်းလန်းအ**မိမြင့်** ပြီးတိုးတက်နေအသင်း (Advancing Life and Regenerating Motherland, ALARM)

Reference Number/ စာအမှတ်: EL-R / 0982

Date / GAR: 10 June, 2016

lube Well

Laboratory Analysis Report /ဓာတ်ခွဲစစ်ဆေးမှုအစီအရင်ခံစာ

Sample Profiles γεροφοοδ

နှဖုနာအမည် /Sample Name	အဝီစီတွင်းစရ	φφισσοφοδ/ Sample ID	1801		
နေရာ (ရှိနယ်) Location (Township)	မင်းဘူးမြို့နယ်၊ စီးဘိုင်ရွာ	လတ္တီတွစ် Latitude			
နေရာ (တိုင်း/မြည်နယ်) Location (Division/State)	မကျေးတိုင်း	လောင်ရှိတွင် Longitude			
ပေးပို့သူအမည် Sender Name	ရွှေကျွန်းကြီး ဆောက်လုပ်ရေး	နမူနာကောက်ယူရှိန် (စနု၊ နာရီ)			
အဖွဲ့အစည်းOrganisation - တော်သွယ်ရန် 09421163612 Contact		Sampling Time (Date, Time)	1.6.2016	2:30 pm	
		နှဖွနာရောက်ရှိရှိန် (ဝန္ နာရီ) Arriving Time (Date, Time)	3.6.2016		

(This laboratory analysis report is based solely on the sample submitted by the customer) (ဤဓာတ်ဖွဲ့စစ်ဆေးမှအစီရင်စံတသည် ပေးပို့သူမှုပို့ဆောင်စုံသည့်နမူမှာကိုသာအခြေစံထားပါသည်။)

_	Analysis Results 00133	odlesson			စံသတ်မှတ်ရက်			
οδ Sr.	အရည်အဝသူညှန်းကိန်း Quality Parameter	ရလစ်အခြေResults		ရလစ်အခြေResults နည်းစဉ် Method		စွန့်ဝရစ်နှန်း Effluent Standard	မှတ်ရက် Remarks	
0	ရည်ဝန်ကိန်း (pH)		7.8	pH meters	6.5 - 8.5	6.0 - 9.0*	Normal	
J	နောက်ကိုမှ (Turbidity)	109	FAU	LovibondSpectroDirect Method No. 385	≤10 FAU	NG	Turbid	
9	ပျော်ဝင်အနည်များ (Total dissolved solids)	~	mg/L	Consort Multi-parameters Conductivity meter	NG	≤2000 mg/l *		
9	ဆိုင်ကြွအနယ် (TSS)	~	mg/L	Oven-drying method	NG	≤50 mg/L *		
9	လျှင်စီးကိန်း (Conductivity)	0.7	mS/cm	Consort Multi-parameters Conductivity meter	≤2.5 mS/cm	NG	Normal	
6	အမေးအသွက် (Hardness)	152.77	mg/L	EDTA Titration Method (volumetric analysis)	≤60 mg/L	NG		
	အစေးအသွက် (Hardness)	2	mg/L	LovibondSpectroDirect Method No. 200	≤60 mg/L	NG	Hard	
9	အောက်ဆီဂျင် ပျော်ဝင်မှု (Dissolved Oxygen)	~	mg/L	Jenway Dissolved Oxygen Meter (Model 970)	≥ 3 mg/L	NG	Aug.	
0	စီဝထိုင်ရာအောက်ဆီရှင်လိုအပ်ချက် (BOD ₃)	~	mg/L	Estimated by Eco-Lab with Jenway Dissolved Oxygen Meter (Model 970)	≤ 3 mg/L	≤ 50 mg/L *		
9	ဓာတုဆိုင်ရာအောက်ဆီဂျင်လိုအပ်ချက် (COD)	~	mg/L	LovibondSpectroDirect Method No. 130, 131, 132	NG	≤ 250 mg/L *		
00	တလိုရှိစ် (Chloride)	54.29	mg/L	Argento Metric method (volumetric analysis)	≤ 250 mg/L	NG	Normal	
	ကလိုနိုင် (Chloride)	~	mg/L	LovibondSpectroDirect Method No. 90	≤ 250 mg/L	NG		

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(మేస్మెంఫీజు) రాత్రిస్థించానులు మాయ్రాయ్యాస్తులు అందిని మాట్లు అందిని ప్రాట్లు అందిని అంద

13.34 Ecology Laboratory Result Tube Well 3 Document 2

ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း Ecological Laboratory

စိမ်းလန်းအမိမြေခွဲ့ဖြိုးတိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

οδ Sr.	အရည်အဝသွေးညွှန်းကိန်း Quality Parameter	qrofess	@Results	දැරිංරේ Method	စ်သတ်မှတ်ရက် Drinking Standard	gğoqòqğı Effluent Standard	မှတ်ရက် Remarks	
00	ကာလိုရင်း (Chlorine total residual)	~	mg/L	LovibondSpectroDirect Method No. 100	NG	≤ 0.2 mg/L *		
وه	ကလိုရင်း (Free Chlorine)	~	mg/L	LovibondSpectroDirect Method No. 100	NG	NG		
90	ဆိုင်ယမ်နီက် (Free Cyanide)	0.03	mg/L	LovibondSpectroDirect Method No. 157	≤ 0.07 mg/L	≤ 0.1 mg/L *	Normal	
9	နိုက်ထြိုင် နိုက်ထရိုဂျင် (Nitrate-Nitrogen)	~	mg/L	LovibondSpectroDirect Method No. 265,267	≤ 10 mg/L	NG		
၁၅	နိုက်ထြံတ် (Nitrite)	< 0.01	mg/L	LovibondSpectroDirect Method No. 270	≤ 0.5 mg/L	NG	Normal	
Эс	ဖော့စစိတ် (Ortho- Phosphate)	~	mg/L	LovibondSpectroDirect Method No. 320,321	NG	NG	-	
oq	ခါန်သတ္တုဓာတ် (Aluminium)	0.02	mg/L	LovibondSpectroDirect Method No. 40	≤ 0.2 mg/L	NG	Normal	
00	စိန်တဝ၆ (Arsenic)	0	mg/L	Lovibond Arsenic test kit code.no -400700	≤ 0.01 mg/L	≤ 0.1 mg/L *		
	စိန်တဝင် (Arsenic)	~	mg/L	AAS, Shirnadzu AA-6200 As (193.7 nm)	≤ 10 mg/L	≤ 100 mg/L *	Normal	
90	ကတ်ခရီယမ် (Cadmium)	~	mg/L	AAS, Shimadzu AA-6200 Cd (228.8 nm)	≤ 0.005 mg/L	≤ 0.1 mg/L *		
jo	ကြေးနီ သတ္တုဓာတ် (Copper)	2	rng/L	AAS, Shimadzu AA-6200 Cu (324.8 nm)	≤ 0.05 mg/L	≤ 0.5 mg/L *		
a	ා්යාහූණර (Iron)	~	mg/L	LovibondSpectroDirect Method No. 220	≤ 0.2 mg/L	≤ 3.5 mg/L *		
	သံသတ္တုမှာတ် (tron)	~	mg/L	AAS, Shimadzu AA-6200 Fe (248.3 rvm)	≤ 0.2 mg/L	≤ 3.5 mg/L *		
JJ	මියාලාුම්ති (Lead)	~	mg/L	AAS, Shimadzu AA-6200 Pb (283.3 nm)	≤ 0.01 mg/L	≤ 0.1 mg/L *	*	
R	မဂ္ဂနိုစ် (Manganese)	₹0,3	786/L	LovibondSpectroDirect Method No. 240	\$ 8.5 mg/L	\$ 3 mg/L	Normal Normal	
J9	ဝိုတာဂ်စီယမ် (Potassium)	2.3	mg/L	LovibondSpectroDirect Method No. 340	≤ 20 mg/L	NG	Normal	
JO	သွပ် သတ္တုဓါတ် (Zinc)	0.05	mg/L	LovibondSpectroDirect Method No. 400		≤2 mg/L *	Normal	

* Myanmar Emission Guideline 2015

NG=No Guideline

ND=Not Detected

စမ်းသစ်ပြီး Tested by

Daw May Myat Khine Lab, Technician II Ecological Laboratory ALARM စစ်ဆေးပြီး Checked by

Daw Lin Myat Myat Aung Lab. Technician I Ecological Laboratory ALARM

Mat.

တာဝန်စုံApproved by

Dr. Aye Aye Win Project Team Leader Ecological Laboratory ALARM

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13.35 Ecology Laboratory Result Tube Well 3 Document 3



ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း **Ecological Laboratory**



စိမ်းလန်းအစီမြေစွဲ ဖြစ်တိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

Explanations

1. pH *9

The WHO drinking water standard of pH should be between 6.5 and 8.5. The effluent limit of Myanmar emission guideline for pH is 5.0 - 9.0

2. Turbidity c

Maximum allowable limit for turbidity is 10 FAU (FAU=NTU) and desirable limit is 5.

3. Total dissolved solid (TDS) 9

Allowable effluent standard of Myanmar for total dissolved solid (TDS) in waste water is 2000 mg/L.

4. Total Suspended Solid (TSS) 9

Maximum allowable effluent standard for suspended solid in Myanmar is 30 ppm (mg/L).

EU drinking standard for conductivity at 20°C is 2.5 mS/cm.

6. Hardness d

There is no drinking or emission guideline for hardness in water. The preferable water quality is soft and the table shows the explanation.

Classification	Hardness in mg/L			
Soft	0-60			
Moderately hard.	61-120			
Hard	121-180			
Very hard	≥ 181			

7. Dissolved Oxygen e

Generally, the dissolved oxygen(DO) content should be more than 3.0 mg/L. DO of rivers and streams water should be \geq 6.0 mg/L and that of surface waters (e.g., Lake) should be \geq 5.0 mg/L.

8. BOD (Biological Oxygen Demand) c9

Myanmar standard limit for BOD of waste water to discharge was 50 mg/L. Although it is not mentioned for BOD of drinking water, the suggested limit for drinking water was ≤ 3 mg/L.

9. COD (Chemical Oxygen Demand) 9

Myanmar effluent standard for COD is 250 mg/L.

10. Chloride c

The SMCL (suggested maximum contaminant level) for chloride is 250 mg/L which is due strictly to the objectionable salty taste produced in drinking water.

11, 12. Chlorine 9

Allowable waste effluent standard of Myanmar for chlorine (total residual) in waste water is 0.2 mg/L. There is no drinking and effluent guidelines for free chlorine.

a WHO Standard for Drinking Water (1993) d USGS Water-Quality Information b EU Standard for Drinking Water c Other Standards

e Michigan Water Quality Standards(Rule 64) f India General Standard for Discharge...

g Myanmar Emission Guideline (2015 December 29) h US EPA Standards

13.36 Ecology Laboratory Result Tube Well 3 Document 4



စိမ်းလန်းအဓိခြေခွဲ့မြိုးတိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM)

13. Cyanide^{a g}

The WHO Standard limit for cyanide in drinking water is less than 0.07 mg/L. Effluent standard limit for cyanide is 0.1 mg/L in Myanmar emission guideline.

14. Nitrate-Nitrogen h

The US EPA Drinking Standard limit for nitrate-nitrogen is less than 10mg/L.

EU Recommended limit for drinking standard is 0.5 mg/L.

16. Phosphate

There is no guidelines for ortho-phosphate in both drinking and effluent waters.

17. Aluminium ab

EU and WHO standard limit for drinking water is 0.2 ppm(mg/L) aluminum.

Arsenic concentration of WHO drinking water standard is at 0.010 parts per million (10 parts per billion = 10 ppb) and the Myanmar emission guideline value is 0.1 ppm (100 ppb).

The WHO drinking standard limit is 0.005 mg/L and the Myanmar effluent limit is 0.1 mg/L.

20. Copper 19

The India drinking standard limit is 0.05 mg/L and the Myanmar effluent limit is 0.5 mg/L.

21. Iron bg

The EU drinking standard limit is 0.2 mg/L and the Myanmar effluent limit is 3.5 mg/L.

The WHO drinking standard limit is 0.01 mg/L and the Myanmar effluent limit is 0.1 mg/L.

23. Manganese ^a

WHO drinking water standard limit is 0.5 mg/L and WHO's effluent standard limit is 2 mg/L.

24. Potassium c

Legal limit for drinking water is 20 mg/L

The Myanmar effluent limit is 2 mg/L.

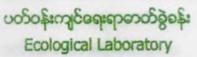
- a WHO Standard for Drinking Water (1993)
- b EU Standard for Drinking Water
- c Other Standards
- d USGS Water-Quality Information
- e Michigan Water Quality Standards(Rule 64)
- f India General Standard for Discharge...
- g Myanmar Emission Guideline
- (2015 December 29)
- h US EPA Standards

10 Dec West (2) | Continue of the continue of

13.38 Ecology Laboratory Result Tube Well 4 Document 1 Tube. Wedd (4) ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲခန်း **Ecological Laboratory** စိမ်းလန်းအမိမြေခွဲ့ခြီးတိုးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM) Reference Number/ စာအမှတ်: EL-R / 01129 Date / G&R: 23 August, 2016 Laboratory Analysis Report /ဝေဝာ်ခွဲစစ်လေးမှုအစီအရင်ခံစာ Sample Profilesessocococ နမူနာအပည် /Sample Name Tube Well (4) φφοσοφοδ/ Sample ID 1998 OFF (1,00) လတ္တီတွစ် Location (Township) Latitude ၀နရာ (တိုင်း/ပြည်နယ်) လောင်ရှိတွင် Location (Division/State) Longitude ပေးရှိသူအမည် Sender Name ရွေကျွန်းကြီး ဆောက်လုပ်ရေး နမူနာတောက်ယူရိန် (ဝန္ နာရီ) အဖွဲ့အဝည်းOrganisation 16.8.2016 Sampling Time (Date, Time) ဆက်သွယ်ရန် နမူနာဓရာက်စို့ရိန် (ဝန္ နာရီ) 09421163612 Contact 18.8.2016 Arriving Time (Date, Time) 2:00 (This laboratory analysis report is based solely on the sample submitted by the customer) (ကျ်ာတ်ဖွဲ့စစ်တေးမှုအပီရှင်ခဲ့တသည် ပေးပို့သူမှင့်ဆောင်ခဲ့သည့်မှုမှုသကိုသာအစြေခံထားပါသည်။) Analysis Results o ໂຄວວ ບໍ່ອຸດວິເສດ ຕົ້ 08 အရည်အသွေမျာ့န်းကိန်း စ်သတ်မှတ်ရက် Stoopst နည်းစဉ် qrv6ssa@Results Sr. Quality Parameter φοδαι Drinking Effluent Method Standard Remar Standard 0 ရည်ဖန်ကိန်း (pH) 7.9 pH meters 6.5-8.5 6.0 - 9.0* Norma အောက်တို့မှ J LovibondSpectroDirect 14 FAU (Turbidity) ≤10 FAU Method No. 385 Turbic ပျော်ဝင်အနည်များ Consort Multi-parameters 9 (Total dissolved solids) mg/L NG ≤2000 mg/l * Conductivity meter ဆိုင်ကြေတနလ် 9 mg/L Oven-drying method (TSS) NG ≤50 mg/L * 9 Consort Multi-parameters ကျွှစ်စီးတိန်း (Conductivity) 0.5 mS/cm ≤2.5 mS/cm Conductivity meter NG Normal အဖေးအသွက် 8 **EDTA Titration Method** ~ mg/L (Hardness) 560 mg/L NG (volumetric analysis) အစေအသျက် LowbondSpectroDirect Very Har 200 (Hardness) mg/L ≤60 mg/L Method No. 200 NG သောက်တီရစ် ပျော်ဝစ်မှ Jenway Dissolved Oxygen 9 ~ (Dissolved Oxygen) mg/L ≥ 3 mg/L Meter (Model 970) Estimated by Eco-Lab စီဝဆိုင်ရာအောက်**လီ**ဂျင်လိုအပ်ရက် 0 with Jenway Dissolved mg/L (BOD₈) 5 3 mg/L \$ 50 mg/L * Oxygen Meter (Model 970) ဓာတုဆိုင်ရာဆောက်ဆီဂျင်လိုအဝ်ရတ် 6 LovibondSpectroDirect ~ mg/L (COD) NG Method No. 130, 131, 132 ≤ 250 mg/L * **ආල්දීම්** 20 Argento Metric method ~ mg/L (Chloride) ≤ 250 mg/L NG (volumetric analysis) **ආදර්මිණ** LovibondSpectroDirect Normal 10 mg/L (Chloride) ≤ 250 mg/L Method No. 90 (This report shall not be reproduced except in full, without written approval of the laboratory) (ခဲ့တ်နှဲ့စန်း၏ စာခြင့်ရေးသားသောသည့်ညီရက်မရှိပဲသနားကိုနှင့်စတတို့အပြည့်အစုံနကွဲ၍ တစ်စိတ်တစ်ပိုင်း ဖြတ်သူအသုံးဖြစ်ခဲ့ စိတ္ထန္တာမြော

-	Securios de la constante de la	8 Bron	တက်ရော	ροοδε (Advancing Life	and Regenerat	ing Motherland,	ALARM)
οδ Sr.	အရည်အစသွေးညွှန်းကိန်း Quality Parameter	elcogeoglesents			ecooligoligol Drinking Standard		youquis Remarks
00	တလိုရင်း (Chlorine total residual)	-	mg/L	LovibondSpectroDirect Method No. 100	NG	≤ 0.2 mg/L *	
oJ	ကလိုရင်း (Free Chlorine)	~	mg/L	LovibondSpectroDirect Method No. 100	NG	NG NG	
op	ထိုင်ယမြိုက် (Free Cyanide)	< 0.01	mg/L	LovibondSpectroDirect Method No. 157	≤ 0.07 mg/L	≤ 0.1 mg/L *	
09	နိုက်ထြစ် နိုက်ထရိုရှင် (Nitrate-Nitrogen)	~	mg/L	LovibandSpectroDirect	≤ 10 mg/L		Normal
99	දින්ඩික්රේ (Nitrite)	0.02	mg/L	Method No. 265,267 LavibondSpectroDirect		NG	
30	අතුමේග් (Ortho- Phosphate)	~	mg/L	Method No. 270 LowbondSpectroDirect	≤ 0.5 mg/L	NG	Normal
nq	ခါန်သတ္တုဓာတ်	0.01	mg/L	Method No. 320,321 LovibondSpectroDirect	NG	NG	-
0	(Aluminium) စိန်တင် (Arsenic)			Method No. 40 Lavibond Arsenic test kit	≤ 0.2 mg/L	NG	Normal
1	8\$ano5 (Arsenic)	~	mg/L	code.no -400700 AAS, Shimadzu AA-6200	≤ 0.01 mg/L	≤ 0.1 mg/L *	Normal
+		0	mg/L	As (193.7 nm)	≤ 10 mg/L	\$ 100 mg/L *	TO THE
9	ကတ်ဇမီယမ် (Cadmium) ကြေနီ သတ္တုဓာတ်	~	mg/L	AAS, Shimadzu AA-6200 Cd (228.8 nm)	≤ 0.005 mg/L	≤ 0.1 mg/L *	B1 - 1
0	(Copper)	~	mg/L	AAS, Shimadzu AA-6200 Cu (324.8 nm)	≤ 0.05 mg/L	≤ 0.5 mg/L *	
1	න්නලාුවෙනි (Iron)	~	mg/L	LevibondSpectroDirect Method No. 220	≤ 0.2 mg/L	≤ 3.5 mg/L *	
1	abanggjenoS (Iron)	~	mg/L	AAS, Shimadzu AA-6200 Fe (248.3 nm)	≤ 0.2 mg/L	≤ 3.5 mg/L *	
	මියාලුබුන් (Lead)	~	mg/L	AAS, Shimadzu AA-6200 Pb (283.3 nm)	≤ 0.01 mg/L	≤ 0.1 mg/L *	
	ယ္ခနိုစ် (Manganese)	< 0.2	mg/L	LovibondSpectroDirect Method No. 240	≤ 0.5 mg/L	≤ 2 mg/L	Normal
	ဝိုတက်စီယင် (Potassium)	5.1	mg/L	LovibondSpectroDirect Method No. 340	≤ 20 mg/L	NG	
	තුරි හනුස්ති (Zinc)	0.1	mg/L	LovibondSpectroDirect			Normal
	Myanmar Emission G	uideline	2015	NG=No Guideline		S2 mg/L * ND=Not Dete	Normal
	රූපාර්ලී: Tested by		08	cools Checked by			
	Xx.			Met		Approv Approv	ed by
	law May Myat Khine		-	Nya.		in	
	Lab. Technician II Scological Laboratory			Lin Myat Myat Ann, Lah, Technicism I		Project To	Aye Win
	ALAKM		Ec	ological Laboratory ALARM		Ecologica	Laboratory ARM

13.40 Ecology Laboratory Result Tube Well 4 Document 3



ဗိမ်းလန်းတစ်ချိတ်ဖြစ်သြီးတက်ရေးအသင်း (Advancing Life and Regenerating Motherland, ALARM) Explanations

1. pH **

The WHO drinking water standard of pH should be between 6.5 and 8.5. The effluent limit of Myanmar emission guideline for pH is 5.0 - 9.0

2. Turbidity ^c

Maximum allowable limit for turbidity is 10 FAU (FAU=NTU) and desirable limit is 5.

3. Total dissolved solid (TDS) 9

Allowable effluent standard of Myanmar for total dissolved solid (TDS) in waste water is 2000 mg/L.

4. Total Suspended Solid (TSS) 9

Maximum allowable effluent standard for suspended solid in Myanmar is 30 ppm (mg/L).

5. Conductivity b

EU drinking standard for conductivity at 20°C is 2.5 mS/cm.

6. Hardness d

There is no drinking or emission guideline for hardness in water. The preferable water quality is soft and the table shows the explanation.

Classification	Hardness in mg/L		
Soft	0-60		
Moderately hard	61-120		
Hard	121-180		
Very hard	≥ 181		

Generally, the dissolved oxygen(DO) content should be more than 3.0 mg/L. DO of rivers an streams water should be ≥ 6.0 mg/L and that of surface waters (e.g., Lake) should be ≥ 5.0 mg/L.

8. BOD (Biological Oxygen Demand) cq

Myanmar standard limit for BOD of waste water to discharge was 50 mg/L. Although it is no mentioned for BOD of drinking water, the suggested limit for drinking water was ≤ 3 mg/L.

9. COD (Chemicai Oxygen Demand) 9

Myanmar effluent standard for COD is 250 mg/L.

10. Chloride ^c

The SMCL (suggested maximum contaminant level) for chloride is 250 mg/L which is due strictly the objectionable salty taste produced in drinking water.

11, 12. Chlorine 9

Allowable waste effluent standard of Myanmar for chlorine (total residual) in waste water is 0.2 mg/ There is no drinking and effluent guidelines for free chlorine.

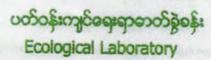
a WHO Standard for Drinking Water (1993) d USGS Water-Quality Information b EU Standard for Orinking Water c Other Standards

e Michigan Water Quality Standards(Rule 64)

† India General Standard for Discharge...

g Myanmar Emission Guideline (2015 December 29) h US EPA Standards

13.41 Ecology Laboratory Result Tube Well 4 Document 4



စိမ်းလန်းတစိတ်ဖြစ် မြိုးတိုးတက်စရာအသစ်း (Advancing Life and Regenerating Motherland, ALARM)

The WHO Standard limit for cyanide in drinking water is less than 0.07 mg/L. Effluent standard limit for cyanide is 0.1 mg/L in Myanmar emission guideline.

14. Nitrate-Nitrogen h

The US EPA Drinking Standard limit for nitrate-nitrogen is less than 10mg/L.

15. Nitrite b

EU Recommended limit for drinking standard is 0.5 mg/L

16. Phosphate

There is no guidelines for ortho-phosphate in both drinking and effluent waters. Inland surface water standard limit of dissolved phosphate (as P) in USEPA is 5 mg/L for surface water.

17. Phosphorous

Standard limit for drinking water for phosphorous was not mentioned in WHO and EU standard.Effluent standard limit of phosphorous in Myanmar standard was 2 mg/L.

18. Aluminium ab

EU and WHO standard limit for drinking water is 0.2 ppm(mg/L) aluminum.

Arsenic concentration of WHO drinking water standard is at 0.010 parts per million (10 parts per billion = 10 ppb) and the Myanmar emission guideline value is 0.1 ppm (100 ppb).

The WHO drinking standard limit is 0.005 mg/L and the Myanmar effluent limit is 0.1 mg/L.

21. Copper 19

The India drinking standard limit is 0.05 mg/L and the Myanmar effluent limit is 0.5 mg/L.

The EU drinking standard limit is 0.2 mg/L and the Myanmar effluent limit is 3.5 mg/L.

23. Lead 19

The WHO drinking standard limit is 0.01 mg/L and the Myanmar effluent limit is 0.1 mg/L.

24. Manganese *

WHO drinking water standard limit is 0.5 mg/L and WHO's effluent standard limit is 2 mg/L.

a WHO Standard for Drinking Water (1993) b EU Standard for Drinking Water

c Other Standards

d USGS Water-Quality Information e Michigan Water Quality Standards(Rule 64) f India General Standard for Discharge...

g Myanmar Emission Guideline (2015 December 29) h US EPA Standards

13.42 Ecology Laboratory Result Tube Well 4 Document 5 ပတ်ဝန်းကျင်ရေးရာဓာတ်ခွဲစန်း **Ecological Laboratory** စိမ်းလန်းတပိစ**ြင့် ဦး**တိုးတက်**ေး့အသ**င်း (Advancing Life and Regenerating Motherland, ALARM) 25. Potassium ^c Legal limit for drinking water is 20 mg/L. 26. Zinc * The Myanmar effluent limit is 2 mg/L. 27. Ammonia bg Standard limit of ammonia in EU standard is less than 0.5 mg/L for drinking water and less than 10 mg/L for effluent in Myanmar standard. 28. Ammonical Nitrogen ^{fh} Standard limit for ammonia nitrogen in India standard for effluent is 50 mg/L. USEPA standard limit of ammonical nitrogen for surface water limit and public sewers standard was 50 mg/L. a WHO Standard for Drinking Water (1993) d USGS Water-Quality Information g Myanmar Emission Guideline b EU Standard for Drinking Water e Michigan Water Quality Standards(Rule 64) (2015 December 29) c Other Standards f India General Standard for Discharge .. h US EPA Standards

13.44 Document of Land and Crops Conservation (1)

မြေအသုံးပြုခွင့်နှင့်မြေပေါ်ရှိ ကောက်ပဲသီးနှံအမြဲလွှဲပြောင်းစွန့်လွှတ်ခြင်းဂတိခံဝန်တချုပ်

၁။ မကွေးတိုင်းဒေသကြီး၊မင်းဘူးခရိုင်၊မင်းဘူး(စကု)မြို့နယ်၊မင်းလှကျင်းကျေးရွာ၊တွင်းအမှတ်(၁၂၅၃)၊ ခုတ်ကြီးကွင်းဦးပိုင်အမှတ်(၉၀/၁၅၉)၊စရိယာ(၄-ဂ၆)ဧကရှိ ယာမြေအတွင်းမှ(၄-၆၅)ဧကနှင့်ပတ်သက်၍အနှင့်အရေး အဝဝ ကိုအကြွင်းမဲ့အကျိုးခံစားနွင့်ရှိသည့်အားလျော်စွာယင်းမြေတွက်၏ ရယူခံစားထိုက်သောအနွင့်အရေးအဝဝကို နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ်ခါတ်အားပေးစက်ရုံသို့လွှဲပြောင်းပေးခြင်းကိုသဘောတွပါသည်။

၂။ လယ်ယာမြေနည်းဥပဒေ(၆ဂ)ပါပြဌာန်းချက်များအတိုင်း သီးနှံနစ်နာကြေး (၂၅၀၀၀၀8/)(ကျပ်နှစ်ဆယ့် ဝီးသိန်းတိတိအားကျေးရွာအုပ်စုလယ်ယာမြေစီမံခန့်ခွဲမှုအဖွဲ့နှင့်မြို့နယ်လယ်ယာမြေစီမံခန့်ခွဲမှုအဖွဲ့ရှေ့မှောက်တွင် နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ်ဖေတ်အားပေးစက်ရုံတာဝန်ခံကပေးအပ်ကြောင်းလွှဲပြောင်းသူကအတည်ပြပြီး အောက်တွင်လက်မှတ်ရေးထိုးကြပါသည်။

၁။ လွှဲပြောင်းသူသည် သီးခံ့နှစ်နာကြေးများရရှိပြီးဖြစ်သည့်အတိုင်း ကောက်ပဲသီးခံ့များနှင့်ပတ်သက်၍အကျိုး အမြတ်ရပိုင်ခွင့်နှင့်ဘကွ အနှင့်အရေးအဝဝကို စွန့်လွှတ်ပါကြောင်းနှစ်ဦးနှစ်မက်သဘောတူညီပြီးအောက်ပါအသိသက် သေများရှေ့မှောက်တွင်တစ်ဦးတစ်ယောက်၏ ရြိမ်းခြောက်မှုပြားယောင်းသွေးဆောင်မှုတိုက်တွန်းမှုမရှိဘဲ ကျွန်တော် ပိုင်ဆိုင်သောကောက်ပဲသီးနှံအမြဲလွှဲပြောင်းစွန့်လွှတ်ကြောင်းဝန်ခံဂတိပြုလက်မှတ်ရေးထိုးပါသည်။

ဦးသိန်းတံ ဦးကိုကိုကျော် බලදුලට (3**දි**) අපදාලම) /ရကန(နိုင်) o pag ျ နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ် ဓါတ်အားပေးစက်ရှိ ကျွန်ပ်တို့ စာရေ မှောက်တွင်" အခွဲဝန် 3000 အတွင်းရေးများ အေဆန်းယုဝင်။ βισσοδυδι 3303\$1\$8051 Dr 208 မင်းဘူး(စက္)မြို့နယ်လယ်ယာမြေစီမံခန့်ခွဲမှုအလွဲ ရက်ရွဲ။ ၂၀၁၆ခုနှစ်၊မတ်လ ရက်

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13.45 Document of Land and Crops Conservation (2)

မြေအသုံးပြုခွင့်နှင့်မြေပေါ်ရှိ ကောက်ပဲသီးနှံအမြဲလွှဲပြောင်းစွန့်လွှတ်ခြင်းဂတိခံဝန်စာချုပ်

၁။ မကွေးတိုင်းဒေသကြီး၊မင်းဘူးခရိုင်၊မင်းဘူး(စကု)မြို့နှယ်၊မင်းလှကျင်းကျေးရွာ၊ကွင်းအမှတ်(၁၂ရ၃)၊ ခုတ်ကြီးကွင်းဦးဝိုင်အမှတ်(၉၀)၊ရေိယာ(ရ.၃၄)ကေရှိ ယာမြေအတွင်းမှ(၃.၁၈)ဧကနှင့်ပတ်သက်၍အခွင့်အရေးအဝဝ ကိုအကြွင်းမဲ့အကျိူးစံစားခွင့်ရှိသည့်အားလျော်စွာ ယင်းမြေကွက်၏ ရယူစံစားထိုက်သောအခွင့်အရေးအဝဝကို နေရောင်ရြည်စွစ်းအင်သုံးလျုပ်စစ်ဓါတ်အားပေးစက်ရှိသို့လွှဲပြောင်းပေးခြင်းကိုသဘောတူပါသည်။

၂။ လယ်ယာမြေနည်းဥပဒေ(၆၅)ပါပြဌာန်းချက်များအတိုင်း သီးနှံနှစ်နာကြေး (၂၅၀၀၀၀၀၆/)(ကျပ်နှစ်ဆယ့် ငါးသိန်းတိတ်အားကျေးရွာအုပ်စုလယ်ယာမြေစီမံခန့်၌မှုအဖွဲ့နှင့်မြို့နယ်လယ်ယာမြေစီမံခန့်၌မှုအဖွဲ့ရှေ့မှောက်တွင် နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ်ဓါတ်အားပေးစက်ရုံတာဝန်ခံကပေးအပ်ကြောင်းလွှဲပြောင်းသူကအတည်ပြုပြီး အောက်တွင်လက်မှတ်ရေးထိုးကြပါသည်။

၁။ လွှဲပြောင်းသူသည် သီးနှံနစ်နာကြေးများရရှိပြီးဖြစ်သည့်အတိုင်း ကောက်ပဲသီးနှံများနှင့်ပတ်သက်၍အကျိုး အမြတ်ရပိုင်ခွင့်နှင့်တကွ အနွင့်အရေးအဝဝကို စွန့်လွှတ်ပါကြောင်းနှစ်ပိုးနှစ်ဖက်သဘောတူညီပြီးအောက်ပါအသိသက် သေများရှေ့မှောက်တွင်တစ်ဦးတစ်ယောက်၏ ခြိမ်းခြောက်မှုပြားယောင်းသွေးဆောင်မှုတိုက်တွန်းမှုမရှိတဲ ကျွန်တော် ပိုင်ဆိုင်သောကောက်ပဲသီးနှံအမြဲလွှဲပြောင်းစွန့်လွှတ်ကြောင်းဝန်ခံဂတ်ပြုလက်မှတ်ရေးထိုးပါသည်။

> (လွှဲမြောင်းသူ) ဦးမြင့်ရွှေ ၈/မဘန(နိုင်) ဝဌရ ၆၃

(လက်ခံသူ) ဦးကိုကိုကျော် ၁၂/ရကန(နိုင်) ၀၂၁၈၄၂ တာဝန်ခံ နေရောင်ရြည်စွမ်းအင်သုံးလျှပ်စစ် ဓါတ်အားပေးစက်ရုံ

''ကျွန်ပ်တို့၏ရေ့မှောက်တွင်"

အဖွဲ့ဝင် Dr ဘစီ အွေဝန် အေါ်ဆန်းယုဝင်း အတွင်းရေးမှုုး ဦးအောင်မင်း

မင်းဘူး(စကု)မြို့နယ်လယ်ယာမြေစီမံစန့်ခွဲမှုအဝွဲ

ရက်စွဲ။၂၀၁၆ခုနှစ်၊မတ်လ ရက်

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13.46 Document of Land and Crops Conservation (3)

မိမိပိုင်ဆိုင်သောမြေနှင့်တောက်ပဲသီးနှံအမြဲလွှဲပြောင်း စွန့်လွှတ်ခြင်းဝန်ခံဂတိပြုချက်

၁။ မကွေးတိုင်းဒေသကြီး၊မင်းဘူးခရိုင်၊မင်းဘူး(စကု)မြို့နယ်၊မင်းလှကျင်းကျေးရွာ၊တွင်းအမှတ်(၁၂၅၃)၊ ခုတ်ကြီးကွင်း၊ဦးပိုင်အမှတ်(၃၁)၊ရေိယာ(၅-၉၆)ဧကရှိ ယာမြေအတွင်းမှ(၁.၅၀)ဧကသည် နေရောင်ရြည်စွမ်းအင် သုံးလှုပ်စစ်ဓါတ်အားပေးစက်ရုံဆောက်လုပ်မည့်စရိယာ (၈၃၆)ဧကအတွင်းပါဝင်သွားသည့် (၁.၅၀)ဧကအပေါ် လယ် ယာမြေနည်းဥပဒေ(၆၅)ပါပြငှာန်းချက်များအတိုင်း မြေလျော်ကြေး(၁၅၀၀၀၀၀)(ကျပ်တစ်ဆယ့်ခုနစ်သိန်းတိတိ) နှင့်သီးနှံနစ်နှာကြေးငွေ(၂၅၀၀၀၀၀)(ကျပ်နှစ်ဆယ့်ငါးသိန်းတိတ်)၊စုစုပေါင်း(၄၂၀၀၀၀၀)(ကျပ်လေးဆယ့်နှစ်သိန်း တိတိ)အား နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ်ဓါတ်အားပေးစက်ရုံမှ တောင်သူဖြစ်သူ ဦးဝင်းညွန့်ထံသို့(၃–၃–၂၀၁၆) ရက်နေ့တွင် မင်းဘူး(စကု)မြို့နယ်၊လယ်ယာမြေစီမံစန့်ရွဲမှအခွဲရေ့မှောက်တွင်ပေးအပ်ခဲ့ပါသည်။

၂။ သို့ဖြစ်ပါ၍မြေလျော်ကြေးနှင့်သီးနှံနှစ်နာကြေးရရှိထားသောဧရိယာ(၁.၅၀)ဧကအားကျွန်တော်မှ နေရောင်ခြည်စွမ်းအင်သုံးလျှစ်စစ်ဓါတ်အားပေးစက်ရုံသို့ အပြီးအဝိုင်စွန့်လွှတ်ပေးကမ်းပါကြောင်းနှင့် နောက်နောင် တွင်နေရောင်ခြည်စွမ်းအင်သုံးလျှစ်စစ်ဓါတ်အားပေးစက်ရုံမှ အမည်ပေါက်ပိုင်ဆိုင်ရန်ဆောင်ရွက်မှုများအပေါ် ကျွန်တော် ဦးဝင်းညွန့်မှ ကန့်ကွက်မှုတစ်စုံတစ်ရာပြုလုစ်မည်မဟုတ်ပါကြောင်း၊တစ်ဦးတစ်ယောက်၏ခြိမ်းခြောက်မှု၊ ပြားယောင်းသွေးဆောင်မှုတိုက်တွန်းမှုမရှိဘဲ ကျွန်တော်ဝိုင်ဆိုင်သော မြေအားစွန့်လွှတ်ကြောင်းဝန်ခံဂတိပြုလက်မှတ် ရေးထိုးပါသည်။

(လက်ခံသူ) ဦးကိုကိုကျော် ၁၂/ရကန(နိုင်) ဝ၂၁၈၄၂ တာဝန်ခံ နေရောင်ခြည်စွမ်းအင်သုံးလျှပ်စစ် ဓါတ်အားပေးစက်ရုံ

'ကျွန်ပ်တို့ရရေ့မှောက်တွင်''

ဉ်က် ဉ်က္ကဌ အဖွဲ့ဝင် အဖွဲ့ဝင် ဦးညီညီဝင်း ဦးသိန်းနိုင်ဝင်း Dr ဘစီ အေါ်ဆန်းယုဝင်း မင်းဘူး(ရက)မြို့နယ်လယ်ယာမြေစီမံခန်ခဲ့မှအရဲ့

မင်းဘူး(စကု)မြို့နယ်လယ်ယာမြေစီမံခန့်ခွဲမှုအဝွဲ့

ဦးအောင်မင်း

ရက်စွဲ။၂၀၁၆ခုနှစ်၊မတ်လ ရက်

16.6.2014-D-SSU(443)

13.47 Document of Form (15) for 700 Acres

ပုံစံ-၁၅

မြေလွတ်၊ မြေလပ်နှင့်မြေရိုင်းများစီမံခန့်ခွဲရေးဗဟိုကော်မတီ အစိုးရကခွင့်ပြုသော ဥပဒေနှင့်ညီညွတ်သည့် အခြားလုပ်ငန်းများအတွက် လုပ်ပိုင်ခွင့်၊ အသုံးပြုခွင့်ပြုသော ခွင့်ပြုမိန့်

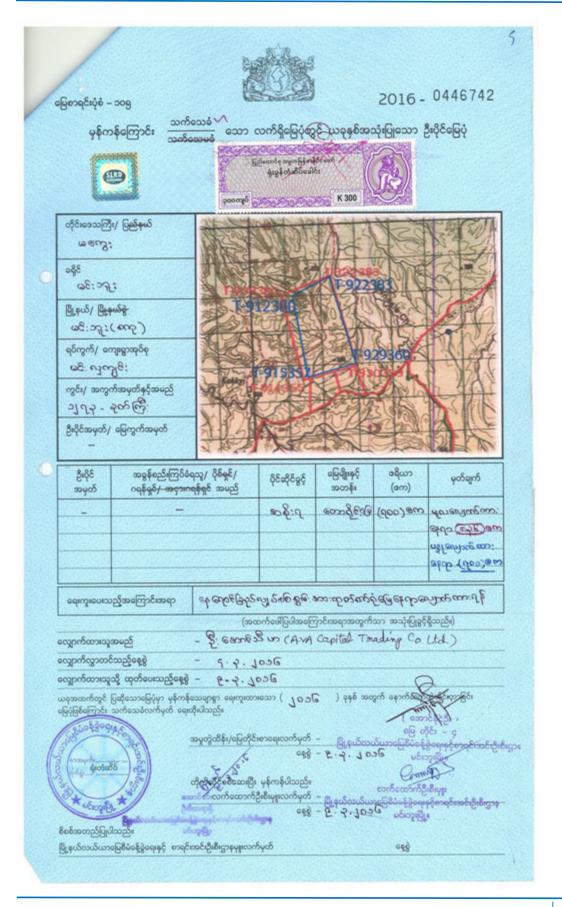
လုပ်ပိုင်ခွင့်၊ အသုံးပြုခွင့်ပြသည့် မြေလွတ်၊ မြေလပ်၊ မြေရိုင်းနှင့်စပ်လျဉ်းသည့် အချက်အလက်များ -----မကွေး----- တိုင်းဒေသကြီး/ပြည်နယ်၊ -----မင်းဘူး-------ရရိုင်၊ -----မင်းဘူး (စကု)----- မြို့နယ်

(၂၀၁၇ မှ ၂၀၄၇ ထိ) နှစ်ပေါင်း (၃၀) နှစ် လုပ်ပိုင်ခွင့်ပြုလိုက်သည်။

ရပ်ကွက်/ ကျေးရွာအုပ်စု	ကွင်း		ဦးဝိုင်/ မြေကွက်	ဧရိယာ		* နယ်နိမိတ်
	အမှတ်	အမည်	အမှတ်	നേ	ဒဿမ	13-13-5
0	J	9	9	9	G	7
မင်းလှကျင်း	၁၂၇၃ ခုတ်ကြီး	-	700	00	သက်သေခံမြေ အတိုင်း	
				700	00	

^{*} သက်သေခံမြေပုံရှိလျှင် "<mark>သက်သေခံမြေပုံအတိုင်း</mark>" ဟု ရေးပါ။

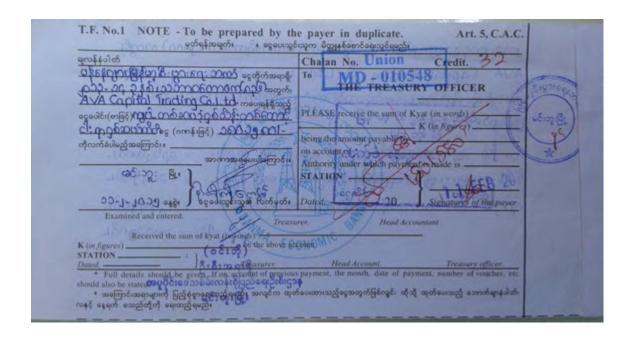
	0	ည်းကမ်းချက်များ	
nc nc	မည်သည့်လုပ်ငန်းအတွက်	နေရောင်	ခြည်စွမ်းအင်သုံးလျှပ်စစ်
	လုပ်ကိုင်အသုံးပြုရန် ခွင့်ပြုခြင်း။	ဓာတ်ဒ	ဘးပေးစက်ရုံ
JII	လုပ်ကိုင်အသုံးပြုခွင့်ပြုသည့်		-၁၀၅.၀၀ ဧက
	မြေလွတ်၊ မြေလပ်နှင့် မြေရိုင်းဧရိယာ		-၂၁၀.၀၀ നേ
	အနက် တစ်နှစ်လျှင်အနည်းဆုံး	! တတိယနှစ်	റാറ.00 നേ
	လုပ်ကိုင်အသုံးပြုရန်သတ်မှတ်ခြင်း။	စတုတ္ထနှစ်	-၁၇၅.၀၀ ဧက
511	ခွင့်ပြုထားသည့်မြေကို သတ်မှတ်ထား ပြောင်းလဲလုပ်ကိုင်လိုလျှင် ကြိုတင်ခွင့်(ပြုချက်ရယူရမည်။	ပုပ်ငန်းမလုပ်ကိုင်ရ။ အကယ်၍
911	သတ်မှတ်ထားသော အာမခံကြေးကို ပေ	ားသွင်းရမည်။	
9 ^a	မိမိလုပ်ကိုင်ခွင့် ရရှိသည့်မြေအတွက် အပြေအကျေ ပေးဆောင်ရမည်။	သတ်မှတ်ထားသော မြေနွ	န်ကို သတ်မှတ်ကာလအတွင်း
Gii	ခွင့်ပြုထားသည့်မြေပေါ် တွင် လုပ်ကိုင် အောင်လုပ်ကိုင်ရမည်။ အကယ်၍ သတ် အစီအစဉ်အတိုင်းဆောင်ရွက်ခြင်း မေ ဘဏ္ဍာငွေအဖြစ် လိုအပ်သလို သိမ်းပ မြေကို ပြန်လည်သိမ်းယူခြင်းခံရမည်။	်မှတ်ထားသည့်ကာလအတွင် ရှိပါက တင်သွင်းထားသော ပူခြင်းခံရမည့်အပြင် လုပ်ပိုင်	း မူလတင်ပြထားသော လုပ်ငန်း အာမခံကြေးကို နိုင်ငံတော် ခွင့်၊ အသုံးပြုခွင့်ပေးထားသော
Ŷ≡	ခွင့်ပြုထားသည့်မြေကို ပြည်ထောင်စုအ ပေးကမ်းခြင်း၊ အဝှားချထားခြင်း၊ အခြ	ားနည်းဖြင့် လွှဲပြောင်းခြင်း သို့	မဟုတ် ခွဲစိတ်ခြင်းမပြုရ။
ดแ	နွင့်ပြုထားသည့်လုဝ်ငနိုးအမျိုးအစားနှင့် လုဝ်ကိုင်ရမည်။	င့် ယင်းနှင့်ဆက်နွယ်လျက်ရှိ	သော စီးပွားရေးလုပ်ငန်းကိုသာ
Gu	ခွင့်ပြုချက်ရယူထားသော လုပ်ငန်းမှဒ ထုတ်ယူခြင်းမပြုရ။	အပ မြေပေါ်မြေအောက်ရှိ	အခြားသယံဧာတပစ္စည်းများကို
100	ခွင့်ပြုထားသောမြေအတွင်း သယံစာ တွေ့ရှိ၍ ပြည်ထောင်စုအစိုးရအဖွဲ့က လို ပြန်လည်သိမ်းယူသည့်အခါ ပြည်ထေ ရမည်။	အပ်လျှင် ခွင့်ပြုထားသောမြေး	အနက် လိုအပ်မည့် မြေဧရိယာကို
SOII	ခွင့်ပြုထားသောမြေအတွင်း နိုင်ငံတော်စ စီမံကိန်းလုပ်ငန်းများ ဆောင်ရွက်ရန် လ ဧရိယာကို ပြန်လည်သိမ်းယူသည့်အခါ အပ်နှံရမည်။	^{ပို} အပ်ခြင်းအတွက် ခွင့်ပြုထား	သောမြေအနက် လိုအပ်မည့် မြေ
၁၂။	လုပ်ပိုင်ခွင့်၊ အသုံးပြုခွင့်ရရှိပြီးနောက် စ ပြန်လည်အပ်နှံရမည်။	ထက်လက်လုပ်ကိုင် အသုံးပြုနို	င်ခြင်းမရှိပါက ဗဟိုကော်မတီသို့
၁၃။	မြေလွှတ်၊ မြေလပ်နှင့် မြေရိုင်းများ စီမံး	န်ခွဲရေးဗဟိုကော်မတီ၏ (၁	- ၁ - ၂၀၁၇)ရက်နေ့ အစည်း
3.	အရားအမှတ်စဉ်(် /ပ)ာ()ဆုံးဖြတ် ဖြစ်ပါသည်။	ချက်အမှတ် <u>၂၀(၄)</u> အရ	လက်မှတ်ရေးထိုး ထုတ်ပေးခြင်း
A CHANGE	කුරු ක්රියා විසින් සහ සම්බන්ධ වෙන සම්බන්ධ වෙන සම්බන්ධ වෙන සම්බන්ධ වෙන සම්බන්ධ සම්බන්ධ සම්බන්ධ සම්බන්ධ සම්බන්ධ ස		0.4
600	ာမှတ်၊ ၁၉/မလရ-၁၆ (၁၁၀/၂၀၁၇)	2000	အတွင်းရေးမှူး
	စွဲ၊၂၀၁၇ ခုနှစ်၊ အအေါ် ဝါရီလ (½º)ရက်	မြေလွတ်၊မြေလပ်နှင့်မြေရိုင်	အတွင်းများရှိခဲ့ရေးဗဟိုကော်မတီ င်းများစီမံခန့်ခွဲရေးဗဟိုကော်မတီ
			1



13.48 Document of 700 Acres Land Premium (Bank Chalan)



13.49 Document of Bank Chalan for Dry Zone Greening Committee



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1002-1004 20 κτη βοικου σε - εξειο 20 20 κτη στο κτη
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13.50 Reserved Trees

Trees declared as reserve are:

Reserved trees	Vernacular or English names	Area in which reserved if standing on land
Pentace burmanica	Thitka ≺Shitja Kashit	
Pentace Griffithii	Thitsho	
Hopea Odorata spp.	Thingan	In the whole of Myanmar
Xylia dolabriformis	Pyinkado Pyin	Sill the whole of Myanina
Acacia catechu	Cutch Sha	
Pterocarpus macrocapus	Padauk)
Dipterocarpus alatus Dipterocarpus turbinatus Dipterocarpus costatus Dipterocarpus pilosus Dipterocarpus grandiflorus Dipterocarpus duperreanus Dipterocarpus macrocarpus Dipterocarpus dyeri Dipterocarpus kerrii	Kanyin	In lower Myanmar
Cinnamomum inunctum	Karawe	In Tavoy Division
Cinnamomum iners	Hmanthin	J
Lagerstro emia Flos Reginate	Pyinma Kamaung Cherry	In Rakhine, Pathane, Daweissein and Tavoy Divisions.
Prunus Puddum, Roxd	Officially	Within a radius of two miles from the Circuit House at Mogok in the Katha Division

13.51 Rates of Timber and Forest Produce Extracted from Public Forest Land

A- Maximum Rates for Timber

A- IVIA	ximum Rates for Timber		
Item	Name of Species	Class	Maximum Rates
No.	(2)	(3)	(4)
(1)	,	, ,	, ,
I (a)	Teak	Unconverted timber under 3'	10 per ton
()		midgirth	'
(b)	Do.	Unconverted timber from 3' to	15 per ton
(5)	23.	3'II" midgirth	10 por ton
(c)	Do.	Unconverted timber from 4' to	25 per ton
(0)	Во.	4'II" midgirth	20 por torr
(d)	Do.	Unconverted timber from 5' to	35 per ton
(u)	Во.		33 per tori
(0)	Do	5'II" midgirth	4E por top
(e)	Do.	Unconverted timber from 6' to	45 per ton
(5)		7'II" midgirth	
(f)	Do.	Unconverted timber from 8' and	50 per ton
		over Midgirth	
2 (a)	Padauk, pyinkado,	Unconverted timber posts.	30 per ton
	thingan, kokko, thitkado,		30 per log or per ton,
(b)	cutch	Logs	as directed by the
	Do.		Conservator.
3 (a)		Unconverted timber logs	20 per log or pen ton,
` ′	In, thitya, ingyin,kanyin,		as directed by the
	thadi, hnaw, yamone,		Conservator
(b)	pyinma	Posts	Per post
(c)	Do.	Poles	
(d)	Do.	Oars or paddles	
(4)	Do.	Logs	
4 (a)	DO.	1093	
7 (a)	All other species except	Posts	
(b)	All other species except	Poles	
(b)	teak		
(c)	Do.	Oars or paddles	
(d)	Do.		
	Do.		

13.52 Notification No. 583/94 (Forest Department)

GOVERNMENT OF THE UNION OF MYANMAR MINISTTRY OF FORESTRY FOREST DEPARTMENT Notification No. 583/94 Yangon, October 26, 1994

The Director General with the approval of the Minister, shall declare in accordance with "The Protection of Wildlife and Wild Plants and Conservation of Nature Areas Law 1994" the following wildlife species as;Category (1) Completely Protected Wild Animals

(a) Figure xxx: Mammals

(a) Figi	(a) Figure xxx: Mammals		
No.	Scientific Name	English Name	
1.	Rhinoceros sondaicus	Javan Rhinoceros	
2.	Didermocerus sumatrensis	Sumatran Rhinoceros	
3.	Tapirus indicus	Tapir	
4.	Budorcas taxicolor	Takin	
5.	Cervus eldi thamin	Brow antlered Deer	
6.	Cervus eldi eldi	Brow antlered Deer	
7.	Elphas maximus	Asian Elephant	
8.	Moschus moschiferus	Musk Deer	
9.	Muntiacus feae	Fea's Barking Deer	
10.	Naemorhedus cranbrooki	Red Goral	
11.	Neofelis nebulosa	Couded Leopard	
12.	Felis temmincki	Golden Cat	
13.	Panthera tigris tigris	Bengal or Indian Tiger	
14.	Panthera Pardus	Leopard	
15.	Panthera tigris corbetti	Indochinese Tiger	
16.	Felis marmorata	Marbled Cat	
17.	Prionodon pardicolor	Spotted Linsang	
18.	Prionodon linsang	Banded Linsang	
19.	Ailurus fulgens	Red Panda	
20.	Orcaella brevirostris	Irrawaddy Dolphin	
21.	Dugong dugon	Dugong	
22.	Canis Lupus	Wolf	
23.	Hylobates hoolock	Hoolock Gibbon	
24.	Hylobates lar	Lar Gibbon/ White – handed	
	Symphalangus sundactylus	Gibbon	
	Presbytis obscures	Siamang Gibbon	
	Presbytis phayrei	Dusky Leaf Monkey	
		Phayre's Leaf Monkey	
	Capricornis sumatraensis	Serow	
	Naemohedus goria	Goral	
	Lutra lutra	The Common Otter	
	Lutra perspicillata	The smooth-coated Indian Otter	
	Aonyx cinera	The small-clawed otter	
	Helarctos malayamus	The Malayan Sun Bear	
	Manis pantadactyla	The Chinese Pangolin	
	Manis javanica	The Malayan Pangolin	
	Bos gaurus	Gaur	

Bos banteng Bos. Javancus	Banteng or Wild Cow
Viverricula indica	The small Indian Civet
Tragulus napu	Chebrotain or Larger Mouse eer
Tragulus javanicus	Lesser Mouse Deer

(b) Figure xxx:Birds

(D) I	(b) Figure xxx:Birds			
No.	Scientific Name	English Name		
1.	Family Phasianidae	Peafowls/Pheasants		
2.	Heliopais personata	Masked finfoot		
3.	Cairina scutulata	White –Winged Wood Duck		
4.	Leptoptilos dubius	Greater Adjutant Stork		
5.	L. javanicus	Lesser Adjutant stork		
6.	Sarkidiornis melanotos	Comb Duck		
7.	Anser indicus	Bar – headed Goos		
8.	Aix galericulata	Mandarin Duck		
9.	Rhodonessa caryophyllaceae	Pink – headed Duak		
10.	Aythya nyroca	Ferruginous Duck		
11.	A baeri	Bear 's Pocard		
12.	Tringa guttifer	Nordmann's Green shank		
13.	Gallinago nemoricola	Wood Snipe		
14.	Ardea insignis	White- belled Heron		
15.	Anhinga melanogaster	Oriental Darter		
16.	Pelecanus philippensis	Spot- billed Pelican		
17.	P. onocrotalus	Eastern White Pelican		
18.	Pseudibis davisoni	White –shoulder Ibis		
19.	Phnchops albicolis	Indian Skimmer		
20.	Grus antigone	Sarus Crane		
21.	G. grus	Comman Crane		
22.	Anthropoids virgo	Demoiselle Crane		
23.	Family Bucerotidae	Hornbills		
24.	Family Accipitridae	Eagle, Kite, Falcon, Hawk, Vulture		
25.	Pitta gurneyi	Gurney's Pitta		
26.	Turdoides gularis	White –throated Babbler		
27.	Crypsirina cucullata	Hooded Treepie		
28.	Yuhina humilis	Myanmar Yuhina		
29.	Sitta victoriae	White –browed Nuthatch		
30.	Family Rallidae	Rails, Crakes		
31.	Gallicrex cinerea	Water Cock		
32.	Phalacrocorax carbo	Great Cormorant		
33.	Ardeidae (all species)	Bitterns		
34.	Upupa epoc	Hoopoe		
35.	Trogonidae (all species)	Trogons		

36.	Pididae (all species)	Woodpeckers
37.	Otis tarda	Great bustard
38.	Strigiformes (all species)	Owls, fish Owls, Barn
39.	Pandion haliaetus	Owl
40.	Falconidae (all species)	Osprey
41.	Caloenas nicobarica	Falcon
42.	Phalacrocorax fuscicollis	Nicobar Pigeon
43.	Sula leucogaster plotus	Indian Shag
44.	Gracula religiosa	Brown Gannet
45.	Ciconidae (all species)	Grackle
46.	Threskiornithidae (all species)	Storks
47.	Anatidae (all species)	Ibises, Spoonbills
48.	Jacanidae (all species)	Geese, Duck
49.	Laridae (all species)	Jacanas
50.	All shore bird species	Gulls, Tern's
		Lapwing, Curlew, Shank,
		Sandpiper, Snipe

(c) Reptiles

(0)	(eptiles	
No.	Scientific Name	English Name
1.	Garcialis gangetius	Gharial or Garvial
2.	Caretta caretta	Crocodile
3.	Lepidochelys olivacea	Loggerhead Turtle
4.	Chelonian mydas	Sea Turtle
5.	Eretmochelys imbricate	Green Turtle
6.	Demochelys coriacea	Hawksbill Turtle
7.	Platysternon megacephalum	Leathery Turtle
8.	Geochelone platynota	Big –headed Turtle
9.	Python reticulatus	Spider Tortoises
		Reticulated Python

Category (2) Protected Wild Animals (a) Figure xxx:Mammals

(a) i	igure XXX.iviairiiriais	
No.	Scientific Name	English Name
1.	Cervus unicolor	Sambhur
2.	Bubalus bubalis	Wild Buffalo
3.	Viverridae species	Wild Cats/Civets
4.	Canidae species	Wild dogs
5.	Herpestidae species	Mangooses
6.	Presbytis species	Leaf-Monkeys
7.	Macaca species	Mecaques/Old World
8.	Tupaia gils	Monkeys
9.	Nycticebus coucang	Tree Shrew
10.	Selenarctos thibetanus	Slow Loris
11.	Mates flavigula	Asiatic Black Bear
12.	Cynocephalus variegatus	Yellow-throated Marten
		Flying Lemur or
		Colugo

(b) Figure Birds

	(b) Figure Birds			
No.	Scientific Name	English Name		
1.	Family- Corvidae	Magpie		
2.	Family- Corvidae	Treepie		
3.	Family- Corvidae	Jay		
4.	Family-Paridae	Tit		
5.	Garrulax species	Laughing Trush		
6.	Yuhina species	Yuhina		
7.	Family- Sittidae	Nuthatch		
8.	Heterophasia species	Sibia		
9.	Irena puella	Fairy Bluebird		
10.	Troglodytes troglo dytes	European Wren		
11.	Cinclus species	Dipper		
12.	Family- Certhidae	Tree creeper		
13.	Prunella species	Accentors		
14.	Oriolus species	Oriole		
15.	Apolonis panayensis	Gloosy Starling		
16.	Sturnus species	European Starling		
17.	Ploceus philippinus	Baya Weaverbird		
18.	Family- Fringillidae (Sub Family-Carduelinae)	Finch		
19.	Family- Alaudide	Skylark		
20.	Family- Zosteropidae	White eye		
21.	Family- eury laimidae	Broad bill		
22.	Family- Capitonidae	Barbet		
23.	Phoenicophaeus species	Malcoha		
24.	Nystyonis amicta	Red-bearded Bee-eater		
25.	Indicator xanthonotus fluvus	Yellow- backed Honey guide		
26.	Family-Psittacidae	Parakeet/ parrot		
27.	Alcedinidae species	Kingfisher		
28.	Collocalia fuciphaga	Edible- nest Swiftlet		
29.	Collocalis maxima	Black – nest Swiftlet		
30.	Ardea purpurea	Purple Heron		
31.	Ardea Cinerea	Grey Heron		
32.	Ardea Species	Heron		
33.	Egretta alba	Great Egret		
34.	Egretta sacra	Reef Egret		
35.	Ardeola bacchus	Chinese Pond Heron		
36.	Ardeola speciosa continentalis	Javan Pond Heron		
37.	Butorides species	Little Green Heron		
38.	Family-Podargidae	Frog Mouth		
39.	Family-Nectarinidae	Sunbird		
40.	Family-Dicaeidae	Flowerpecker		
41.	Family-Pittidae	Pittas		
42.	Family-Columbidae	Green Pigeon		
43.	Family- Compephagidae	Minivets		

(c) Reptiles

No.	Scientific Name	English Name
-----	-----------------	--------------

1.	Crocodylus species	Estarine or Saltwater Crocodiles/
		Mugger or Marsh Crocodiles/
	Siamese	Crocodiles
2.	Emydiade species	Fresh- water Turtles
3.	Testudinidae species	Land Tortoises
4.	Trionychidae species	Soft – shelled Turtles
5.	Veranus species	Monitor Lizards
6.	Python molurus	Rock Python

Category (3) Seasonally Protected Wild Animals

1. List of Wild Animals Protected from June 15th to September 30th.

(a) Figure Mammals

No.	Scientific Name	English Name
1.	Axis porcinus	Hog Deer
2.	Muntiacus muntjak	Barking Deer

2. List of Wild Animals Protected from March 15^{th} to September 30^{th} .

No.	Scientific Name	English Name
1.	Family-Phasianidae	Partridge/Framcolin
	Sub Family-Perdicinae	
2.	Turnix species	Quails
3.	Aegithina tiphia	Lora
4.	Chlorosis species	Leaf birds
5.	Family-Columbidae	Doves
6.	Gallinula Chloropus	Common Moorhen
7.	Porphyrio porphyrio	Purple Swamphen
8.	Family-Pycononotidae	Bulbul
9.	Family-Turtidae	Robin <red stars<chats<forktails<="" td=""></red>
10.	Family-Muscicapidae	Paradise Flycatcher
11.	Family-Cuculidae Sub Family-	Cuckoo <kole< td=""></kole<>
12.	Cuculinae	Nightjars
13.	Family-Capriumulgidae	Drongos
	Family-Decruridae	

By order Director General Forest Department

13.53 Reserved Trees of Myanmar

No	Scientific Name	Common Name	Whole Country	Upper Myanmar	Lower Myanmar
1	Tectona grandis	Teak	**		
2	Pentace burmanica	Thitka	**		
3	Xantolis burmanica	Thitcho	**		
4	Hopea odorata	Thingan	**		
5	Xylia xylocarpa	Pyinkado	**		
6	Acacia catechu	Sha	**		
7	Pterocarpus macrocarpus	Padauk	**		
8	Excoecaria agallocha	Thayaw	**		
9	Shorea obtuse	Thit-ya	**		
10	Shorea siamensis	Ingyin	**		
11	Pinus khasya	Tinshu	**		
12	Dipterocarpus alatus	Kanyin			*
13	Lindera assamica	Karaway			*
14	Cinnamomum	Hmanthin			*
15	Lagerstroemia floribunda	Kamaung			*
16	Prunus cerasoides	Cherry		****	
17	Some medicinal plant	-	**		
18	Some orchid species	-	**		

**** : In this region declared as reserved tree Source: Forest Department Fact and Figure, 2006.

13.54 Diesel Consumption

SKG & RGP Co.,Ltd. Minbu Solar Power Plant Project ကုပ်ငန်းခွင်ဘုံး စက်ယျှနေားများနှင့် အုပ်ထွပ်မှုဘုံး ဖော်တော်ယာဉ်/ ဖော်တော်ရာိုင်တယ်/ မီးတော်များ၏ ထီတနေ့န်းဆသား

	and and and	သီဗာနန်း(လီတာ)			and Calmbrane	P . P
οģ	စက်အမျိုးအမည်	တစ်မှာရီ	anbens	medandu	ထသုံရပြထိလမိုအမား	မှတ်ရက်
1	Excavator	29.5		13 &	SmoS	
2	Dozer	27.3		10 81	BacS	
3	Dump Truck	13.6		38 8€	SouS	
4	Grader	18.2		1.80	SecS	
5	Compactor	13.6		21 &	SacS	
6	Water Bowser	4.546		11 &	కింద	
	Vehicle & Generator					
1	KIA		10	18:	SeoS	17914865
5	1SUZU		5.4	1 &r	Sou5	თუცოჩვნ
3	CANTER		7.1	1 de	SecS	იუყორგნ
A	Misubishi		10	1 &	Socia	იუციჩნნ
5	Hiks(Toyota)		12.1	180	SecS.	თვიჩწმ
5	FAW		12.5	28€	కించ్	199731
7	Toyota(SURF)		5.4	2.8	Book	იგინგნ
8	Missani		4.5	1 &	මහිනී(95)	იჩანგნ
9	Toyota(Vigo)		5.4	1 &c	Soci	రెక్టించిస్తేక
10	Hijet		10	1 81	බහිතේ(92)	იჩინგნ
11	Subaru		4.5	1&	මහිනේ(92)	იგინგნ
12	ISUZU(GDI)		10	1 &	බරාරේ(92)	იგანტნ
13	Motor cycle		1	29 8€	සිරර්ණ්(දිංදි)	
14	ZZO KVA (generator)	9		1 0/1	BacS	
15	65 KVA (generator)	4.5		1 rope	BecS	
16	20 KVA (generator)	1		1 rde	BooS	
17	6 KVA (generator)	1		6-001	SouS	

AMENING HAN GENERAL MANAGER
MINDU ROLAR POWER PLANT PROJECT
SKG & ROPCO, ETD.

13.55 Health and Safety Management Plan (Electrical power)

Subject: Safety Management Plan



Electric Power Engineering Company Limited First Edition, October 2016

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SAFETY POLICY

The Management of *ELECTRIC POWER ENGINEERING Co., Ltd.* is committed to take all reasonable steps within its means to ensure a safe and healthy working environment to its employees, contractor personnel, clients, visitors and anyone else who is affected by the work.

In particular term, our policy is:

- (a) To place the Safety and Health of all employees ahead of the company's commercial interest.
- (b) To arrange, provide and maintain safe system of work for all employees.
- (c) To clearly define areas of safety and health responsibility.
- (d) To provide adequate and proper facilities, equipment and safety apparel and ensure its correct use.
- (e) To provide adequate training, information and instruction on safety and health conditions at the workplace.

With this policy, the Management believes that, with the support of its Employees and Sub-Contractor, we shall strive to continually improve our performance by:

- (a) Prevention of Injury
- (b) Prevention of ill health

All members of the workforce should acknowledge their responsibility for health, safety and welfare in conjunction with the above policy, and provide a positive contribution to the health and safety of themselves as well as others in the workplace.

Htay Myint

Managing Director

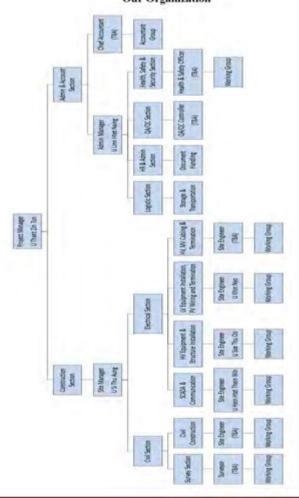
Date: Tuesday, October 4, 2016.

CHAPTER 1

Purpose and Scope

- This Electrical Safety Manual provides guidelines on safety procedures and practices, especially focusing on electrical work.
- It gives direction to implement requirements and achieve compliance with regard to occupational health, safety and statutory guidelines.
- This Electrical Safety Manual is being widely circulated to promote an electrically safe workplace free from unauthorized exposure to electrical hazards for all employees and outsourced personnel so as to prevent accidents to themselves, the public (community) and the company's property.
- The Electrical Safety Manual shall apply to all premises (offices, Sub-Stations and Grids) of the company and electrical network system managed by the company as on date.

Our Organization



CHAPTER 2

Definition

To clarify the intent and meaning of the wording used in this Safety Management Plan, the following definitions are given:

APPROVED

When applied to articles of protective equipment means that these articles have been specified for use by the EPE's and outsourced employees or by the approval authority (i.e. Safety Concerns Committee) constituted by the G.M. (Operations).

AUTHORIZED PERSON

An Authorized person is a person authorized under the EPE Company who is to carry out such duties incidental to the transmission, distribution and use of electrical energy, the nature of which shall depend upon the technical knowledge and experience of the individual and he shall not be less in authority than a lineman, jointer, fitter and mechanic.

EARTH

Earth means the conducting mass of earth or a conductor/ strip/ wire connected to it through very small impedance.

ELECTRICAL EQUIPMENT

It means all the electrical apparatus pertaining to the sub transmission, distribution and utilization of electrical energy.

EMERGENCY

Emergency means that an unusual condition exists which endangers life and or property.

EMPLOYEE

Employee means a person who is in receipt of pay, salary and other benefits from the company time to time in lien of service render by him.

HAZARD

It is any unsafe act or unsafe condition that may lead to injury of persons or damage to property.

ISOLATED

It means physically disconnected from all possible source of supply.

PERMIT TO WORK

It means a form of declaration issued by an Authorized Person (PSC) to another Authorized Person (sub transmission / distribution) for a work to be carried put on any equipment in normal & breakdown conditions.

POWER SYSTEM CONTROL

It means the main controlling agency which controls & coordinates all switching operations of entire network (sub transmission and distribution) of EPE including issue of PTW.

PROTECTIVE DEVICES

It means equipment specially designed for the protection of workmen and included fire extinguishers also.

QUALIFIED

Qualified means any person who has adequate knowledge of the hazards involved in any operation.

WORKING PARTY

It means the persons under the immediate supervision of an Authorized Person.

CHAPTER -3

Dos and Don'ts

Sr.No.	DO's	Sr.No.	Do Not's
ì	Before replacing a lamp or handling a fan, make sure that the supply is switched off.	1	Do not connect single pole switch or fuse in a neutral circuit, but always connect in the live or phase wire.
2	Place Safety Tagging or other warning boards on main switch before commencing work.	2	Do not close any switch, unless you are familiar with the circuit which it controls and know the reason for its being open.
3	Before working on any circuit or apparatus, make sure that the controlling switches are open and locked.	3	Do not touch or tamper with any electrical gear or conductor, unless you have made sure that it is dead and earthed. High voltage apparatus may give leakage shock or flash over even without touching.
4	Always treat circuit as live until you have proved them to be dead, the insulation of the conductor may be defective.	4	Do not work on live circuit without the orders of the authorized person. Make certain that all safety precautions have been taken.
5	Cultivate the habit or turning your face away whenever the flash or an arc may occur.	5	Do not disconnect earthing connection or render it ineffective of the safety gadgets installed on mains and apparatus.
6	Guard against arcs as well as high voltage; remember that burns from arc are very severe.	6	Do not tamper with the meter board and cut- outs, unless you are authorized to do so.
7	See that all the splices and connections are securely made.	7	Do not expose your eyes to an electrical arc. Painful injury may result even with short exposure.
8	Use extreme care when breaking an inductive circuit as dangerously high voltage is likely to result.	8	Do not close or open a switch slowly or hesitatingly. Do it quickly and positively.
9	Thoroughly discharge to earth all cables before working on cores.	9	Do not place any part of your body in circuit either to ground or across the terminal when making a connection or doing operation.
10	Test rubber gloves periodically.	10	Do not touch an electrical circuit when your hands are wet, bleeding from a cut or have an abrasion.
11	Place rubber mats in front of electrical switchboard.	11	Do not work on energized circuit without taking extra precautions, such as the use of rubber gloves. Do not use metal case flash light around apparatus which is energized.
12	Preach and practice safety at all the time. Good work can be spoiled by an accident.	12	Do not wear loose clothing, metal watch straps, bangles or finger rings while working on appliances. Do not hang clothes and such other things on electric fittings. Do not touch the circuit with bare fingers or hand or other makeshift devices to determine whether or not it is live.
13	Work deliberately and carefully. Haste causes many accidents. Be sure of what you are doing.	13	Do not work on pole or any elevated position if there is a live part on it, without the safety harness and rubber gloves and unless the authorized person stand on the ground nearby to direct operation and give warning.

14	Always obey the safety instructions given by the person in-charge.	14	Do not use a ladder without a lashing rope, otherwise the ladder should be held firmly by another person. Do not remove Safety Tags or other signs or interface with safety barriers or go beyond them.
15	Always report immediately to the person in-charge or to any other proper authority of any dangerous condition or a practice, which you may observe.	15	Do not bring naked light near battery. Smoking in the battery room is prohibited. Do not allow visitors and un-authorized person to touch or handle electrical apparatus or come within the danger zone of high voltage apparatus.
16	Ensure that all portable appliances are provided with 3 pin plug and socket connections. Also the metal work of the apparatus is effectively earthed.	16	Do not use a lamp in a metal holder fixed to the end of a loose flexible wire as a portable hand lamp. Do not disconnect a plug by pulling the flexible cable or when the switch is on.

GENERAL SITE SAFETY RULES

- · Wear your safety helmet at all times in the hard hat or helmet zone.
- Wear safety glasses / goggles when chipping, grinding or whenever an eye injury hazard exists.
- · Wear ear plug / mufflers when hacking or whenever a noise induced deafness (NID) hazard exist.
- Wear protective hand gloves when welding, gas cutting or whenever a hand injury hazard (burning)
 exists.
- · Wear safety harness when working at height, edge of structures or whenever a falling hazard exists.
- Wear safety shoe / protective footwear at all times.
- . Do not consume any form of alcoholic drink during working hour
- No horse plays whilst working.
- Do not misuse or remove any fire protection equipment.
- · Observe and obey all warning signs and notices.
- Report all unsafe conditions to your Supervisors or Safety Supervisor.
- Always follow the operating instruction, when in doubt ask your Supervisor.
- Do not remove any barricades or guardrails. If you need to do so, report to your Supervisor or Safety Supervisor.
- Always use grounded electrical equipment and hand tools which are in good condition.
- Do not throw any debris from height.



- Do not take short cut by climbing on pipe line. Use safe and proper access at all times.
- Maintain good housekeeping at all times.
- No entering of restricted area when no authorisation has been given.
- · Obey all safety rules and regulations.
- Report all injuries immediately to your Supervisors or Safety Supervisors.

CHAPTER -4

EARTHING

Definitions-

DEAD: - the term used to describe a circuit / equipment to indicate that a voltage is not applied.

LIVE PART: - a conductor or conductive part intended to be energized in normal use including a neutral conductor

NEUTRAL CONDUCTOR: - a conductor connected to the neutral point of a system and capable of contributing to the transmission of Electrical Energy.

EARTH GRID: - a system grounding electrodes consisting of inter connected connectors buried in the earth to provide a common ground for electrical devices and metallic structures.

EARTH MAT:-a grounding system formed by a grid horizontally buried conductor / plate and which serves to dissipate the earth fault current to earth and also as equipment bonding conductor system.

A. OBJECTIVES OF EARTHING

The basics of safe grounding are

- To design and construct system that is capable to carry current under normal and fault conditions to ground
- 2 The earth path should be capable of handling magnitude and duration of current as per the overcurrent protection of the system without any fire or flash or explosion.
- 3. Persons in the vicinity of earthed structures and installations shall not be exposed to the dangers of electrical shocks.

B. GENERAL GUIDELINES FOR EARTHING

An effective grounding system must satisfy the following conditions: -

- Provide a low impedance path to ground for personnel and equipment.
- Withstand and dissipate repeated faults and surge currents
- 3 Provide ample corrosion allowance to various chemicals to ensure continuous service during life of the equipment being protected.
- 4. Provide rugged mechanical properties for easy driving of earth electrodes with minimum difficulty.
- All non-current carrying metal parts associated with installation shall:-

Be effectively earthed to a grounding system or mat which will limit the touch and step potential to tolerable values.

Limit the ground potential rise to tolerable values so as to prevent danger due to transfer of potential through ground, earth wires and cable sheath fences, pipe lines etc.

Maintain the resistance of the earth connection to such a value as to make operation of the protective device

C. STATUTORY STIPULATIONS

- All medium voltage equipment shall be earthed by two separate and distinct connections.
- As far as possible, all earth connections shall be visible for inspection.
- 3 Each earth system shall be so designed that testing of individual earth electrode should be possible.
- Resistance of earth system shall conform to degree of shock protection desired.

D. SAFETY PRECAUTIONS FOR EARTHING

The precautions mentioned below should be adapted to the extent applicable and possible

- Examine earthing devices periodically and always prior to their use.

 Use only earthing switches or any other special apparatus where provided for earthing. 2)
- 3) Verify that the circuit is dead by means of discharging rod. The indicator itself should first be tested on a live circuit or proving unit before and after the verification.

- Earthing should be done in such a manner that the persons doing the job are protected by earth 4) connections on both sides of their working zone.
- 5) All the three phases should be effectively earthed and short circuited though work may be proceeding on one phase only.

E. EARTHING OF OVERHEAD LINES

All metal supports, all reinforced and pre-stressed cement concrete supports of overhead lines and metallic fittings attached thereto shall be permanently and effectively earthed. For this purpose a continuous earth wire shall be provided and securely fastened to each pole and connected with earth ordinarily at three points in every kilometer, the spacing between the points being as nearly equidistance as possible. Alternatively, each support and the metallic fitting attached thereto shall be efficiently earthed

- Metallic bearer wire used for supporting insulated wire of low and medium voltage overhead service 1
- lines shall be efficiently earthed or insulated.

 Each stay wire shall be similarly earthed unless insulator has been placed in it at a height not less than 3.0 2 meters from the ground.

F. EARTHING AND SHORT -CIRCUITING MAINS

- High voltage mains shall not be worked upon unless they are discharged to earth, after making them dead are earthed, short-circuited with earthing. Short circuiting equipment is adequate to carry possible short circuit currents. All earthing switches wherever installed should be locked up.
- 2 If a cable is required to be cut, a steel wedge shall be carefully driven through it at the point where it is to be cut.
- After testing the cable with DC voltage the cable shall be discharged through 2 mega ohms resistance and 3. not directly owing to dielectric absorption, which is particularly prominent in the DC voltage testing of high voltage cables. The cable shall be discharged for sufficiently long period to prevent rebuilding up of the voltage as per the work instructions.
- The earthing device when used shall be first connected to an effective earth. The other end of the device 4. shall then be connected to the conductors to be earthed.
- Except for the purpose of testing, phasing etc. the earthing and the short-circuiting devices shall remain connected for the duration of the work.

G. REMOVING THE EARTH CONNECTIONS

On completion of work, removal of the earthing and short circuiting devices shall be carried out in the reverse order to that adopted for placing, that is, the end of earthing device attached to the conductors of the earthed mains or apparatus shall be removed first and the other end the connected to earth shall be removed last. The conductor shall not be touched after the earthing device has been removed from it.

H. TESTING AND RECORD

- All earthing systems belonging to the utility shall in addition, be tested for resistance on dry day during the dry season not less than once every two years.
- 2 A record of every earth test made & the result thereof shall be kept by the utility for a period of not less than two years after the day of testing.
- 3. It shall be available to the Electrical Inspector or any officer appointed to assist the Inspector & authorized.



CHAPTER -5

PERTMIT TO WORK SYSTEM

Permit to work system provides in-built safety to workmen engaged in electrical work.

PERMIT TO WORK LINTRODUCTION

The "Permit to Work & Safety Tagging System (PTW & STS)" is the process, introduced in EPE: -a power distribution utility- to put in place standard working practice which will promote a culture of safe working among its personnel while carrying out any work in electrical equipment/system. This in turn will ensure safety of personnel, safety of equipment and safety of society at large.

This document defines the process of obtaining a permit to work on a certain electrical equipment of EPE and also puts in place the usage of the relevant "Tags" to designate the electrical equipment under maintenance or during any activity that puts off the circuit or abnormal conditions.

EPE system requires 'Power System Control (PSC)', Distribution, Network, Grid Maintenance and Projects personnel to coordinate and to carry out the work on the equipment / system. PTW & STS then becomes a "Safety Contract" between all the personnel and facilitates a safe working environment.

The STS is used in conjunction with PTW or otherwise to provide visible cautions / signage about the area and dangers associated with handling of the electrical equipment / system.

The team whose are involved "The Project Manager/ Engineer, Assistant Project Manager/ Engineer, Safety-Officer/Supervisor and the Requester" of the permit shall assess and ensure all necessary safety precautions and the following conditions before issuing the permit to work;

- a. Nature of work to be perform
- b. Location where the work is to be carried out
- c. Equipment and machinery involved
- d. Duration of the work carried out;
- e. Presence of inherent or potential hazards;
- Provision and use of personal protective equipment;
- g. Provision of firefighting access and facilities; and
- h. Other precautionary measures to be taken

For methods of work: Contractors on site to acquire a set of safe work practices related to their work on site.

Every Contractor and Sub contractor, self-employed person, must conduct a risk assessment in relation to the safety and health hazards associated with any routine and non – routine work carried out on site. All reasonable practicable measures must be taken to eliminate any foreseeable risk to any person who may be affected by their undertaking.

If the risk cannot be eliminated, reasonable practicable measures must be taken to minimise the risk as follow in decreasing order of preference,

- 1. Substitution;
- 2. Engineering control
- 3. Administrative controls
- 4. Provision and use of Suitable Personal Protective Equipment

PERMIT TO								
Sr.No								
PTW No	**********							
PTW Issued by-								
Name of the Electr	ical equipment	10						
Name of the Statio	ń / Line		Voltage lev	el		4-0		
PTW Issued to		**********	***********	******	*******			
DESCRIPTION			REMAR	KS				
Nature of work to	be carried out on the equip	ment / System						
Equipment / Line	isolated at location (s)							
Grounding Locat								
DNoP Tags place	d at Location(s)							
Particulars of the	keys handed over, if any							
NOTE: All Othe	er equipment(s)/ System(s) a	re Live						
Time to clear in	emergency (hours)							
Validity of PTW	Į.				From		To	
			Date/	Time	Brogge -			
			Name		Design		Time	Sign
Authorized Person	Handling over PTW				1777			
Authorized Person	Receiving PTW							
If PTW issued to	more than one person, indicat	e the other PTW Nos	s.					
Extension of the	PTW required- YES/NO (If Y	ES, fill the details b	elow)					
Reason for exten	sion				-			
New Validity of	PTW				From		To	
			Date / Ti	Date / Time				
			Name		Design.	Time	Sig	gri
Authorized Perso	on requesting extension of PTV	V						
Authorized Perso	on approving the extension of I	PTW						
Authorized Perso	on handing over extended PTW	/						
Transfer of PTW	in case of - Shift Change / Pe	rmit Holder going of	f duty due to an	y unavo	idable reason	or to Projec	t Personnel	le T
			Name		Design	Time	Sig	gri
PTW Transferred	i by				1			
PTW Transferred	í to						- 1	
specified on this I	nat all men under my charge le PTW and that all the tools, te and the PTW be cleared.							
Name	Designation Sign D					Tir	ne	
		11						
						-		
All isolation points		Yes 🗆		No				
Safety Zone is crea		Yes				9		
	ve gears are available			- 118	Yes		No □	
Personnel Protectiv	a Gaine an a a summer							
	y Hamess, Rubber Gloves, Sa	fety Shoes, etc)						

PERMIT TO WORK # EPE Form NO Zone / District Date PTW No. Issued By Time 120 mm Taken Over by Time Authorized by Name of Equipment Nature of Work PTW Cleared at/ Transferred to

70 mm

POCKET PTW FORMET

INSTALLATION WORK PERMIT SYSTEM

Following Form shall be used for Civil / Long duration works at Grid Substations / Transmission & Sub-Transmission Lines.

있는데 10mm () 20mm () 10mm () 1	tion work at Grid Substations / Transmission & Sub-
Transmission Lines	
Form No. –	
Work Permit No. –	
Name of the Grid Substation –	
Name of the Transmission Line –	
Voltage level (KV) _	
voltage level (IX v)	\$22 \$22 \$23 \$23 \$23 \$23 \$23 \$24 \$25 \$24 \$25
Zone	
District -	
System	
Location -	
Date –	
Installation Work Permit Issued by –	
Installation Work Permit Issued to -	Employee Nos –
No. of Tags – DnoP –	Caution –
Type / Nature of work –	
The state of the s	
Type of Association of working party with EPE – E	
Name & Designation of the Working Party Supervi	
	1991. To the contract of the co
Installation Work Permit Transferred to -	
(Wherein the employee is transferred on long leave	a atc)
Installation Work Permit Cleared by –	Employee Nos -
histaliation work remit cleared by	
Any Other Observation –	
They office constitution	
MOTOR PROPERTY DESIGNATION OF THE PROPERTY OF	
,	

SAFETY TAGGING SYSTEM

SAFETY TAGGING SYSTEM GUIDELINES

The safety tagging system is intended to achieve following standards in the working lives of the personnel

- a) Safety of the personnel and the public at large
- b) Safety of equipment & property
 c) Designate the abnormal conditions in the circuit of EPE network

All circuits, equipment & systems are deemed to be in energized state unless the tags are placed to designate

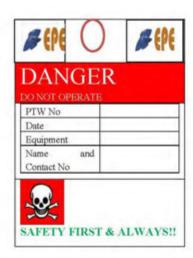
TYPES OF SAFETY TAGS AND THEIR USAGE -

Do Not Operate (DNoP) Tag Caution Order Tag

DO NOT OPERATE (DNoP) TAG

- · DNoP tags are associated with the outage of the circuit/equipment for which the PTW is obtained from Power System Control.
- · DNoP will have the same number as the PTW for the circuit/equipment.
- · DNoP has to be filled by the permit holder and to be necessarily placed at all the isolating/grounding points for the circuits/equipment that are taken out or isolated from the system & are not energized.
- . The Permit Holder to notify the Power System Control about the number of DNoP tags placed on isolating/grounding points for the circuits/equipments that are taken out or isolated from the system & are not energized.
- . DNoP tags are to be attached to open switches, breakers, isolators, disconnects. Jumpers, taps, GO Switches & other means through which known sources of electric energy may be supplied to the lines & equipment.
- The DNoP tag acts as a lock. Once the tag is attached to a piece of equipment that equipment cannot be connected to known sources of electric energy; not even for test purposes.
- · A personnel carrying out isolation operations of the particular equipment is responsible for placement & removal of DNoP tags.

The DNoP tags are of specific dimensions & are for the purpose of preventing the personnel from charging the equipment under outage hence have "RED" colour with the danger mark (skull & crossed bones).







Back

Length – 100 mm Width - 80 mm

CAUTION ORDER TAG:-

A Caution Order tag may be used in conjunction with a PTW or Independently.

A Caution Order shall be used to provide general information on the status of new, abandoned, or abnormal

equipment, cables, abnormal isolating features, also Transformer and breaker alarms.

The caution order is used to notify any abnormal condition of the equipment and thus technically has a tag that is yellow in color & with specific dimensions.

1. PURPOSE

Caution Order tag is used to indicate abnormal conditions such as failure, hazards, relay inoperative, equipment not in service, temporary changes in operating rules etc. This tag can be placed on either energized or de energized equipment. This Caution Order tag may be issued either to a person or placed on equipment to designate a particular operating condition.

2. DESIGNATING EQUIPMENT FAILURE / DEFECT.

Equipment failures/defects are designated by placing Caution Order tags on control switches, valves etc. until the equipment is taken out for inspection and repairs.

3. DESIGNATING HAZARDS, CAUTIONING AGAINST OPERATION OF SWITCHES, DISCONNECTS, VALVES AND PUMPS (WHICH PROHIBITS THE OPERATION OF EQUIPMENT)

4. ISSUING TO A PERSON

The Caution Order may be issued to a person when he/she is working near energized lines or equipment and there is a possibility that the working personnel accidentally come in contact or foul the equipment.

While getting a caution order issued, the working party should indicate to the operating party the possible hazards by way of nature of caution and by way of nature of work.

For transmission lines with auto-re-closing facility, when a Caution Order of this nature is issued, the reclosing gear is to be made INOPERATIVE.

NOTE: - It should be clearly understood that a caution order issued to a person neither authorizes him / her to

operate the equipment nor does it prevent him / her from operation or energizing of the equipment except when an automatic trip out occurs.



Width - 80 mm

RESPONSIBILITIES -

Permit holder is responsible for

- Contacting the Power System Control to avail the applicable permit.
- In case of manned grid stations operation staff will contact PSC for availing the permit and subsequently hand over the same.
- Co-coordinating equipment conditions & work activities with all job site supervisors.
- · Communicating the conditions of circuits or equipment to all crews/Job site supervisors.
- Informing Power System Control of any permit transfers to other authorized personnel. In manned grid substations this notification will be done through operation staff.
- Notifying Power System Control if there is a change in the scope of work or job conditions.
- · Notifying Power System Control if there is a change in the scope of work or job conditions
- Contacting Power System Control to report clear of the applicable permit as soon as the work is completed. In manned grid substations, the permit holder will return the permit to the operation staff who in turn will clear the permit to PSC.
- Advising Power System Control of any special circumstances as a result of the work performed that
 may affect the operation of the system.
- Ensuring that it is safe for the circuit/equipment to be re-energized.
- Returning all switching devices & equipment back to the configurations found when accepting the permit.
- Reviewing & answering that all applicable work practices are followed.
- Responsible for the safety of all personnel at the work location & for the overall coordination & supervision of the job.

Power System Control is responsible for

- Ensuring that the person requesting the permit is authorized to receive the permit
- Authorizing permits.
- Audit the implementation & the record upkeep of the PTW & STS with the help of the concerned DM / APSM / APM.

The Functions / Sections / Groups that utilize the permit & tagging system are responsible for

- · Ensuring that revisions / updates to the authorized personnel list (tagging list) are completed.
- · Ensuring that initial training & annual refresher training of permit & tagging procedure are completed.
- Ensuring that personnel they have authorized are trained & qualified as permit holders.

CHAPTER - 6

SAFETY INSTRUCTIONS

This section gives details of safety measures and recommendations for providing safe working conditions at site.

INSPECTION OF SAFETY EQUIPMENTS

All equipment used for working on overhead lines and apparatus shall be surveyed every month by a responsible official and he shall take random checks; on the equipment to satisfy himself that the equipment is in good condition paying special attention to the safety equipment such as safety belt, gloves, ropes used for hoisting etc. as per schedule. Any replacement due to wear and tear shall be made immediately. Every authorized person / in charge of a working party before commencing his work shall ensure that all equipment being used are in safe condition and not weakened by deterioration, abrasion etc.

He shall not permit the work to be carried out if for any reason he is in doubt that the equipment is unsuitable or deteriorated to the extent that it is likely to cause a hazard

A. SAFETY INSRUCTIONS FOR WORKING ON MAINS AND APPARATUS UP TO AND INCLUDING 650 VOLTS.

WORK ON DEAD MAINS AND APPARATUS

Only Authorized person is authorized to work on live low and medium voltage mains and apparatus, all mains and apparatus to be worked upon shall be isolated from all sources of supply before starting the work, proved dead, earthed and short circuited. For earthing and short-circuiting only appropriate methods (earthing chains, earthing rods etc.) should be used. Measures shall be taken against, the inadvertent energizing (back charging) of the mains and the apparatus.

WORK ON LIVE MAINS AND APPARATUS

Only competent, experienced and authorized persons shall work on live mains and apparatus, and such persons should take all safety measures as may be required under the Indian Electricity Rules 1956. Safety Tags shall be attached on or adjacent to the live apparatus and at the limits of the zone in which work may be carried out. Immediately before starting work, rubber gauntlets, if used, shall be thoroughly examined by authorized person / user to see whether they are in sound condition. Under no circumstances shall a person work with unsound gauntlets, mats, stools, platforms or other accessories, proper testing should be carried out as per manufacturer guidelines.

CONNECTING DEAD MAINS TO LIVE MAINS

When dead mains are connected to live mains, all connections to the live parts shall be made last, and in all cases the phases sequence should be checked to ensure that only like phases are connected together by testing Phase Sequence tester Rod & Phase Sequence Meter for HT & LT respectively. Before inserting fuses or links in distribution pillar controlling the cable on which a fault has been cleared, each phase shall first be connected through a test switch fuse lower than the value of the load.

SAFETY INSTRUCTIONS FOR WORKING ON MAINS AND APPARATUS AT VOLTAGES ABOVE 650 VOLTS.

GENERAL

1) All high voltage mains and apparatus shall be regarded as live and a source of danger and treated accordingly, unless it is positively known to be dead and earthed.

- 2) No person shall work on, test or earth mains or apparatus unless covered by a permit to work and after providing the mains dead except for the purpose of connecting the testing apparatus etc. which is specially designed for connecting to the live parts.
- 3) The operations of proving dead, earthing and short-circuiting of any mains shall be carried out only by an authorized person under the instructions of the person in charge of the work.

4) While working on mains, the following precautions shall be taken:

No person, after receiving a permit to work, shall work on, or in any way interfere with, any mains or conduits containing a live mains except under the personal instructions and supervision, on the site of work, of competent person.

When any live main is to be earthed, the procedure prescribed scrupulously followed.

The earths and short circuits, specified on the permit to work shall not be removed or interfered with except by authority from the person in charge of the work.

MINIMUM WORKING DISTANCE

No person shall work within minimum working distance from the exposed live mains and apparatus. The minimum working distance depends upon the actual voltages. Exposed live equipment in the vicinity shall be guarded off so that the persons are working on the released equipment in service. The guarding shall be done in such a way that it does not hinder the movement of the maintenance personnel. If necessary a person for observing safety could be posted.

All barriers, shutters etc. of high voltage equipment must always be kept locked except when required for carrying out work under a permit to work (Safety Tagging) wherever possible. Keys controlling locks, except those in the possession of specified officials, shall be kept in safer place in control room or zonal office. The controlling / movement of keys shall only be retained by authorized persons / site in-charges.

STATUTORY CLEARNCES

Minimum Clearances (in meters) between Lines when crossing each other

System voltage	11-66 KV	110-132 KV	220 KV	400 KV	800 KV
Low & Medium	2.44	3,05	4.58	5.49	7.94
11-66 KV	2.44	3.05	4.58	5.49	7.94
110-132 KV	3.05	3.05	4.58	5.49	7.94
220 KV	4.58	4.58	4.58	5.49	7.94
400 KV	5.49	5.49	5.49	5.49	7.94
800 KV	7.94	7.94	7.94		7.94

Clearance From building from EHV Lines.

Clearance From building from Eff v Elics.	
Vertical Clearance	
Voltage up to & including 33kV - 3.7m	
For EHV line - 3.7 m plus 0.3 m for additional 33kV	
Horizontal Clearance	
For high voltage lines up to & including 11kV - 1.2m	
For high voltage line above 11kV up to 33kV - 2.0m	
For EHV line 2.0 m plus 0.3 m for every additional 33 kV	

Clearance above the ground of the lowest overhead conductor including service lines erected across road/street:

Low & medium voltage line - 5.8 m	
High voltage line - 6.1 m	
Clearance shows ground of overhead line conductor greated also where other than along or coross street	



For low, medium & high voltage up to 11kv (Bare) - 4.6 m

For low, medium & high voltage up to 11kV (insulated) - 4.6 m

For high voltage above 11 kV - 5.2 m

For EHV lines - 5.2 m plus 0.3 m for every 33kV

OPERATIONS OF SWITCHES AND ISOLATORS

GENERAL

No high voltage switch, isolator or earthing switch shall be operated or earth connection attached or removed without the sanction of an authorized person, except in the case of moveable earth connection on high voltage overhead lines, which may be fixed or moved by an authorized person under the direction of the permit to work, which authorizes him to carry out the work.

When a switching operation has to be carried out, the authorized person shall convey his instructions to the operating person detailed to carry out the operations. On receipt of the instructions the Operating person shall notify the authorized person of any objections to the carrying out of such instructions, the authorized person shall then decide whether the work is to proceed.

The authorized person shall immediately after this, inform the Power System Control of his instructions and the objections if any. The authorized person shall also inform the same receiving station of the operations he is to perform just prior to carrying them out, with objections if any. The procedure for delivering the message and logging them shall be carried out in all cases. The two messages shall be checked by Shift in charge / Shift Officer of Grid / PSC and clearance given for carrying out the work, if in order. On completion the authorized person shall report back to the grid station & perform operations according to the guide lines of Power System Control.

EMERGENCY

In case of danger to life, switches may be opened without instructions but in no case must a switch be closed (as per PTW guidelines) except with previous written instruction or special permission from an authorized person or when a switch trips on temporary faults, and then only twice in succession.

When any operation is carried out in an emergency in case of grave danger without the permit to work being issued or without emergency authorization or in case of trapping due to temporary faults the grid station from which supply is received shall be informed as soon as possible and the message logged on log sheet & GDR. The number of the message on the log sheet shall be marked in the report of occurrence.

Such messages shall also be conveyed immediately to the APSM / DM or the person authorized by him in this behalf.

TESTING OF MAINS AND APPARATUS

No person shall apply test voltage to any mains unless he has received a permit to work and has warned all persons working on the mains of the proposed application of the test voltage. If any part, which will thus become alive is exposed, the person in charge of the test shall take due precautions to ensure that them exposed live portion does not constitute danger to any person. It should also be ensured before the application of test voltage, that no other permit to work has been issued for working on this main.

AUTHORIZATION FOR TESTING

When equipment is isolated from the mains supply for the testing, the official responsible may give sanction for the operation of switches, isolators, earthing switches, earth connections etc. and for the application of testing supplies to the isolated section, without reference to him. The person in charge of the testing then becomes wholly responsible for the safety precautions within the isolated sections but no switch or isolator connecting any isolated sections to the main supply system shall be operated without direct sanction of the responsible official except for purpose of obtaining testing supplies.

DEVICES FOR PROVING MAINS & APPARATUS DEAD

HIGH VOLTAGE INDICATORS RODS (NEON TESTER)

High voltage neon lamp contact indicator rods are used for proving exposed mains and apparatus dead. Each rod is fitted with an indicating neon bulb, (it should always be tested before using) which glow, when the contact end of the rod comes in contact with exposed live parts. Each rod is clearly marked for maximum voltage on which it may be safely used and shall not, under any circumstances, be used on higher voltages.

USE OF HIGH VOLTAGE INDICATOR RODS

Contact indicator and phasing rods are provided for phasing and proving exposed mains and apparatus dead. A set consists of two rods connected in series by a length of insulated rods. Both rods are fitted with contact tips and indicating tubes. When the contact tip of one rod is applied to exposed live part and that of the other to earth or other exposed live part provided there is sufficient voltage difference between the indicating tubes should glow. Each set of rods is normally marked for the maximum voltage on which it can be safely used and shall not, under any circumstances, be used on higher voltages.

TESTING AND MARKING OF DEVICES

It shall be ensured that all devices for proving high voltage mains and apparatus dead are marked clearly with the maximum voltage for which they are intended and should be tested periodically as per manufacturer guidelines.

WORKING ON CABLES

IDENTIFICATION OF CABLES TO BE WORKED UPON

A cable shall be identified as that having been proved dead prior to cutting or carrying out any operation which may involve work on or movement of the cable, A neon-contact indicating rod, induction testing set may be used for proving the cable dead. Simply with the help of neon-contact indicating rod cable shall be checked after switched off.

WORKING ON HIGH VOLTAGE CABLE

Work on high voltage cables shall be only permitted on receipt of the permit to work. In addition to the precautions taken under the person carrying out such work shall be personally instructed on the spot by an authorized person who shall first satisfy himself that the cable has been made dead isolated and earthed and if possible, the switch controlling the cable drawn from the cubicle and suitable danger boards installed in position.

WORKING ON UNDER GROUND CABLES

- For isolation of cables open at least one set of disconnecting switches or fuses in every source through which
 the cables can be made alive including leads to the cable of potential transformers and then discharge the cable
 to earth.
- Cable route indicators should be provided and cable route records maintained. It would access the particulars of all underground cables correctly in the vicinity of the faulty cable.
- Use of sharp edged crowbars or pick axes should be avoided during excavation while locating the faulty cable or laying new cable.
- 4) All the cables in the vicinity in the fault area shall be exposed and identified to establish the identification of the faulty cable.
- 5) Before any high voltage joint of chamber is to be opened in circumstances where it is not desirable to spike the cables or earthing the joint or chambers, the authorized person shall satisfy from cable route record and, if necessary, by approved tests that the joint or chamber is associated with the particular cable which has been made dead and it is safe to work on it.
- 7) Employees shall not step on live cables even though those are insulated and enclosed in a lead sheath. Tools and materials shall not be rested against the sheath of the cable.

WORKING ON HEIGHT



Before any work is began on any pole or tower of a high voltage overhead line, which is adjacent and parallel to any other high voltage overhead line with conductors "alive" or any pole or tower which supports, more than one set of high voltage conductors "alive" the following special precautions, in addition to the foregoing, shall be taken in every case:

- 1) The authorized person in charge of the work shall ensure that each workman who is to work on the poles or towers is definitely informed and thoroughly understands on which set of conductors the work is to be carried
- 2) A "red" flag / Caution Tape (or lamp at night) which are available with maintenance crew, shall be displayed on the side of the pole or structure on which the conductors are "alive"
- 3) Work shall not be performed on any higher position of tower / line when a line below is energized.

WORKING ON HIGH VOLTAGE APPARATUS AND OVERHEAD LINES

Work on high voltage apparatus:-

Before commencing any work of repairs, alterations, extensions, additions or cleaning of high voltage apparatus, the following operations shall be carried out in sequence.

1) The apparatus or cable or transmission line shall be switched out and isolated from all points of supply under

- the direction of the authorized person.
- 2) The switches, isolators and control links shall be locked in position by the keys provided for the purpose
- 3) Safety Tags (as per PTW guidelines) (see chapter 5) shall be placed at all points where apparatus can be made alive.
- 4) All apparatus shall be discharged to earth and efficiently connected to earth near all points from which supply could be connected to it or between such points and the place of the work. All earthing shall be done by the approved methods. The earthing leads used for earthing shall be of adequate cross section according to voltage levels to enable passage of the fault current without fusing. Safety Tags shall be removed by an authorized
- 5) Earthing shall also be carried out at the point of work by means of temporary earths on each phase and in no case shall the temporary earths be removed from two phases simultaneously while the work is being carried out.

WORKING ON LOWER PORTION OF TOWERS CARRYING LIVE LINES

Painting and other work on the lower portion of towers or supports carrying live lines, and above the anticlimbing device may be permitted under the permit to work card provided that suitable precautions are taken to ensure that all persons carrying out work are acquainted with the distinctive marks (caution order) that have been placed on the tower and the support. For this purpose all the towers and the supports shall be distinctly marked either by color or by other positive manner above which no operation shall be carried out without making the line dead. Distinctive marking shall be so provided that it is not possible to get nearer than a minimum distance of 6 feet from a live conductor.

WORKING ON DEAD LINES AND EQUIPMENTS

GROUNDING OF LINES AND EQUIPMENTS

- (1) Before doing any work on dead lines or equipment where there is a possibility of their becoming energized from any source, such line or equipment should be short circuited and grounded between the location of work and all possible sources of energy.
- (2) Conductors to be grounded should be checked for potential by an approved method before the ground is installed.
- (3) Temporary grounding cables shall be flexible stranded copper not less than No.10 and shall be equipped with approved clamps at each end.
- (4) Grounding cables should be inspected before each use.
- (5) When grounding lines or equipment, the connection to the ground shall be made first and that to the circuit or equipment last. In removing grounds, first remove the connection to the circuit or apparatus and then remove the ground connection. Insulated hot-sticks should be used in making the ground connection to the circuit or apparatus
- (6) Grounds shall be placed on all phases even if work is to be carried out on one phase only.
- (7) For work on the line, ground shall be placed at nearest tower on each side of the point of work, but in no case should earths be more than six spans apart. As an additional safety measure, if possible, in addition to above grounds, line should also be grounded on the tower where the work is to be carried out.

- (8) When work is to be carried out on lines of all-insulated construction and grounding point is not provided at point of work, temporary grounds shall be connected at point of work to an efficient portable earth stake driven into the ground. The line shall also be grounded at the nearest line grounding point on either side of the point of
- (9) Where two or more crews are working independently on the same line or equipment, each crew shall properly protect themselves by placing their own temporary grounds.

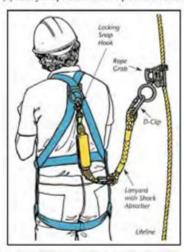
LINE WORK ON POLES AND TOWERS

- (1) Before climbing any elevated structure, every employee shall first assure himself that the structure is strong enough to sustain his weight safely.
- (2) If poles or cross arms are apparently unsafe because of decay or unbalanced tensions of wires on them, they shall be properly braced or guyed before they are climbed.

 (3) Linemen shall wear their safety lines while working on the poles and towers.

 (4) Wire hooks shall not be attached to linemen's belts.

- (5) Safety straps should not be placed above the top cross arm when it is at the top of the pole.



WORKING ON LINES UNDER ADVERSE WEATHER CONDITIONS

In the event of the near approach of lightning or thunderstorm all work on overhead lines shall cease immediately.

WORKING ON SWITCHING OPERATIONS

- 1) Every message relating to the switching operations on the high voltage system shall, wherever practicable, be written down. Every such message shall be repeated in full to the sender to ensure that the message has been accurately received (as per PTW guidelines) (see chapter-5)
- A record of high voltage switching will be entered in station log.
 All breakers and isolators should bear lettering or sign boards to indicate the circuit they control.
- 4) When releasing the electric circuits, breakers or equipment for work on them, the associated breaker and disconnecting switches shall be opened in the following order:
- 4.1 The breaker will be opened first.
- 4.2 The isolator will be opened, but before operating the isolator, it shall be made sure that the breaker is open.
- 5) After opening isolators and air break switches, check carefully to see that all blades are in full open position.
- 6) When lines and circuits are taken out of service, the breaker control circuit should be opened either by operating the opening device or by removing the control circuit fuses
- 7) If the circuit is controlled by automatic re-closing breaker, the re-closing mechanism shall be made inoperative.
- 8) Isolators shall be closed in firm positive manner, using sufficient force to make full contact of blades.

9) Before removing fuses, switches should be opened if provided. Removing fuses from inductive circuit carrying current without opening the switch is hazardous.

WORKING IN SUB STATIONS

- 1) Safety Tags should be placed on all enclosures of high voltage equipment and wherever necessary warn persons of the presence of high voltage equipment. The different safety audits to be conducted as per guidelines
- 2) Gates in switchyard fences and doors to switch gear and other enclosures containing live equipment, or other hazards, should be kept locked at all times except when Authorized Person entered for working inside
- 3) When carrying ladders, pipes, conduits, reinforced rods and other long material in to stations, switchyards, switch gear rooms and other places where there is a danger of touching the live parts, the material should be held by two men, one at each end, and carried in the hands and not on the shoulders.
- 4) When working in the vicinity of circuit breakers or buses use every precaution to avoid injury from arcing.
- 5) Area is to be guarded off wherever possible, where men are working on H.T. equipment.

WORKING ON TRANSFORMER

- 1) When work is to be carried out on a transformer, both low and high tension breakers and isolators shall be opened. Similarly, during isolation of transformers to which potential transformers are connected, such potential transformers shall be isolated.
- 2) Before starting any work on a transformer installation, it is important to check carefully for back feed, abnormal voltage or other dangerous conditions. Unusual circuit conditions may exist which require special consideration.
- 3) Whenever transformers are replaced, the new transformer should be checked carefully for voltage, polarity and phase sequence before taking into service.
- 4) Area should always be cordoned off & Safety tagging should be done prior to starting the job on transformer.

WORKING ON INSTRUMENT TRANSFORMERS

- 1) The cases of all instrument transformers should be grounded.
- Current transformers secondaries should never be open circuited when current is flowing in the primary.
 The secondary circuit of current transformers should be connected to ground at all times when the transformer is in service.
- 4) Potential transformers secondaries should never be shorted.
- 5) The low voltage winding of potential transformers should always have one side permanently and effectively grounded.

WORKING ON POLE MOUNTED SUBSTATIONS (DISTRIBUTION TRANSFORMER)

The following precautions shall be observed in case of carrying out work on the pole-mounted sub-stations (i.e. Distribution transformers)

- 1. The work shall be carried out under a permit to work.
- 2. Before changing or replenishing oil or painting, all exposed live parts of the transformers shall be disconnected.
- 3. While working on poles that have lightning arresters installed on them, the workman shall avoid touching lightning arresters and lightning arresters jumper.

WORKING ON FILTERATION OF OIL OF TRANSFORMER

When carrying out work of filtering of oil on transformers, care shall be exercised that all exposed live conductors are suitably barricaded so that no person and no apparatus such as flexible hose etc. that is being handled comes in contact with the live parts. All such work shall be carried out under the direct supervision of an authorized person.

WORKING ON CIRCUIT BREAKERS

For isolation purposes it shall be ensured that

- 1. Disconnecting switches on sides, control switches, relay trip blocking switches and compartments doors are
- 2. Mechanical blocking, wherever necessary, to prevent unauthorized movement of the mechanism is installed
- 3. In OCBs trip-free feature should be blocked.



WORKING ON METAL CLAD, SWITCH GEAR AND CONTROL PANEL

- While working on manually operated panel mounted circuit breakers when the operating handle is on the front and the circuit breaker is on the rear of switchgear or on another panel, a danger notice shall be placed on the handle.
- 2) When the work is to be carried out on the bus bars spouts the following operations shall be carried out.
 - The section of bus bars on which the work is to be carried out shall be made dead and shall be isolated from all points of supply.
 - The isolating arrangements and the shutters of live spouts shall be locked so that they cannot be operated.
 - Where duplicate switches in one tank or on load bus bar isolators are installed and is impossible to
 isolate them from all points of supply, then all switches and selectors that could be closed on the bus
 bars on which work is to be carried out shall have their mechanism locked in the open position and the
 closing mechanism shall be made inoperative.
 - The bus bar shall be earthed with approved earthing equipment at a panel other than at which work is
 to be done and the isolated section of the bus bars.

WORKING ON OUTDOOR STRUCTURE

BUS BARS

- In isolating the point of work from supply, care shall be taken to disconnect right points in case of sectionalized, and/or mesh schemes of bus bars.
- Isolators/switches closing on the section of bus bars on which work is to be carried out shall be locked in open position and the closing mechanism rendered inoperative.
- 3) While working on the outdoor structure at a height more than 3 meters from the ground level, safety equipment such as safety belts, handling, etc. should be used.
- 4) No person shall stand directly below the place of work when the work is in progress in the outdoor structure to avoid any tools or bolts or nuts or clamps etc. falling on their heads.
- 5) Helmets should be invariably used while working on the outdoor structures, on the outdoor structures, both by the men stationed at the ground and those on the structures.

CAPACITORS

- Every capacitor shall be treated as hot until proved otherwise. Capacitors stores energy and are not necessarily dead when disconnected from the line. Once charged, a capacitor may retain its charge for several hours after it has been disconnected.
- 2) When a capacitor is to be worked on, first open all cutouts or disconnecting devices to the capacitor, then wait for at-least five minutes for the internal resistors to reduce the voltage. Next, using the hot stick (discharge rod), short circuit and ground all terminals of the capacitors. These terminals should remain short circuited and grounded while work is being done on the capacitor.
- To bring the capacitor banks back into service, first remove the jumpers with hot sticks, and then close the cutouts.

LIGHTNING ARRESTOR

 No work shall be done on the lightning arresters unless it is disconnected from the line circuit and grounded at both the lines and ground terminals.

WORKING ON STORAGE BATTERIES

- When making electrolyte for storage batteries always pour acid into the water. The reverse method may cause an explosion. Suitable goggles or face shields should always be worn when making electrolyte. Ensuring the usage of PPE's by out sourcing staff is the responsibility of the Shift Officer.
- Smoking and use of matches or other open flames are not permitted in battery rooms or while inspecting filling, testing or handling batteries.



CHAPTER -7

HOUSEKEEPING

Workmen are frequently injured, by stumbling, stepping on, or bumping into tools, material and other objects left lying around, or by objects falling from above.

- A. To ensure good housekeeping following precautions should be observed:
- Walks, stairways, fire escapes and all other passageways shall be kept clear of all obstructions.
 Tools and materials should not be placed where they may cause tripping or stumbling hazards or where they may fall and strike anyone below.
- 3. Puddles of oil and water create slipping hazards and should be cleaned up promptly.
- 4. Nails in boards, such as those removed from scaffolds, forms and packing boxes, constitute hazards and should be removed. The boards should be carefully stacked or stored.
- 5. Dirty and oily waste rags should be deposited in approved containers and disposed off as soon as practicable to avoid fire hazard.
- B. Broken light bulbs, glass metal and scrap and other sharp objects should be dumped in places or containers provided specially for them.
- C. Discarded fluorescent and other gas filled tubes shall be disposed off safely.
- D. Places where persons work or pass in emergencies, shall be provided during time of use with adequate lighting (natural / artificial / or both) for operations or special type of work performed.
- E. General lighting shall be of a uniform level widely distributed.
- F. In big installations / offices emergency lighting shall be provided.
- G. Adequate ventilation shall be provided in work places by natural / artificial means.

CHAPTER - 8

PERSONNEL PROTECTIVE EQUIPMENTS (PPE's) AND DEVICES

The company shall provide adequate & approved PPE's for various jobs depending upon the hazard. The centralized procurement of PPE's shall be made which will ensure the quality as per respective standards.

PPE Guidelines:-

- Use suitable protective equipment, like rubber gloves, mats, safety glasses, etc., wherever required as per instructions or wherever it provides greater safety.
- 2. All safety devices should be checked before starting work.
- Safety equipment should be tested at frequent intervals to ensure that equipment would provide the safety desired.
- Protective gears such as helmets, safety shoes, high reflective- vest are issued to linesmen, jointers, supervisors as applicable for personal protection and their usage is monitored.
- 5. It is responsibility of supervisor to ensure the usage of P.P.E.'s.
- 6. The P.P.E.'s shall not be carried / stored with tools etc. to avoid damage to them.
- Any employee working on height above 8 feet from ground except working on platform should use Safety body harness.
- 8. Uses only approve type of operating rods.
- 9. Operating Rods shall be kept as dry as possible. It should not be dropped / left lying on ground.

A. HAND TOOLS

- 1) Many accidents results form improper use of tools and use of defective tools and equipment.
- Employees should use only those tools and equipment, which are in good condition, and only of the purpose for which they are designed. Where proper and safe tools are not available for the work at hand, then employee shall report the fact to his supervisor.
- Tools, which develop defects while in use, should be removed from the service, tagged and not used again until brought in good condition.
- Impact tools such as chisels, drills, hammers and wedges with mushrooms heads should not be used until they have been reconditioned.
- 4) Hammers, axes, shovel and similar tools should not be used if handles are loose, cracked or splintered
- 5) Defective wrenches such as open end and adjustable wrenches with spread jaws or pipe wrenches with dull teeth should not be used, as they are likely to slip.
- 6) Pipe or other extensions should not be used on a wrench handle to increase the leverage unless the wrench is specifically designed for such an extension.
- 7) Portable electric tools should be equipped with 3 wire cord having the ground wire permanently connected to the tool frame and is to be grounded at the other end.
- Metal rules, metal tape lines or lines containing wires shall not be used around electric conductors or equipment.
- 9) All tools carried on trucks should be inspected each month and defective tools repaired or replaced.

B. LADDERS

- 1. Inspect the ladder before use.
- 2. Ensure firm footing.
- 3. Secure at top or have a man at the foot.
- 4. Ensure correct angle (75 degree) or position ladder 1 foot out at base for every 4 feet of vertical height.
- 5. Ensure that the ladder rises 3 feet above landing point.
- 6. Face the ladder when climbing or descending.
- 7. Avoid make shift arrangement in lieu of ladder
- 8. Ensure the rubber shoes at both arms and at each terminal. i.e. at each end
- 9. Before fixing confirm that no electrically charged conductor is passing nearby

PROTECTIVE BARRIER (TEMPORARY)
When the work is conducted along public streets or highways, pedestrian and vehicular traffic shall be warned by signs and flags by day and red lights or flares by night. Wherever necessary, signalmen should be provided.

D. EARTHING DEVICES

- 1. Only approved earthing devices shall be used in all work.

 2. Care shall be taken to maintain earthing by ensuring condition of clamps.

 3. Neon line tester may be used to check the bus bar area, cables, and overhead conductors but prior to use it should be ensured that tester is in good condition.

CHAPTER -9

CONSTRUCTION

During construction activity, it is important to keep in mind various aspects relating to

- 1. Excavation
- Scaffolding
- 3. Rigging and Hoisting

EXCAVATION

- 1. Proper and adequate timber shoring and bracings shall be provided to prevent sliding or slipping of loose or unstable earth, rock or other material or caving in of excavation
- 2. Under cutting of banks of trenches and other excavations shall be avoided.
- 3. Excavated material shall be dumped away from the edge of the excavated trench to avoid the slipping of the excavated material in to the trench.
- 4. Excavations shall be properly fenced to protect men and animals from falling in
- 5. Warning signals shall be placed near the excavation to warn the approaching traffic and men. At nigh, red danger light shall be displayed at a conspicuous place near the excavation.

SCAFFOLDING

- 1. Scaffolds shall be build of sound material, securely fastened, and be capable of supporting four times the combined weight of men land materials, which may be placed on them
- 2. Wood planks used in scaffolds should be not less than ten inches wide and two inches thick, and shall not extend beyond the outer supports more than twelve inches nor less than six inches unless securely fastened down. Wooden planks without any nails projecting should be used; similarly planks or bellies with cracks should not be used for scaffolding purposes
- 3. Guardrails and toe boards shall be installed on all scaffolds that are ten feet or more in height, land on all scaffolds immediately adjacent to excavations, deep water, machinery or other sources of danger.

RIGGING AND HOISTING

- 1. Man in-charge of working party shall be responsible for the safe loading and use of ropes, chains, cables, slings, jacks, skids and other hoisting and rigging apparatus. In no case shall such equipment be used until the foreman has determined that it is free from defects land safe for use.
- 2. Before operating crane, derrick or other hoisting equipment, the operator should sound warning and accept only one person's signal to start raising, lowering or swinging load. However, the operator shall stop immediately upon signal from anyone.
- 3. Never place yourselves near cables under tension, and under no condition within the angle formed by ropes or cables. When anyone is in this or other dangerous position, the hoist operator shall never place tension on a rope or cable.
- 4 Employees shall familiarize themselves with the proper use of knots, ties, land hitches, and safe methods of hooking and slinging required in their work.
- 5. Particular care must be exercised to see that cables, chains and other hoisting equipment are not unduly stressed by improper use. All ropes, cables chains etc., shall be discarded when they have worn or deteriorated to the point where their safe use may be questionable in the judgment of the supervisor
- 6. Chains shall not be spliced or joined by makeshift means such as open links, bolts, or wire. Some competent person shall insert new links, or the chain returned to the manufacturer for repairs.

 7. Wire ropes or cables should not be allowed to kink as this weakens them.
- 8. When applying U-bolt clips to cables, a sufficient number should be used. Hooks, rings, clevises and other fittings used on chains or cables shall exceed the carrying capacity of the chain or cable.

ROPES

Fiber rope shall be properly cared for to retain its strength and lasting quality. Following precautions will preserve the strength and life of rope:

1. Where a rope sling passes over sharp edges, pads should be used to protect the fibers against cutting and

undue stress.

- 2. Do not drag rope on the ground unnecessarily as dirt chafes the fibers.
- 3. Do not use too small a sheave.
- 4. Do not use sheaves with rough surface or broken edges.
- 5. Do not let rope slip on which drum or lie idle on moving drum.
- 6. Do not place kinked rope under stress
- 7. Do not allow rope to unravel. Finish the ends.
- 8. Do not tie the knobs where splices should be used.
- 9. Do not allow ropes to become oil-soaked nor exposed to acid or corrosive substances.
- 10. Do not allow rope to remain dirty or gritty. Wash and dry
- 11. Do not allow rope to remain exposed to weather any more than necessary. Carefully dry rope when it becomes wet.
- 12. Do not use excessive heat when drying rope.

LIFTING AND CARRYING

- 1) Most lifting accidents are due to improper lifting methods rather than due to lifting too heavy loads.
- When lifting heavy objects, the back should be kept close to vertical and the lifting done with leg and arm muscles rather than with back muscles.
- Bulky loads should be carried in such a way as to permit unobstructed view ahead.
 Pipes, conduits, reinforcing rods and other conducting material should not be carried on shoulders near exposed live electrical equipment or conductors.
- 4) Rope tackle and slings wherever required should be checked to ascertain that they have sufficient strength to perform the work in hand.

 5) Chain hoists should not be used until their condition is known to be satisfactory. Care should be taken to
- avoid overstraining hoisting equipment. Chains should be inspected before use and at intervals during extended operations to avoid failure of worn or weakened links, hooks, or other parts.
- 6) No one shall stand or pass under any suspended load being handled by a crane, derrick or other hoisting equipment.

TREE TRIMMING

The public shall be protected against hazards of tree trimming along public streets & highways by placing danger signs & signals.

- 1. Before climbing a tree, the trimmer should look it over carefully to decide how best to climb it.
- The limbs should be carefully inspected to make sure that they could hold the trimmers weight.
- 2. Axes should not be used aloft, always use saw or bill hooks.
- 3. All tools should be raised & lowered by hand lines in such way as to avoid Conductors.
- 4. Before cutting down the tree all limbs should be cut off for sufficient height to avoid striking electric lines. Where there is danger that the tree may be strike & damage property, block & tackle should be used to control the direction of fall.
- 6. Felling operation once started, should be finished before the crew leaves for break etc.



CHAPTER -10

TRANSPORTATION

- Vehicle should be kept in good operating condition & driven in a safe manner so as to prevent injury to you and others & save damage or loss of valuable equipment. Driving of vehicle is a responsibility not a privilege.
 Every driver of company shall be thoroughly familiar & comply with the state/city traffic laws covering the
- territory where he operates.
- Before operating a company vehicle each driver should make sure that it is in proper operating condition.
 Before filling the patrol tank the engine should always be shut off. The hose nozzle should be kept in contact with the tank to avoid static sparks.
- 5. Switch off the mobile phone while in the petrol / diesel station.

Most traffic accidents can be prevented by faithful observance of three things:-

- a) Control Speeds
- b) Avoid Distractions
- c) Drive Defensively
- 1. Park the vehicle on the proper side of the street.
- 2. When parking along a highway at night, light shall be left on but dimmed.
- 3. Before leaving a parked vehicle, always remove the ignition key to prevent theft or unauthorized starting of vehicle.
- 4. Loading of vehicles should not exceed their rated capacity & objects should not be permitted to extend beyond the sides.
- 5. The man in charge of party should carefully inspect the loading of material before starting a vehicle.
- 6. In case of accidents do not become involved in an argument as to who was responsible for an accident.
- 7. Do not loose your temper, try to be helpful.

CHAPTER-11

SAFE GUARDING THE PUBLIC

- 1) Every effort should be made to protect the public at all times where company's work is in progress by the use of signs, barricades or personal warning.
- 2) When working on customer's premises or public property, every effort should be made to avoid hazards to persons or unnecessary property damage.
- 3) Barriers shall be placed around all open manholes, exposed open ditches and excavations.
- 4) Authorized visitors shall not be left to find their own way.
- 5) Public shall be encouraged to report dangerous situation which may come to their notice.
- 6) Visitors shall be provided proper Personnel Protective Equipment wherever required.

CHAPTER -12

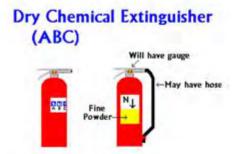
FIRE

TYPES OF FIRE

- 1. Class A Wood, paper, cloth, trash, plastics, Solid combustible materials that are not metals
- 2. Class B Flammable liquids: gasoline, oil, grease, acetone any non-metal in a liquid state, on fire
- 3. Class C Flammable Gases: Propane, Butane, Acetylene
- 4. Class D Metals: potassium, sodium, aluminum, magnesium
- Class E Electrical Fire
 Class K Kitchen Type.

EXTINGUISHING FIRES

- For extinguishing combustible material such as paper, wood etc., use ABC type Fire extinguishers.
 For electrical equipment use only carbon dioxide or dry powder. (If fire Extinguisher written to use for class



Carbon Dioxide Extinguisher

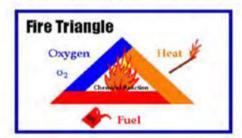


PRINCIPLE OF FIRE FIGHTING Eliminate one of three factors causing fire

HEAT: - By cooling water etc.

OXYGEN: - by smothering and exclusion of air.

FUEL: - is eliminated by segregation, cooling or smothering.



TO PREVENT FIRE AND EXPLOSIONS

- 1) Waste paper, rags and other combustible material should not be allowed to accumulate
- 2) Flammable liquids shall be kept in approved safety cans and identified by proper labels.
 3) Varnish, paints, lacquers and thinners are highly inflammable and should be stored away from all open flames or possible sources of ignition. Matches and open flames should not be used where varnish paint or lacquer is being applied with a spray gun.
- 180 (due to being applied with a spray gun.

 4) Open flames and smoking are prohibited in all areas where inflammable liquids or gases are stored or being used. Such areas shall be posted with appropriate warning signs.

 5) All employees should be familiar with the location and proper use of fire extinguishers in their work area.

 6) No employee should smoke or use matches or open flames on customer's premises unless it is positively
- known that such action do not conflict with the customer's rules.

Project Fire Drill

EPE will plan to do live fire Drill yearly and Dry Fire Drill wherever New Employee employed.

Emergency Plan for Fire Break Out

- 1. Inform all staff and workman by rising Alarm.
- 2. Form Fire Fighting Group.
- 3. Inform outside fire station if fire look to be out of own control.
- 4. Make fire How and train all employee to know about fire How chart.
- 5. Regular checking plan for. All fire fighting Equipment.
- 6. Arrange to train proper fire fighting for staff.



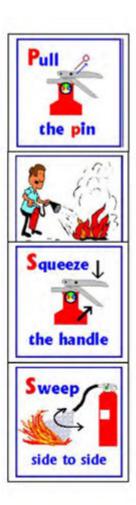
FIRE AND FIRE PROTECTION

How to use a Fire Extinguisher
Simply follow the following steps "P-A-S-S"
P – Pull the safety pin
Pull the Pin at the top of the extinguisher

 $A-{\rm Aim}$ the nozzle to base of the fire. Aim the nozzle or the outlet towards the base of the fire. Some hose assemblies are clipped to the body of the extinguisher, then release the hose and point.

S – Squeeze the handle or lever Squeeze the handle, lever to release the extinguishing agent. In some cases valves are present. Before approaching the fire try a short burst.

S – Sweep Sweep from side to side at the base of the fire until it is out. After fire is doused, watch for the smoldering hot spots and possible re-flash. Put off the fire completely.



CHAPTER -13

ACCIDENT REPORTS, RECORDS AND INVESTIGATION

- 1) Accident records are essential aids for prevention of accidents. They show the type of accidents most frequently encountered where they occur and their relative severity. A study of these records emphasis common hazards and prompts a better understanding of the causes of accidents and most effective methods of preventing them.
- 2) All accidents, which result in injury or not shall be promptly reported to Manager. Many injury-free accidents, which are not reported, recur with serious injuries.

 3) All accidents to the public involving company personnel, equipment or property shall be reported promptly
- to Manager.
- 4) Accidents are reported to Safety section, in writing by concerned Manager. Accident Committee analyzes these reports, for corrective & preventive measures.
- 5) Every accident should be investigated to determine the cause and what steps are needed to prevent a recurrence. It shall be the responsibility of the person in charge of the work to get complete details of the accident as soon as possible after it occurs.
- 6) All accidents, whether they result in personal injury or not, shall be promptly investigated by the Manager or his representative.

Accident Investigation Procedures

Company employees should be instructed to report all accidents immediately and to leave the accident scene undisturbed. The investigation should begin as soon as the injured person(s) and potential hazards are taken care of. Effective accident investigation reflects the facts that can be used to identify basic causes for purposes of analysis and development of control measures.

Safety Officer/Manager shall conduct accident investigation. The standard accident investigation report to be used for minor accidents (i.e. without permanent disability). For serious accident, a full report covering the following elements shall be prepared and submitted to the Management within 7 days by the Project safety Officer. The key elements for all accident/incident investigations are as follows:

- Caring for the injured worker(s) and his/their most current injury/treatment status
- Personal information of the injured worker(s)
- Accident description
- Weather condition
- Sequence of events
- Material, plants and equipment involved with photos
- Working procedures and method statement
- The statements of the supervisors involved
- Relevant safety in-house rules

Accident Analysis

Monthly Accident Statistic

A Monthly Accident Statistic report is prepared on a monthly basis, which contains the following information: -

- Number of reportable accident occurred on each individual site; a:
- b. Type of accident/Incident
- ċ. Trend analysis

Review in the Safety Management Committee Meeting.

The cause of accident/incident shall be reviewed in the Site Safety Management Committee meeting. Method for preventing recurrence of similar accident/incident is also determined and agreed (e.g. training, use of PPE etc...)

Definition of Dangerous Occurrence

- Collapse or failure of a crane, winch, hoist or other appliance used in raising or lowering persons
 or goods or any part thereof (except the breakage of chain or rope slings), or overturning of a
 crane
- Explosion or fire causing damage to the structure of any room or place in which persons are employed, or to any machine or plant, resulting in the complete suspension of ordinary work.
- Electrical short-circuits or failure of electrical machinery, plant or apparatus attended by explosion or fire, causing structural damage involving its stoppage or disuse.
- Explosion of a receiver or container used for the storage at a pressure greater than atmospheric
 pressure of any gas or gases (including air) or any liquid or solid resulting from the compression
 of gas.
- Collapse in whole or part from any cause whatsoever of any roof, wall, floor, structure or foundation forming part of the premises of an industrial undertaking in which persons are employed.

Handling Procedures

- All accidents/ incidents shall be notified to Site Engineer and shall be investigated by Safety
 Officer/Manager whether an injury has occurred or not.
- If further medical treatment is required for minor injury, arrange either site or public transport to carry the injured to the hospital.
- Site Engineer shall report all accidents, incidents or dangerous occurrence on site to client, Project Manager/Director, Project Safety Representative.
- A written report should be completed and submitted to client within 7 days.
- The findings of the investigation shall be discussed in the Site Safety Committee Meeting.
- Safety Officer/Manager will investigate the occurrence and complete a standard form and written report with recommendations to prevent the recurrence. This report will be copied to Project Manager for taking preventive measures.
- For fatal accident, the Senior Management must be informed at the earliest possible time. The Safety Manager shall be involved in the preparing the accident.



CHAPTER-14

ELECTRIC SHOCK AND FIRST AID PROCEDURE

FIRST AID GENERAL

First Aid means what one should do to reduce the suffering of the patient after an accident until the doctor arrives, it may give life to dying person.

FIRST AID INSTRUCTIONS

- 1. Remove the patient from the source of accident / remove the cause of injury.
- Keeps the injured person lying down in a comfortable position.
- 3. If the breathing has ceased, immediate measures must be taken to restore it.
- 4. If the patient has received burns attend to them.
- 5. When the patient has fractured a bone, no attempt must be made to move him.
- 6. Treat the patient for shock.
- 7. Send for medical help.
- 8. Never give water to patient.
- 9. Keep by standards away from the patient.
- 10. Keep the patient warm

INSPECTION OF FIRST AID EQUIPMENTS AND BOX

All first aid equipment and box in grid station, substations and vans shall be checked periodically by an authorized person who will sign the format F08 (COR - P-12) (see annexure X) placed therein together with the date on which the check was carried out.

TREATMENT FOR THE ELECTRIC SHOCK

RELEASE FROM CONTACT

Switch off the electric supply immediately or send someone to do so. Do not attempt to remove a person from contact with high voltages unless suitable articles insulated for the system voltages are used for the purposes. When attempting to free a person from contact with low or medium voltage use rubber gloves, shoes, mat or insulated stick, but if these are not available use a loop of rope, cap or coat to drag the person free Whatever is used should be dry and non-conducting.

AFTER RELEASE

As soon as the victim is clear off the conductor and is found breathless, rapidly feel with your finger in his mouth and throat and remove any foreign matter (tobacco, false teeth etc.). Then begin artificial respiration. Do not stop to loosen the victim's clothing now; every moment of delay is serious. Keep the patient warm.

ARTIFICAL RESPIRATION (HOLGER NIELSEN)

POSITION

Place the patient with face downwards, head turned slightly to one side, with arms raised and bent, and the side of the head resting where the hands join. Slap patient between the shoulders smartly with the flat of the hand several times. Kneel on right knee opposite patient's hand and place left foot by the patients elbow

a) FIRST MOVEMENT

Keep arm straight, palms of hands between & below shoulder blades and thumbs on spine. Rock forward with firm pressure and take 2.5 seconds for this movement.

b) SECOND MOVEMENT

Release pressure quickly and gradually slide your hands out to the patient's elbows and then raise the patient's arms and pulls slightly towards you, taking 2.5 seconds for this movement.

c) THIRD MOVEMENT

Lay the patient's arm down again and replace your hands below shoulder blades.

d) Repeat the complete cycle twelve times to the minute.

e) IF THERE ARE CHEST INJURIES

Lay the patient face downwards with head turned slightly to one side, with arms raised and bent, and the side of the head resting where the hands join. Grasp the patient's elbows and then pull slightly towards you, taking 2.5 seconds for this movement.

Return the arms to first position and repeat the movements at the rate of 12 times per minute. (In case of chest injuries if possible, the hip-lift backpressure should be given preference).



IF THE ARMS ARE INJURED

Lay the patient's head downward with his arms in such a position as to minimize risk of increasing injury. Keep your arm straight with palms on patient's shoulder blades and thumbs on spine, rock forward with firm pressure for 2.5 seconds. Release pressure gradually and slide your hands to the armpits and pull slightly towards you, taking 2.5 seconds for this movement.

- g) Continue the artificial respiration without interruption, until natural breathing is restored, or until the physician arrives. A brief return to natural respiration is not a certain indication for stopping the resuscitation. The patient must be watched, and if natural breathing stops, artificial respiration be resumed at once.
- h) In carrying out resuscitation it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.
- i) Send for medical assistance,
- j) If patient recovers before the medical assistance arrives, regulate your artificial respiration to the rate of the patient's breathing, and when he has sufficiently recovered make him comfortable and give hot tea. Do not allow patient to exert himself even by walking until a doctor has seen him as the shock may have affected his heart.

BURNS AND PHYSICAL SHOCK

BURNS

Burns should be treated with "Burn Dressings" and covered to exclude the air

PHYSICAL SHOCK

In addition to suffering from electric shock it is also probable the patient will be suffering from physical shock, and it is important that this condition be treated. The patient must be kept warm with blankets or coats, and if available, hot water bottles should be applied on the feet.

HEAT STROKE

Heat Stroke in proper is an entirely different reaction in the human body, to the same conditions, which favors Heat Exhaustion. It is serious and often lead to fatal condition. Hot, humid atmosphere and inadequate drinking of water favors development of Heat Stroke. Casualty shows mental excitement, restlessness vomiting, muscular cramps and high temp.

TREATMENT

- · Wrap him up completely in cold water soaked bed sheet.
- · Fan vigorously.
- · Send for doctor.

HEAT EXHAUSTION

Heat Exhaustion occurs among the workers in stuffy atmosphere or in overheated, poorly ventilated room. There may be feeling of giddiness or fainting skin is always cold & moisture prevention by wearing loose clothing, drinking large quantities of water is possible.

ACTIVE FIRST AID TREATMENT FOR HEAT EXHAUSION

- · Remove patient to cooler conditions in the fresh air.
- · Lay him down & loose all clothing around neck.
- · Fan him vigorously
- . Dash cold water on the neck & head to stimulate.

ELECTRICAL SHOCK

Electrical Shock is the sudden and accidental stimulation of the body's nervous system by an electric current. Effect of electrical current depend upon the path of the current, the amount of current, and the length of time in Contact with the current. A person can become a part of an electrical circuit by touching both ends of an open circuit at the same time, by contact with a short circuit, or by contact with the current carrying conductor while in contact with ground (Earth).

The effects of current on the human body range from are mild tingling sensation to death. Contact with current can cause several muscular contractions strong enough to break bones, as a less deep tissue burns and heavy bleeding.

A commonly held misconception is that high voltage is more dangerous than low voltage. Low voltage (down to approximately 50 V) can kill just as quickly as high voltage: severity of shock is dependent upon current. Less than one ampere of current can cause death because current flow is related to voltage and resistance; ohm's law demonstrates that specific conditions at the time of the incident determine the degree of hazard.

The current that flows through a body depends on the resistance between the body and the points of contact, as well as on the resistance of the body itself. Dry, clean, unbroken human skin has an electrical resistance of 1 lakh to 6 lakh ohms, depending on thickness. Wet or broken skin has a resistance or approximately 500 ohms. Thus, with the same voltage source one could receive 200 times more current with wet skin than with dry skin. If the current stays on the outside of the skin, a person may only receive minor burns, but if the current can penetrate the skin, the damage can be more serious. Though current is the primary source of electrical damage to body tissue, the common 60 Hz AC line voltage provides a unique danger to the heart. Because 60 Hz is close to the frequency at which ventricular fibrillation of the heart often occurs, 60 heard is more disruptive to the human nervous system than pure D.C. ventricular fibrillation occurs when each individual muscle fiber of the heart contracts in an irregular, random twitching manner that results in no pumping of blood. The danger of ventricular fibrillation is far less with A.C. that is higher or lower than 60 Hz infrequency.

The effects of current, especially 60 Hz AC, on the human body can be better understood by examining the fact present in table

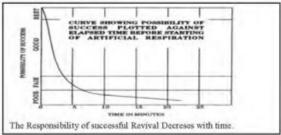
Effect of 60 Hz AC Electrical Shock

0.001 Ampere	The shock is barely felt. The major hazard is high probability that the person will make a sudden, involuntary moment that will cause him or her to fall or to come in to connect with something more hazardous.
0.002 to 0.0025 Amperes	Muscle will be paralyzed if the current path is through the body. With muscle control paralyzed, a person will be unable to break contact. Men's muscles become paralyzed at a minimum current of 0.009 amperes, and women's muscles become paralyzed at a minimum current of 0.006 amperes on the average.
0.0025 to 0.075 Amperes	The electrical shock can be very painful and severe muscular contractions can occur that are strong enough to break bones. Prolonged contact will produce unconsciousness and death in approximately three minutes if paralysis of respiratory muscles occurs.
0.075 to 0.3 Amperes	Death is a near certainty if exposure to this level of current extends to longer than one quarter of a second.
2.5 Amperes or greater	The heartbeat of a person exposed to these levels of current will stop immediately, with severe tissue damage is certainty.



The internal resistance of the body also contributes to the potential severity of shock. Internal body resistance, due to the contact of body fluids, maybe 30 ohms for current, flow from head to foot. The path of a current is important when discussing shock damage. Most fatal electrical shocks travel through the heart. This means that hand to hand, either hand to the left foot, or head to foot shocks have the most potential for serious injury.

There is little time to waste in the event of severe electrical shock. The victim should be removed from contact with the current as soon as possible, and in a manner that will not pose a shock hazard to the rescuer. If the victim is near or touching live wires, the wires should be removed with a dry non-conducting object. If the power cannot be shut off, the victim should be pushed or dragged from contact with dry wood, rope, or other insulating materials. After the victim has been removed from contact with the electricity, call for medical help and begin first aid procedures immediately. Resuscitation efforts should always be attempted and continued. There is no way to tell what damage the victim has sustained, but effort should be made to give that person the best possible chance for survival.



Detailed instruction in CPR (cardiopulmonary resuscitation) is it requires special training in the recognition of cardiac arrest and in the performance of CPR. Instruction includes practice of proper individual and team resuscitation of a special mannequin. CPR should be performed only by trained and certified persons. The importance of receiving such training is that it can mean the difference between saving a life and letting a person die.

To perform first aid to a person who has come into contact with electricity and who is unconscious, the following steps must be taken:

· Remove the person from contact with the current without coming into contact with it.

- Check to see if the victim is breathing and if there is a heartbeat present. If the person is not breathing,
 or is not breathing well, administer mouth to mouth breathing. If there is no pulse, administer CPR.
- When the person is breathing on his or her own, check for other problems that may need immediately
 attention. If the person is bleeding excessively, stop the bleeding by use of pressure on the wound or on
 pressure points in major arteries or veins.
- Determine severity of burns. Burns are common in electrical accidents and can be quite serious.
 Severity of burns is dependent upon depth, area, and location. The treatment required is different for each degree of severity and the correct first a procedure should be followed.
- If there are any broken bones or severe sprains, the best idea to immobilize the limb so that the brake cannot experience motion and cause greater damage.

In addition to following the preceding steps, the person administering first aid should check the victim for signs of physiological shock (not electrical shock). Shock result from the depression of vital body functions. It can be life-threatening even though the actual injury might not be fatal otherwise. Vital functions are depressed when a large amount of blood is lost, when the rate of blood flow is reduced, or when the oxygen supply is insufficient. Shock can be caused by any type of severe injury. Injury -related shock include pale (or bluish) skin, rapid pulse, and rapid breathing. The victim should be left lying down, and covered just enough to maintain the body temperature. Medical help should be obtained as soon as possible.

This object you have shown what happens when the body is exposed to electric current, what should be done for a victim of accidental electrical contact, and what order should be followed. Obtaining the information and training necessary to be effective in giving first aid is available.

CHAPTER-15

EMERGENCY PREPAREDNESS AND RESPONSE

PURPOSE

To establishes a system for dealing with emergency situations to minimize hazards to human health & Safety.

SCOPE

Applicable to any fire, explosion or other disaster leading to emergency situation, which means, any significant, on-routine situation, which endangers the personnel property, other interested parties or surrounding environment. Separate procedures may be followed for personnel injuries/medical emergencies.

ACTIVITY

Identify potential accident conditioned emergency situations for the activities in different departments in consultation with concerned HOG & make all concerned personnel aware of the significant risk attached to their area of work that may lead to emergency situation and discuss the situations with concerned team headland make emergency plan & also check their emergency preparedness and response to such situations and clearly identify responsibilities while preparing emergency pal, consider providing controls for and mitigating the safety hazards associated with the activity, i.e. post effect. And train the personnel in dealing with emergency situations as per emergency plan. By carry out periodic drills i.e. mock-drills/fire drills etc. (at least once a year) creating emergency situations and keep records.

Emergency Response Plan

- The nature of assistance required;
- Establish Emergency response team and define responsibilities
- A brief description of the emergency situation, in particular the number of persons injured and their condition;
- Name, contact telephone number or other means of contacting the person calling;
- The address / location of the incident / accident, and;
- In case of fire, detail what is on fire and whether dangerous goods, chemicals or inflammable gas cylinders are involved or close to the fire;
- Call the first aider to the scene for emergency assistance. The first aider shall render first aid to
 the injured at the spot. If the condition of the injured permit, the victim(s) shall be carried to
 the most convenient place for the rescue services to take over.
- the most convenient place for the rescue services to take over.
 For an accident in which a large number of persons are injured, notify the Hospital Authority as well to enable them to get prepared to receive and treat the victims and to decide whether to dispatch medical personnel to the accident scene;
- In case of fire, arrange evacuation of all personnel from the fire scene;
- Notify the Client's site staff;
- For investigation purpose, ensure that the accident scene is not disturbed.

Duties and Responsibilities of Emergency Team Members

The emergency Team is appointed to plan for and handle all emergency situations. The team should consist of the following members. All Emergency Procedures are subject to review in the site safety committee meeting.

Team Member by default	Duties and Responsibilities
Project or Construction Manager as the team leader;	Decision-making and approval on use of resources.
Site Engineer as Coordinator,	Coordinates with all parties and persons involved including sourcing external help in case of emergency.
Safety Officer/Manager as the advisor	In case of emergency, gives professional advises on loss prevention and assists in coordination. Draft emergency procedures.
Safety Supervisors as team members;	Report emergent findings, announce emergency actions to all personnel in his duty areas, direct evacuation.
Electrician, mechanics as team members (to be appointed).	In case of emergency, to cut off or provide temporary power supply as directed.

An emergency escape plan and Emergency Team member name list with contact numbers is to be regularly updated and posted up at prominent locations on site by the Safety Officer/Manager.

CHAPTER 16

Group Meetings and employee-instructions

Site Safety Committee Meeting

Site Safety Committee meetings are held once a month. The following procedure applies to the meeting of the Safety Committee:

- a. At least one week before the meeting, the Project Manager or his nominee asks the members for items to be included in the agenda and issues that agenda. The agenda includes each item discussed at the previous meeting unless the meeting has taken the decision that the action on that item is complete and the minutes record the decision. The agenda contains particularly:
 - · Confirmation of last meeting minutes,
 - · Progress on actions from the previous meeting;
 - · Safety Inspection Report:
 - · Incident / Accident Statistics;
 - · Hazards Identified;
 - · Any Other Business, and
 - · Date of Next Meeting.
- b. The meeting considers each item on the agenda and, on the basis of the facts presented, decides to recommend action, hold the item for a future meeting to allow time for information gathering, or decides to drop the item. It is important that the meeting has facts, rather than conjecture, on which to base its discussion and recommendations. In the absence of firm information, it should allocate the responsibility for the collection and submission of the information to an individual or team and ensure that the item is reviewed at the next meeting.
- c. Secretary is responsible for the preparation of the minutes that are circulated to the members with a copy being retained in the official file. Copies are also available to any person in the site with the reasonable cause for access to them.

Tool-Box Meeting

- a. These are briefing sessions held on a daily / weekly basis before a task is to be carried out which;
 - i. discuss about particular work hazards, and
 - ii. involves personnel who are carrying out the work.
- b. The procedure is flexible, depending on the nature of the work, the experience of the workers and the person who is authoritative on the task involved.
- c. Attendance of the workers present in this meeting and the topics discussed must be recorded.

Supervisor and Safety Audit

Description	ription Frequency By who?		Remarks
General surveillance	Daily	Installation manager	By absence of the installation manager delegated to
Safety audits	Weekly/ monthly	Installation Manager, project manager, site manager, safety Manager	Using our own inspection system (regular checklists)
Occupational safety audit	1 time /year or project	Safety specialist	For a random Safety check of our projects. By (certified) Safety Specialist

Overview of Safety Measures

Nr	Occupational risks	Countermeasures	First responsible
1	Fire, Incidents/ Accidents	Employees instructed before the start about emergency response on the site Minimising flammable products and practices Portable phone (cell phone) available, emergency number known to all employees on the site	Contractor: installation manager Contractor: Contractor:
2	Escape route	Checking of escape route Instruction of fitters Is necessary, make an appointment with the provider	Contractor: / installation manager:
3	Unsafe situation on access paths	Good housekeeping Make appointments with Contractor for holding free of access paths	Contractor:
4	Good housekeeping	Daily monitoring Periodic safety inspections	Installation manager

CHAPTER 17

ACTIVITIES, HAZARDS AND RISKS

General

For Civil activities the construction industry has a list of civil activities and related hazards.

Applicable (Y/N)	Construction activities Civil	Hazards	Countermeasures	Responsible	Due
	Air hammer operation	Noise, whole- body vibration, silica dust, compressed air hazard	Safe Work permit Use of ear protection Use of dust mask Tools and air hoses of good quality Job rotation to avoid vibration issues		
	Bricklaying, concrete finishing and masoning	Cement dermatitis, awkward postures, heavy loads, working at height	Use of gloves to avoid contact Manual handling procedure & training Working at height procedure		
	Carpentering	Wood dust, heavy loads, repetitive motion, working at height	Dust collection Dust mask Manual handling procedure Working at height		
	Concrete and terrazzo finishing	Awkward postures	- Manual handling procedure		
	Demolition work	Lead, dust, noise, working at height, confined space, electrical, dangerous substances spraying from pipes	Safe Work permits incl. working at height, confines space. LOTO pipework, electrical Waste disposal for lead Dust mask lead dust Use of ear protection is mandatory		
	Drilling, earth, rock	Silica dust, whole-body vibration, noise	Use of dust mask Use of ear protection Job rotation to avoid vibration issues or sufficient breaks		

Applicable (Y/N)	Construction activities Civil	Hazards	Countermeasures	Responsible	Due date
	Electrical work (high or low voltage)	Heavy metals in solder fumes, heavy loads.t	Safe Work permit for electrical work Fume extraction Manual handling procedure		
	Excavating and loading machine operation	Silica dust, histoplasmosis, whole-body vibration, heat stress, noise, unknown underground cables/gas pipes.	Safe Work permit Use of dust mask Job rotation to avoid vibration issues Use of ear protection Identification of pipework		
	Glazier setting	Awkward postures	 Safe Work permit Manual handling 		
	Grinding, cutting	Noise, vibration, cut hazard, projection of fragments, release unknown substance, electrical	Safe Work permit LOTO (electrical, dangerous substance) Use of ear protection Use of gloves Safety goggles		
	Hoist and winch operation	Noise, lubricating oil	Safe Work permit Use of ear protection		
	Installing of floors (including terrazzo), carpets	Vapour from bonding agents, dermatitis, awkward postures	 Good ventilation Dust mask Gloves to avoid contact 		
	Insulation work (mechanical and floor, ceiling and wall)	synthetic fibres, awkward postures	Dust mask Manual handling		
	Iron and steel work (reinforcement and structural)	Awkward postures, heavy loads, working at heights, noise	Safe Work permit and working at height procedure Use of ear protection Manual handling		
	Manual handling in general	Awkward postures, heavy loads	Manual handling procedure Lifting device		
	Maintenance work	Entrapment, electrical hazard	Safe Work permit Lock Out Tag Out		

Applicable (Y/N)	Construction activities Civil	Hazards	Countermeasures	Responsible	Due date
	Painting, plastering and paperhanging	Solvent vapours, toxic metals in pigments, paint additives, dermatitis, awkward postures and vapours from glue	- Proper ventilation - Gloves		
	Plumbing and pipefitting	Lead fumes and particles, welding fumes	Fume extraction Proper ventilation		
	Roof work and shingler work	Roofing tar, heat, working at heights	- Safe Work permit - Working at height		
	Scaffolding	Working at height, weather conditions (earthquake sensitive area, etc.).	Safe Work permit Working at height		
	Sheet metal work	Awkward postures, heavy loads, working at heights, noise	Manual handling Safe Work permit Working at height Use of ear protection		
	Soldering	Metal fumes, lead, cadmium	Fume extraction Proper ventilation		
	Steam fitters	Welding fumes	Fume extraction Proper ventilation		
	Tiling	Bonding agents, repetitive movements with loads	Proper ventilation Manual handling		
	Truck and tractor equipment operators	Whole-body vibration, diesel engine exhaust	Proper emission of diesel exhaust system Truck & tractor equipped with exhaust system		
	Tunnel work	Confined space	- Safe work Procedure		
	Welding	Welding emissions	Fume extraction Proper ventilation		
	Hazardous materials (e.g., lead, toxic	dust, chemical burn, chemical intexcication	Safe Work permit Good ventilation Chemical gloves		

Applicable (Y/N)	Construction activities Civil	Hazards	Countermeasures	Responsible	Due
	dumps, adhesives, sealants) removal work.		- Safety goggles		
	Specific project work to add		8		
	Specific project work to add		-		

Civil activities with related hazards

Equipment Number Equipment Name	Contractor
Potential Hazards:	☐ Electrical ☐Pneumatic ☐Mechanical ☐Multiple Lockouts
	☐ Hydraulic ☐ Chemical ☐ Combustibles ☐ Confined Space
Method of	☐ Cable Termination ☐ Rectified ☐ Lockout/ Tag out ☐ Cleaning World
Neutralizing Energy	r: □ Disconnect Lines □ EI Maintenance □ Finishing Work
Permit Required:	☐ LOTO Permit ☐ Hot Work
Lockout Procedur 1. Notify all affected	
2. After completing	inspection and Shut Down equipment, if running, as trained. If you are not contact your supervisor for instructions.
3. After all steps have	ve been completed, begin your work assignment.
4. After completion guards are secured i	of the work, assure that your work is clean, clear of all debris and that all n place.
5. Notify all affected of the lock-out will	d personnel that the equipment is equipment is operational and that removal occur.
6. Remove all Lock	s and tags following the Lock -out / Tag- out program instructions.
	of the equipment, inspect the area to ensure that all employees, contractors nucl are safely positioned.
8. When production	is ready, verify that equipment is operating correctly.
9. Close out any app	olicable permit/s and return them to the Authorized permit issuer.
10. This LOTO peri	mit is valid for just 8 hrs. from the time of approval.

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13.56 Health and Safety Policy and Procedures (Civil)



"HEALTH & SAFETY POLICY & PROCEDURES"

Submitted By

SKG & RGP CO., LTD.

PROJECT NAME : Minbu Solar Power (220Mw DC) Plant Project

LOCATION : Sagu, Minbu Townships, Magwe Division, Myanmar

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1. Introduction

This Health & Safety Plan has been developed to provide early guidelines to enable the CONTRACTOR to plan and assist in effective management of Health & Safety requirements by conducting its undertakings in such a manner as to minimize any potential Health & Safety effect.

The purpose of this document is not to substitute the contractual Health & Safety requirements but to provide guidelines to members of the Project Management Team on the criteria to be applied during the project cycle.

This Health & Safety Plan is a "live document" and as work progresses, the plan shall be further developed and elaborated which shall be presented to COMPANY for review.

The register will identify any major accident potential which shall be submitted to the COMPANY for review and comment.

2. Health & Safety Policy

The main goals of contractor Health & Safety are to eliminate, no accidents or incidents, no damage to the environment, and to provide a safe and comfortable working and living environment, during the entire construction period.

Sub-Contractor shall maintain its own safety philosophy as described below.

- · All incidents and accidents are preventable.
- · All tasks shall be planned and performed with concern for Health & Safety liability
- Emphasize design as the best preventative measure to reduce risk and adverse Health & Safety effects
- · Minimize the consumption of materials, fuels, and energy and Maintain the natural environment.
- · Provide clear and concise written instruction, rules and plans for the work to be performed.
- . General communication notices/signs shall be written in English and Burmese.
- · Use trained and qualified labours and supervisors.
- · Recognize and reward outstanding performance.
- · Provide adequate personnel protective equipment.
- · Monitor the correct use of personnel protective equipment.
- · Provide mechanically correct tools and equipment.
- Maintain a fire prevention and protection program.
- · Provide suitable first aid and medical facilities
- · Maintain a safe off site transport system.

3. Project Health & Safety Goal

Health & Safety is the top project priority of CONTRACTOR and a primary responsibility of all management and supervision on the project. CONTRACTOR shall implement a 'zero tolerance' policy for Health & Safety incidents and accidents.



4. Health & Safety Organization & Responsibility

4.1 Responsibility

Health & Safety in the work place is everybody's responsibility. However, certain individuals shall be required to accept additional responsibilities based on job assignment. These shall include the following:

4.2 Project Manager

- Coordinate with Contractor's Health & Safety Representative.
- . Relay Contractor requirement of Health & Safety to Site Manager.
- Make clear that Health & Safety is line organizations responsibility.

4.3 Site Manager

- Has the overall accountability for Health & Safety at the construction Site.
- Be accountable for achieving Health & Safety targets.
- · Be responsible for ensuring that Contractor's implement, administer, plan, train & enforce the Health & Safety plan.
- · Use only competent and trained personnel to work on Site.
- Inform Contractor Representative immediately of any accidents, incidents, and mishaps with the potential of injury and illness consequences.
- Encourage the reporting by all persons of "near miss incidents" and "unsafe acts".

4.4 Safety Officer

- Assist Health & Safety Manager and perform the Health & Safety Program.
- Advise the supervisory personnel of each discipline for Health & Safety activities.
- Report immediately to the Project Manager any near miss incidents also any safety violations that may require work to be stopped.

4.5 Employee (Supervisor/Worker)

- · Comply with Health & Safety rules and regulations.
- . Work safely and shall not do anything that can cause injury to him (her) or others.
- Ensure work tools, apparatus, appliances, materials, and/or equipment including Personal Protective Equipment is used correctly.
- Report all near misses, incidents and accidents to Safety supervisor.
- Attend all Tool Box Meetings, other meetings and/or training relating to Health & Safety.

5. Rules & Regulations

5.1 Discipline

The following violations are of a serious nature and are subject to immediate dismissal from the Site.

- · Firearms, bladed weapons, explosives.
- Entering work area in possession of / or under the influence of liquor, prohibited drugs and other intoxicating substances.
- Persons found guilty of less serious safety violations will have their ID badge punched with a hole for each violation
 if they have demonstrated a blatant disregard for safety rules.
- . Should a person have their ID card punched for a third time they will be immediately dismissed from the project.

5.2 Housekeeping

Scrap, trash and other wastes shall be placed in designated area.

Work areas shall be kept clean and orderly. Materials, tools, and equipment shall be stored in a stable position (tied, stacked) to prevent rolling or falling. A safety access way to all work areas shall be maintained at store and maintained work shop.



5.3 Tools and Equipment

All of tools and equipment (e.g. hand and power tools, spanner, lifting jack, grinder & hand drill etc.) require special attention and protection for their use and guidelines for storage.

All tools and equipment shall be inspected in accordance with contractor and sub-contractor procedures.

5.4 Compressed Gases

Compressed gas cylinder valves shall be closed

- whenever work is finished
- · The cylinders are empty
- · The cylinders are moved.

Compressed gas cylinders shall not be used as, or placed where they may become part of, an electrical circuit.

Compressed gas cylinders shall not be taken into a confined space.

Compressed gas cylinders shall not be used as rollers.

Empty cylinders must be removed immediately from the work area and returned to the main storage area.

If a key wrench is required, it shall be in place on the valve of acetylene bottles at all times during use.

5.5 Fire Prevention

The arc welder is capable of producing temperatures in excess of 10,000 degrees F, therefore it is important that the workplace be made fire safe.

This can be accomplished by using metal sheets or fire resistant curtains as fire barriers. The floor should be concrete or another fire resistant.

5.6 Fire Extinguishers

At least one fire extinguisher should always be immediately available in the area of any welding operation.

5.7 Personnel Protective Equipment

All persons involved in welding and cutting operations must be issued with and use the required Protective Equipment.

5.8 Storage of gasoline and diesel

Use only approved containers for storage them.

Storage of gasoline and diesel will be away from any work activity, or offices, on the other hand storage of gasoline, and diesel will be on a paved area to prevent land contamination.

Any place used for storage of flammable liquids shall be supported by a fire extinguisher.

Also, any place used for storage of flammable liquids will contain warning signs of no smoking. Do not perform any hot work around it.

5.9 Refuelling of vehicles/mobile equipment

Contractors shall set up a procedure for refuelling of mobile equipment which shall include;-

Refuelling of equipment in area isolated from the general work area and from any source of ignition. The area shall be curbed to contain possible oil/fuel spillage.

Provision of "No Smoking" and "Turn off Ignition" signs



5.10 Smoking

Smoking is strictly prohibited at the Site except at suitably signed designated smoking areas.

5.11 Prevention of Heat Stress.

Persons working outside can be exposed to extreme weather conditions that, not only affects their production output but also can also seriously affect their health.

Heat stress is one of the most common and potentially serious illnesses that construction workers confront where high temperatures are normally encountered. Its results can be mild resulting in fatigue, irritability, anxiety, decreased concentrations and movement however, these conditions can and do lead to death. Preventative measures and immediate first aid treatment are essential to protect all persons on the project.

Provision of copious amounts of good quality potable water for all persons to prevent personal de-hydration.

Add to the water re hydration minerals (electrolyte powder) or make it available for individuals use.

Provision of shaded areas for persons to take rest. Rotation of workers duties to avoid continual working in extreme hazardous areas e.g. confined spaces, working at height, welding etc. Re-scheduling of hot/hazardous jobs to be done at cooler times of the day.

5.12 Site Sanitation

Contractor shall furnish and maintain, or arrange to maintain, at each of its work areas adequate waste disposal and toilet facilities and potable water for the use of its employees. Sub-Contractor shall provide its employees with all necessary instruction as to the use of sanitation facilities at the site, and shall take all other steps, which may be necessary or appropriate in order that its employees utilize such facilities.

Individual subcontractors shall provide toilet facilities for the use of their personnel.

These sanitary fixtures shall be placed at each location where work is performed.

6. Earth Equipment

Excavator, Dozer and earth equipment shall operate under the authority of Contractor and project manager.

Foreman and supervisor closely supervise the operation of equipment.

6.1. End of workday

Operators of vehicle/earth equipment shall do the following at the end of the workday:

- · Park on stop yard
- · Rest down the bucket/blade/ripper
- Put stopper at tire vehicle
- · Switch off engine at ignition and left the key
- Close cabins and make operation equipment inaccessible for unauthorized people
- · Take all necessary measures to safeguard the engine and mobile parts



7. Personnel Protective Equipment (PPE)

7.1 Personal Protection

The CONTRACTOR/Sub contractor shall provide the standard PPE e.g. Safety helmet, safety glasses & steel toe cap safety footwear as well as the additional requirements highlighted in a risk assessment. Subcontractor shall train and require their employees to wear appropriate personal protection equipment that is maintained in good condition. Subcontractor's employees shall not commence work until proper protective equipment is worn at all times while on-Site.

8. Tool Box

'Tool box talks' will be held on a daily basis for all members of the work force ensuring that each person receives at least one talk each week. The constantly changing work patterns and areas of working can be discussed and reviewed at these sessions.

It is envisaged that the duration of the talks would be approximately 10 minutes. The meeting should take place as close to the work place as possible so that any examples of Health & Safety practices or proposed changes are more easily viewed at the time.

Site Supervision will normally give 'Tool box talks'; however, members of the Site Health & Safety Department will also provide assistance as required.

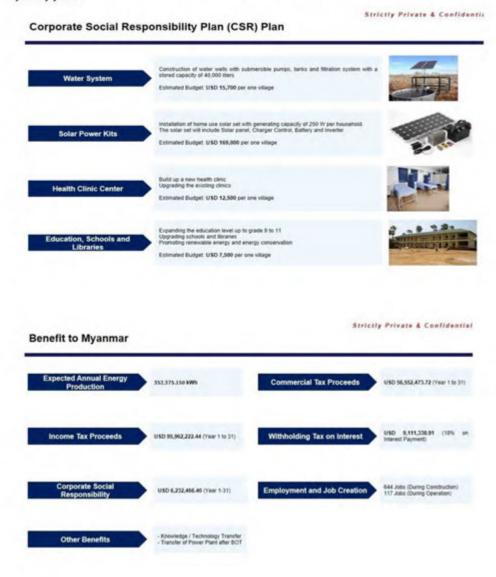
13.57 Cooperate Social Responsibility (CSR) Plan



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GEP (Myanmar) Co., Ltd.'s Cooperate Social Responsibility (CSR) Plan

GEP (Myanmar) Co., Ltd. will have CSR plan for project's surrounding villages and region year by year.





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Current Contribution of GEP (Myanmar)

GEP (Thailand) Co., Ltd. provided some contributions in the need of local.









Since, GEP (Myanmar) Co., Ltd. concerns about the livelihood of villagers nearby the Facility site, GEP will arrange yearly budget for CSR plan at least \$300,000 USD for all villages which will start prior to project's near village.. During the beginning stage, GEP will focus on community development and employees' welfare in Minbu district, where the power plant is located. The nearest residential place from proposed solar power plant project site is Zee Aing village and Lay Pin Village, Minbu. GEP CSR investment strategy will prioritize the area where we believe our technology and our people can make the biggest impact. In addition, GEP approach will encourage innovation and education to create solutions those are scalable, replicable, and sustainable. By focusing on long-term solutions, GEP aim to have our contributions make a long lasting difference. According to ESIA report, the following key issues should be addressed:

- Development Plan of Water Supply System in Rural Area:
 - The village is relying on two sources of water, which are pond and two water wells. Pond is mostly dried due to the weather condition in the area, whereas water wells serve as main sources of water to the local villagers. Water is a scare resource for cultivation, livestock breeding and domestic use. So, water well with pump, tanks, and filtration system is a good solution to be implemented. The total cost for two 4" tube water wells, two submerside pumps for two 4" tube water wells, eight 250W solar panels and two inverters for submerside pumps, eight 5,000 liter water tanks and two filtration system is approximately \$15,700 USD (transportation and supervision charges are inclusive).
- Development Plan of Solar Power for Household Use in Rural Area:
 - Currently, only 20% of electricity demand is accommodated. Installing a home
 use solar set is feasible due to climate condition in the area. The cost of setting
 up (materials are inclusive) a home use solar panel including the battery is
 approximately at 650 USD per one set and it is expected to deliver an electric



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power up to 250W. One solar set is enough for one household. So, the total cost of 260 solar set is approximately \$169,000 USD. The first 14 solar set will be distributed to 14 households during the first month and 41 sets each month will be allocated during second to seventh month.

The CSR plan for Zee Aing village and Lay Pin Village are expected to completely allocate the resources to every household in the village within seven months period. After the completion of CSR plan in Zee Aing and Lay Pin Village (These two villages are most priority due to close with project), this plan will be duplicated to the other village close to the Facility site.

Yours Sincerely,

Aung Thiha

Managing Director

GEP (Myanmar) Co., Ltd.

13.58 The Applicable Laws and Legal Commitments for Solar Power Plant (English and Myanmar)



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The Applicable Laws and Legal Commitments for Solar Power Plant

- 1. The Environmental Conservation Law (2012)
- 2. The Environmental Conservation Rules (2014)
- 3. Environmental Impact Assessment Procedure (2015)
- 4. Emission Quality Standards Guideline (2015)
- 5. The Myanmar Investment Law (2016)
- 6. The Electricity Law (2014)
- 7. Protection the Rights of National Races Law(2015
- 8.) The Public Health Law (1972)
- 9. Prevention and Control of Communicable Disease Law (1995)
- 10. The Control of Smoking and Consumption of Tobacco Product Law (2006)
- 11. The Myanmar Fire Force Law (2015)
- 12. The Motor Vehicle Law (2015) and Rules (1987)
- 13. The Myanma Insurance Law(1993)
- 14. Labor Organization Law (2011)
- 15. Settlement of Labor Disputes law (2012)
- 16. The Development of Employment and Skill Law(2013)
- 17. 2013, The Minimum Wages Law
- 18. 2016, Payment of Wages Law
- 19. Workmen's Compensation Act (1923)
- 20. The Leaves and Holiday Act (1951)
- 21. Social Security Law(2012)
- 22. Petroleum Act (1934)
- 23. The Petroleum Rules (1937)
- 24. Underground Water Act
- 25. Conservation of Water Resources and Rivers Law (2006)
- 26. Freshwater Fisheries Law (1991)
- 27. The Protection and Preservation of Cultural Heritage Regions Law (1998)
- 28. The Protection and Preservation of Antique Objects Law (2015)
- 29. The Protection and Preservation of Ancient Monument Law (2015)
- 30. Farm Land Law (2012)
- 31. Forest Law (1992)



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1. The Environmental Conservation Law (2012)

Purpose; to construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations; to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation.

- The project proponent has to pay the compensation for damages if the project will causes injuries to environment under the sub-section (o) of section 7 of said law
- The project proponent has to purify, emit, dispose and keep the polluted materials in line with the stipulated standards, under section 14 of said law
- The project proponent has to install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment, under section 15 of said law.
- The project proponent has to allow relevant government organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not, under section 24 of said law.
- The project proponent has to comply with the terms and conditions included in prior permission, under section 25 of said law.
- The project proponent has to abide by the stipulations included in the rules, regulation, bylaw, order, notification and procedure, which are issued by said law, under section 29.

2. The Environmental Conservation Rules (2014)

- The project proponent has to avoid emit, discharge or dispose the materials which can pollute
 to environment, or hazardous waste or hazardous material prescribed by notification in the
 place where directly or indirectly injure to public under sub- rule (a) of rule 68.
- The project proponent has to avoid performing to damage to ecosystem and the environment generated by said ecosystem under sub-rule (b) of rule 68.

3. Environment Impact Assessment Procedure (2015)

 The project proponent has to be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant



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who is appointed or hired to perform on behalf of project owner under sub-rule (a) of rule 102.

- The project proponent has to support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project under sub-rule (b) of rule 102.
- The project proponent has to fully implement all commitments of project and conditions
 included in EMP. Moreover the project proponent has to be liable for contractor and subcontractor who perform on behalf of him/her have to fully abide by the relevant laws, rules,
 this procedure, EMP and all conditions under rule 103.
- The project proponent has to be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under rule 104.
- The project proponent has to inform the completed information, after specifying the adverse impacts caused by the project, from time to time under rule 105.
- The project proponent has to continuously monitor all adverse impacts in the preconstruction phrase, construction phrase, operation phrase, suspension phrase, closure
 phrase and post-closure phrase, moreover has to implement the EMP with abiding the all
 conditions included in ECC, relevant laws & rules and this procedure under rule 106.
- The project proponent has to submit, as soon as possible, the failures of his or her
 responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure
 or failure should be known by the Ministry the project proponent has to submit within 24
 hours and other than this situation has to submit within 7 days from knowing it under rule
 107.
- The project proponent has to submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP under rule 108.
- The project proponent has to prepare the monitoring report in accord with the rule 109.
- The project proponent has to show this monitoring report in public place such as library, hall
 and website and office of project for the purpose to know this report by public within 10 days
 from the date which the report is submitted to the Ministry. Moreover has to give the copy of
 this report, by email or other way which way agreed with the asked person, to any asked
 person or organization under rule 110.



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- The project proponent has to allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project & other work-place related to this project in any time under rule 113.
- The project proponent has to allow inspector to immediately enter and inspect in any time if
 it is emergency or failure to implement the requirements related to social or environment or
 caused to it under rule 115.
- The project proponent has to allow inspector to inspect the contractor and sub-contractor who implement on behalf of project under rule 117.

4. Emission Quality Standards Guideline (2015)

 The project proponent has to emit, discharge or dispose in line with the standards stipulated in said guideline.

5. The Myanmar Investment Law (2016)

Purpose; to ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the prescribed insurance in line with the above law.

- The project proponent has to lease the land or building owned by government or private with lease agreement and register it by the registration of deeps law under sub-section (a) and (d) of section 50 of said law.
- The project proponent has to appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise, in line with the subsection (b) of section51of said law.
- The project proponent has to appoint the nationalities in normal work without expertise, in line with the sub-section (c) of section51of said law.
- The project proponent has to appoint either foreigner or nationality with the appointment agreement in accord with the law, in line with the sub-section (d) of section51of said law.



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- The project proponent has to comply with the international best practices, existing laws, rules
 and procedures to not damage, pollute, and injure to environment, cultural heritage and
 social, in line with the sub-section (g) of section65of said law.
- The project proponent has to close the project after paying the compensation to the
 employees in accord with the existing laws if violates the appointment agreement or
 terminate, transfer or suspend the investment or reduce the number of employees, in line
 with the sub-section (i) of section65 of said law.
- The project proponent has to pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period, in line with the sub-section (j) of section65of said law.
- The project proponent has to pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work, in line with the sub-section (k) of section65of said law.
- The project proponent has to stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, directives, in line with the sub-section (I) of section65of said law.
- The project proponent has to abide by labor laws, in line with the sub-section (m) of section65of said law.
- The project proponent has to pay the compensation to the injured person for damages if damages of environment or socio-economy is occurred by misuse of project, in line with the sub-section (o) of section 65 of said law.
- The project proponent has to allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project, in line with the sub-section (p) of section65of said law..
- The project proponent has to obtain the permission of MIC before EIA process and report back this process to MIC, in line with the sub-section (q) of section 65of said law.
- The project proponent has to insure the prescribed insurance by rules, under section 73 of said law.



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The Electricity Law (2014)

Purpose: To ensure the compliance with the conditions of permission for productions of electricity, abiding by any stipulation, implementing with the best practices and paying compensation in line with above law.

- The project proponent will implement the project with the best practices to reduce the damages on the environment, health and socio-economy, also will pay compensation for the damages and will pay the fund for environmental conservation, under sub-section (b) of section 10 of said law.
- The project proponent has to take the certificate of electric safety, issued by the chiefinspector, before the commencement of power generation under section 18 of said law.
- The project proponent has to be liable for damages to any person or enterprise by failure to
 abide by the quality standards or rules, regulation, by-law, order and directive issued under
 said law according to sub-section (a) of section 21 of said law.
- The project proponent has to be liable for damages to any person or enterprise by negligence
 of project owner according to sub-section (a) of section22 of said law.
- The project owner has to comply with the permission for electric searching and generation under sub-section (a) and (b) of section 26 of said law.
- The project proponent will inform promptly to chief-inspector and head officer of related office while occurring of accident in electricity generation under section 27 of said law.
- The project proponent will comply with the standards, rules and procedure, moreover will allow the inspection by respected governmental department and organization if it is necessary under section 40 of said law.
- The project proponent will pay the compensation to anyone who is injured or caused to death
 in electric shock or fire caused by the negligence or omitting of the project owner or
 representative of project owner, under section 68 of said law.



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Protection the Rights of National Races Law (2015)

Purpose: To ensure to disclose to residents ethnic nationalities about the project fully, moreover to ensure to cooperate with them. This law focuses the following matters;

Section 5

- The project proponent has to disclose to the residents national races all about the project fully.
- The project proponent has to cooperate with the residents national races.

8. The Public Health Law (1972)

Purpose: To ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department.

The project owner will cooperate with the authorized person or organization in line with the section 3 and 5 of said law.

- Section 3 The project proponent has to abide by any instruction or stipulation for public health.
- Section 5 The project proponent has to allow any inspection, anytime, anywhere if it is needed

9. Prevention and Control of Communicable Diseases Law (1995)

Purpose: To ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department.

- The project proponent has to built the housing in line with the health standards, distribute
 the healthful drinking water & using water and arrange to systematically discharge the
 garbage & sewage under clause (9) of sub-section (a) of section 3 of said law.
- The project proponent has to abide by any instruction or stipulation by Department of health and Ministry of Health under section 4 of said law.
- The project proponent has to inform promptly to the nearest health department or hospital
 if the following are occurred: (section 9)
 - (a) Mass death of animals included in birds or chicken;
 - (b) Mass death of mouse;



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- (c) Suspense of occurring of communicable disease or occurring of communicable disease;
- (d) Occurring of communicable disease which must be informed.
- The project proponent has to allow any inspection, anytime, anywhere if it is need to inspect
 by health officer under section 11 of said law.

10. The Control of Smoking and Consumption of Tobacco Product Law (2006)

Purpose: To ensure the creation of smoking area and non-smoking area in the power plant area for health and control of smoking.

- The project proponent has to keep the caption and mark referring that is non-smoking area
 in the project area under sub-section (a) of section 9 of said law.
- The project proponent has to arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations under sub-section (b) of section 9 of said law.
- The project proponent has to supervise and carry out the measures so that no one shall smoke at the non-smoking area under sub-section (c) of section 9 of said law.

The project proponent has to allow the inspection of supervisory body in the power plant area under sub-section (d) of section 9 of said law.

11. The Myanmar Fire Force Law (2015)

Purpose: To ensure to prevent the fire, to provide the precautionary material and apparatuses, if the fire caused in the project area to be defeated because the project is business in which electricity and any inflammable materials such as petroleum are used. So, the project owner has to institute the specific fire service in line with the above law. This law focused the following

- The project proponent has to institute the specific fire services, under sub-section (a) of section 25.
- The project owner has to provide materials and apparatuses for fire precaution and prevention. Sub-section (b) of section 25.

12. The Motor Vehicles law (2015) and Rules (1987)

Purpose: When the construction period and if it is needed in operation and production period for the all vehicles.



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The project proponent has to promise to abide by the nearly all provisions of said law and rules, especially the provisions related to air pollution, noise pollution and life safety.

13. The Myanma Insurance Law

Purpose: The project can cause the damages to the environment and injuries to public so to ensure the needed insurances are insured at Myanma Insurance. This law focuses the following matters;

Section 15 - If the project proponent uses the owned vehicles the project owner has to insure the insurance for injured person.

Section 16 The project proponent has to insure the insurance to compensate for general damages because the project may cause the damages to the environment and injury to public.

14. Labor Organization Law (2011)

Purpose: To ensure protection the rights of the employees, having the good relationships between the employees and employer and enabling to form and carry out the labor organizations systematically and independently.

Section 17 - The project owner promises to allow the labour organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labour laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached.

- Section 18

 The project proponent promises to demand the re-appointment of worker who is dismissed by the employer without the conformity with the labour laws.
- Section 19 The project proponent promises to send the representatives to the Conciliation Body in settling a dispute between the employer and the worker.
- Section 20 The project proponent promises the labour organization to participate and discuss in discussing with the government, the employer and the



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complaining employees in respect of employee's rights or interest contained in the labour laws.

- Section 21 The project proponent promises the labour organization to participate in solving the collective bargains of the employees in accord with the labour laws.
- Section 22

 The project proponent promises the labour organization to carry out
 the holding the meetings, going on strike and other collective activities in line with
 the procedure, regulation ,by-law and directive of relevant Chief Labour Organization

15. The Settlement of Labour Dispute Law, 2012

- The project proponent has not to absent to negotiation within the stipulated time for complaint under section 38 of said law.
- The project proponent has not to change the existing stipulations for employees within conducting period before Tribunal under section 39 of said law.

16. Employment and Skill Development Law (2013)

Purpose: To ensure the job security and to develop the employee's skill with the fund of project owner.

- The project proponent has to appoint employees with the contract in line with the provision of section 5 of said law.
- The project proponent has to carry out the training programs with the policy of Skill
 Development Body to develop the employment skill of employees who is appointed or will be
 appointed, under section 14 of said law.
- The project proponent has to monthly pay to the fund, which is fund for development of skill
 of employees, not less below 0.5 percentage of the total payment to the level of worker
 supervisor and the workers below such level under sub-section (a) of section 30 of said law.

The project proponent has to promise not to deduct from the payment of employees for above mentioned fund under sub-section (b) of section 30 of said law.



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17. 2013, The Minimum Wages Law

Purpose: To ensure the project owner pay the wages not less than prescribed wages and notify obviously this wages in work place, moreover to be inspected.

- . The project proponent has to pay the wages in line with section 12 of said law.
- The project proponent has to notify the prescribed wages obviously in work place under subsection (a) of section 13 of said law.
- The project proponent has to correctly record the lists, schedules, documents and wages and
 report these to the relevant department and give if these are asked while inspecting, in accord
 with the stipulations under sub-section (b)(c)(d) of section13 of said law.
 - The project proponent has to allow to be inspected by the inspector, under sub-section (d) and (e) of section 13 and section 18 of said law.
 - The project proponent has to allow holiday for medical treatment if the employee' health is not fit to work, under sub-section (f) of section 13 of said law.
 - The project proponent has to allow holidays without deducting from the wages if one of parents or one of family dies, under sub-section (g) of section 13 of said law.

18. Payment of Wages Law (2016)

- The project proponent has to pay the wages in accord with the section 3 and 4 of said law under section 3 & 4 of said law.
- The project proponent has to submit with the agreements of employees & reasonable ground to department if it is difficult to pay because of force majeure included in natural disaster under section 5 of said law.
- The project proponent has to abide by the provisions of section 7 to 13 in chapter (3) in respect
 of deduction from wages.
- The project proponent has to pay the overtime fees, prescribed by law, to the employees who
 work over working hours under section 14 of said law.



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19. Workmen's Compensation Act (1923)

Purpose: To ensure the compensations to injured employee while implementing in line with the above law. To abide by the prescribed compensations in various kinds of injury. This law focuses as follow;

Section 13 The project proponent has to pay the compensation in line with the provisions of said law base on kind of injury and case by case.

20. The Leaves and Holiday Act (1951)

Purpose: The employees can take the leaves and get the holidays legally and to ensure the right to get the holidays and leaves. This law focuses the following matters;
The project proponent has to allow the leaves and holidays in line with the law.

21. Social Security Law

Purpose: The project proponent has to create the social security for the employees because the project is the business under the Myanmar Citizen Investment Law. To ensure the social security for employees of the project, the project owner has to register to the social security offices and to pay the prescribed fund.

- The project proponent has to register to the respected social security office under sub-section
 (a) of section 11 of said law
- The project proponent has to pay the social security fund for at least four types of social security included in sub-section (a) of section 15 under section 15 of said law.
- The project proponent has to pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees . Moreover the project owner



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will pay the cost for paying the above mentioned fund only myself under sub-section (b) of section 18 of said law.

- The project proponent has to pay the fund for accidence under sub-section (b) of section 48
 of said law. (but this fund is not related to workmen compensation)
- The project proponent has to make correctly and submit the list and record provided in section
 75 to respected social security office under section 75 of said law.

22. Petroleum Act (1934)

Purpose: The project will carry the oil in any phase and may import it. So, to ensure to take the license for importation and storage and abide by the stipulations in the license.

The project proponent has to obtain the license for importation, transportation and storage
of the fuel under section 3 of said law and abide by the stipulations in the license.

23. The Petroleum Rules (1937)

Purpose; To ensure the project owner has to abide by the stipulations for transportation of oil.

 The project proponent will abide by the provision of chapter (3) of the Petroleum Rules for transportation and the provisions of chapter (4) of said rules for storage.

24. The Underground Water Act (1930)

 The project proponent has to obtain the license granted by the water officer for sinking the underground water before sinking water, under section 3 of said law

25. Conservation of Water Resources and Rivers Law (2006)

Purpose: The project proponent will avoid the disposal of stipulated materials into river-creek.

- The project proponent has to avoid any performing to damage to the river, creek and water resource under sub-section (a) of section 8.
- The project proponent has to avoid the violation of conditions stipulated by the directorate for prevention of water pollution under sub-section (b) of section 24.



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26. Freshwater Fisheries Law (1991)

Purpose: According to the sub-section (e) of section 2 of said law, the freshwater area includes any river, creek, pond and water area so the project will use the river or creek which is freshwater area. If the project will build the dam beside the river and to change the water way in freshwater area to ensure getting the permission is granted by the fishery department before construction.

The project proponent has to avoid any water pollution and disturbing to fish &other aquatic lives in any fresh-water such as river, creek under section 40 of said law.

27. The Protection and Preservation of Cultural Heritage Regions Law (1998)

Purpose: To ensure the protection of cultural heritages and the cultural heritage area from the damage by the natural disaster or man-made.

- Section 13 The project proponent has to apply to get the prior permission of Directorate
 of Ancient-Research to build the road, bridge or dam in the cultural heritage area.
- Section 22 The project proponent promises not to build the building which is not in line
 with the stipulations prescribed by the Ministry of Culture in the cultural heritage area.

28. The Protection and Preservation of Antique Objective Law (2015)

Purpose; to ensure the protection of ancient monument and information about it if it was in the project area. This law focus as follows;

 The project proponent has to inform to the village-tract or ward administrator if any antique objective is found in project area under section 12 of said law.

29. The Protection and Preservation of Ancient Monument Law (2015)

Purpose; to ensure the protection of ancient monument and information about it if it was in the project area. This law focus as follows;



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- Section 12 The project proponent has to report to the village-tract or ward administrators if the project proponent will find any ancient monument under the ground or on the ground or under the water.
- Section 15 The project proponent has to obtain the prior permission of Department of
 Archeological Research and Museum if the project area is in the prescribed area of Ancient
 monument.
- Sub-section (f) of section 20 The project proponent has to obtain the prior permission, by written, of Department of Ancient Research and National Museum if the project proponent dispose the chemical and solid waste in the Ancient Monument are

30. The Farm Land Law (2012)

 The project proponent has to obtain the permit, to use the farm land other means except paddy land, issued by Magawe Region Government under sub-section (b) of section 30.

31. The Forest Law (1992)

 Sub-section (a) of section 12 - The project proponent has to obtain the approval of Ministry if the project area is included in the forest land or the land administrated by the government which covers the forest under section 12.

> Aung Thiha Managing Director GEP (Myanmar)

Rung L.

EIA Report for the Implementing Solar Power Plant Project in Minbu District, Magwe Region

နေရောင်ခြည် စွမ်းအင်သုံးဓာတ်အားပေးစက်ရုံစီမံကိန်းက လိုက်နာ ဆောင်ရွက်ရမည့် ဥပဒေဆိုင်ရာ ကတိကပတ်များ

၁။ ပတ်ဂန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂) စီမံကိန်းပိုင်ရှင်သည်-

- (က) ပတ်ပန်းကျင်ကို ညစ်ညမ်းစေခဲ့လျှင် ပန်ကြီးဌာနက သတ်မှတ်သည့် လျော်ကြေးငွေကို ပုဒ်မဂု၊ ပုဒ်မခွဲ (က)အရ ပေးလျော်ပါမည်။
- (စ) ပတ်ဂန်းကျင်ကို ညစ်ညမ်းမှု ဖြစ်ပေါ် စေသည့် ထုတ်လွှတ်ခြင်းကို သတ်မှတ်ထားသည် ပတ်ဂန်းကျင်အရည်အသွေး စံချိန်စံညွှန်းများနှင့်အညီ ထုတ်လွှတ်ပါမည်။(ပုဒ်မ၁၄ အရ)
- (ဂ) ပတ်ပန်းကျင်ညစ်ညမ်းမှုများကို စောင်ကြပ်ကြည့်ရှုရန်၊ ထိန်းချုပ်ရန်၊ စီမံခန့်ခွဲရန်၊ လျော့ချရန် သို့မဟုတ် ပပျောက်စေရန် လုပ်ငန်းခွင် အထောက်အကူပြုပစ္စည်း သို့မဟုတ် ထိန်းချုပ်ရေး ပစ္စည်းကိရိယာကို တပ်ဆင်ခြင်း သို့မဟုတ် သုံးစွဲခြင်း ပြုပါမည်။ ထိုသို့မဆောင်ရွက်နိုင်ပါက စွန့်ပစ်ပစ္စည်းများကို ပတ်ပန်းကျင်ကို မထိခိုက်စေသော နည်းလမ်းများနှင့်အညီ စွန့်ပစ်ပါမည်။ (ပုဒ်မ၁၅ အရ)
- (ဃ) ဂန်ကြီးဌာနက ထုတ်ပေးသည် ကြိုတင်ခွင့်ပြုချက်ပါ စည်းကမ်းချက်များနှင့်အညီ ဆောင်ရွက်ခြင်းရှိ မရှိ လာရောက်စစ်ဆေးသည် တာဂန်ရှိပုဂ္ဂိုဟ် သို့မဟုတ် အဖွဲ့ အစည်းအား စစ်ဆေးခွင့်ပြုပါမည်။ (ပုဒ်မ ၂၄ အရ)
- (င) ပတ်ဂန်းကျင်ထိန်းသိမ်းရေး ဥပဒေအရ ထုတ်ပြန်သော နည်းဥပဒေများ၊ အမိန့် ကြော်ငြာစာ၊ အမိန့် ၊ညွှန်ကြားချက်နှင့် လုပ်ထုံးလုပ်နည်းပါ တားမြစ်ချက်များကို လိုက်နာပါမည်။ (ပုဒ်မ၂၉ အရ)

၂။ ပတ်ဂန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ (၂၀၁၄) စီမံကိန်းပိုင်ရှင်သည်-

- (က) နည်းဥပဒေ ၆၉၊ နည်းဥပဒေခွဲ (က)အရ ပတ်ဂန်းကျင်ကို ညစ်ညမ်းစေသည့် ပစ္စည်းများကို အများပြည်သူအားတိုက်ရိုက်ဖြစ်စေ သွယ်ပိုက်၍ ဖြစ်စေ ထိခိုက်စေနိုင်မည့် နေရာတစ်ခုခုတွင် တစ်နည်းနည်းဖြင့် ထုတ်လွှတ်ခြင်း၊ ထုတ်လွှတ်စေခြင်း၊ စွန့်ပစ်ခြင်း၊ စွန့်ပစ်စေခြင်း၊ စုပုံခြင်း၊ စုပုံစေခြင်း မပြုပါ။
- (ခ) နည်းဥပဒေ ၆၉၊ နည်းဥပဒေခွဲ (က)အရ ပတ်ဂန်းကျင်ထိန်းသိမ်းရေးဥပဒေ၊ နည်းဥပဒေများ တစ်ခုခုအရ အမိန့်ကြော်ငြာစာဖြင့် သတ်မှတ်ထားသော ဘေးအန္တရာယ်ရှိ ပစ္စည်းများကို အများပြည်သူအား တိုက်ရိုက်ဖြစ်စေ သွယ်ဂိုက်၍ ဖြစ်စေ ထိခိုက်စေနိုင်မည့် နေရာတစ်ခုခုတွင် တစ်နည်းနည်းဖြင့် ထုတ်လွှတ်ခြင်း၊ ထုတ်လွှတ်စေခြင်း၊ စွန့်ပစ်ခြင်း၊ စွန့်ပစ်စေခြင်း၊ စုပုံခြင်း၊ စုပုံစေခြင်း မပြုပါ။
- (ဂ) နည်းဥပဒေ ၆၉၊ နည်းဥပဒေခွဲ (ခ)အရ ဂေဟစနစ်နှင့် ယင်းစနစ်ကြောင့် ဖြစ်ပေါ် ပြောင်းလဲနေသော သဘာပပတ်ပန်းကျင်ကို ထိခိုက်ပျက်စီးစေနိုင်သည့် ပြုလုပ်မှုကို ဆောင်ရွက်ခြင်းမပြုပါ။

၃။ ပတ်ပန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းဥပဒေ (၂၀၁၅) စီမံကိန်းပိုင်ရှင်သည်-

(က) မိမိကိုယ်တိုင်ကြောင့်ဖြစ်စေ၊ မိမိကိုယ်စားဆောင်ရွက်သည့် ကန်ထရိုက်တာ၊ လက်ခွဲ ဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာ၊ အရာရှိ၊ အလုပ်သမား၊ ကိုယ်စားလှယ် သို့မဟုတ် အတိုင်ပင်ခံ၏ ပြုလုပ်မှု သို့မဟုတ်

- ပျက်ကွက်မှုကြောင့် ပေါ် ပေါက်သည့် ဆိုးကျိုး သက်ရောက်မှုကို တာပန် ယူပါမည်။ (အပိုဒ် ၁၀၂ (က)အရ)
- (ခ) စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူကို လက်ရှိ သို့မဟုတ် စီမံကိန်း မဆောင်ရွက်မီ ကာလထက် မနိမ့်ကျသော လူမှုစီးပွားရေး တည်ငြိမ်ခိုင်မာမှ ရရှိသည်အထိ ဆောင်ရွက်ပေးရန်နှင့် သက်မွေးပမ်းကျောင်းလုပ်ငန်းများ ပြန်လည် တည်ထောာင်ရေးနှင့် ပြန်လည်နေရာချထားရေး အစီအစဉ်များကို စီမံကိန်းကြောင့် ထိခိုက်ခံစားရသူများ၊ သက်ဆိုင်ရာ အစိုးရဌာန၊ အဖွဲ့အစည်းများ၊ အခြား သက်ဆိုင်သူများနှင့် တိုင်ပင်ဆွေးနွေး၍ လိုအပ်သလို ပံ့ပိုးပေးပါမည်။ (အပိုဒ် ၁၀၂(စ)အရ)
- (ဂ) ပတ်ပန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်၊ စီမံကိန်း ကတ်ကပတ်အားလုံးနှင့် စည်းကမ်းချက် များကို အပြည်အပ အကောင်အထည်ဖော်ပါမည်။ မိမိကိုယ်စား ဆောင်ရွက်သည့် ကန်ထရိုက်တာ၊ လက်ခွဲဆောင်ရွက်ပေးသူ ဆပ်ကန်ထရိုက်တာ များက စီမံကိန်းအတွက် လုပ်ငန်းများဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာ ဥပဒေ၊ နည်းဥပဒေများ၊ ဤလုပ်ထုံးလုပ်နည်း၊ ပတ်ပန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်နှင့် စည်းကမ်းချက်များအားလုံးကို အပြည့်အပ လိုက်နာဆောင်ရွက် စေပါမည်။ (အပိုဒ်၁ပ၄ အရ)
- (ဃ) ပတ်ဂန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ လိုက်နာဆောင်ရွက်မှု သက်သေခံလက်မှတ်၊ သက်ဆိုင်ရာဥပဒေများ၊ နည်းဥပဒေများ၊ ဤလုပ်ထုံးလုပ်နည်းနှင့် စံချိန်စံညွှန်းတို့တွင် ပါရှိသော လိုအပ်ချက်အားလုံးကို တာဂန်ယူသည်အပြင် ထိရောက်စွာ အကောင်အထည် ဖော်ဆောင်ရွက်ပါမည်။ (အပိုဒ်၁ပ၅အရ)
- (င)အကြိုတည်ဆောက်ခြင်း၊ တည်ဆောက်ခြင်း၊ လုပ်ငန်းလည်ပတ် ဆောင်ရွက်ခြင်း၊ လုပ်ငန်းရပ်စဲခြင်း၊ လုပ်ငန်းပိတ်သိမ်းခြင်း နှင့် လုပ်ငန်းပိတ်သိမ်းပြီးကာလတို့တွင်

- ဆိုးကျိုးသက်ရောက်မှု အားလုံးအတွက် စီမံကိန်းနှင့် ဆက်စပ်ဆေင်ရွက်မှုများကို စဉ်ဆက်မပြတ် ဘက်စုံစောင့်ကြပ် စစ်ဆေးပါမည်။ (အပိုဒ် ၁ဂ၆ အရ)
- (စ) မိမိ၏ တာဂန် သို့မဟုတ် ဆောင်ရွက်ချက် ပျက်ကွက်မှုကို အမြန်ဆုံး စာဖြင့် တင်ပြ ပါမည်။ ပျက်ကွက်မှုကြောင့် ပတ်ဂန်းကျင်အပေါ် သက်ရောက်မှုဖြစ်နိုင်သည် ကိစ္စ သို့မဟုတ် ဂန်ကြီးဌာနက အမြန်သိရန်လိုအပ်သည့် ကိစ္စကို ၂၄နာရီအတွင်း လည်းကောင်း အခြားကိစ္စဖြစ်ပါက စတင်သိရှိချိန်မှ ဂုရက်အတွင်း လည်းကောင်း ဂန်ကြီးဌာနသို့ တင်ပြရမည်။ (အပိုဒ် ၁၀၇ အရ)
- (ဆ) ပတ်ဂန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်၏ ဇယားပါအတိုင်း စောင်ကြပ်ကြည်ရှမှု အစီရင်ခံစာကို ၆လ တကြိမ် သို့မဟုတ် ဂန်ကြီးဌာနက သတ်မှတ်ထားသည့် အတိုင်း ဂန်ကြီးဌာနသို့ အစီရင်ခံတင်ပြပါမည်။ (အပိုဒ်၁ဂ၈ အရ)
- (ဇ) စောင် ့ကြပ်ကြည့်ရှမှု အစီရင်ခံစာတွင် အပိုဒ်၁၀၉ ပါ သတ်မှတ်ချက်များ အနည်းဆုံး ထည်သွင်းဖော်ပြပါမည်။ (အပိုဒ် ၁၀၉ အရ)
- (စျ) အပိုဒ် ၁၀၈ အရ တင်ပြသည် နေ့ရက်မှ ၁၀ရက်အတွင်း အများပြည်သူ သိရှိနိုင်ရန် စီမံကိန်း၏ ပက်ဘ်ဆိုဒ်၊ စာကြည်တိုက်၊ ပြည်သူ့ခန်းမ၊ အများပြည်သူစုပေးရာ နေရာနှင့် စီမံကိန်းရုံးဌာန တို့တွင် အများပြည်သူသိရှိစေရန် ယင်းအစီရင်ခံစာကို တင်ပြပါမည်။ ယင်းအစီရင်ခံစာ၏ ဒီဂျီတယ် မိတ္တူကို တောင်းခံချက်ကို လက်ခံရရှိသည် နေ့မှစ ၁၀ ရက်အတွင်း အီးမေးလ်ဖြင့် ဖြစ်စေ၊ တောင်းခံသူနှင့် သဘောထားတူညီထားသည် အခြားနည်းလမ်းဖြင့် ဖြစ်စေ တောင်းခံသူအား ပေးပါမည်။ (အပိုဒ်၁၁၀ အရ)
- (ည) စောင့်ကြပ်ကြည့်ရှုရန်နှင့် စစ်ဆေးရန် တာပန်ရှိသူကို သာမန်အလုပ်မျိန်အတွင်း ပင်ရောက်ခွင့်ပြုပါမည်။ (အပိုဒ်၁၁၃ (က) အရ) စီမံကိန်း၏ ရုံးများ၊ လုပ်ငန်းခွင်၊

- စီမံကိန်းနှင့် သက်ဆိုင်သော လုပ်ငန်းများ ဆောင်ရွက်နေသည့် အခြား နေရာများ သို့ လိုအပ်ပါက အချိန်မရွေး ပင်ရောက်ခွင့်ပြုပါမည်။
- (ဍ) အရေးပေါ် အခြေအနေတွင် ဖြစ်စေ၊ ပတ်ဂန်းကျင်ဆိုင်ရာနှင့် လူမှုရေးဆိုင်ရာ လိုအပ်ချက် ကို ဆောင်ရွက်ပေးရန် ပျက်ကွက်လျှင် ဖြစ်စေ၊ ထိုသို့ ပျက်ကွက်နိုင်သည်ဟု ယူဆလျှင် ဖြစ်စေ စစ်ဆေးရန် တာဂန်ရှိသူက ပင်ရောက်စစ်ဆေးလိုသည့် အချိန်တွင် ချက်ချင်းခွင့်ပြုပါမည်။ (အပိုဒ် ၁၁၅ အရ)
- (ဌ) ကိုယ်စားဆောင်ရွက်ပေးသူ ကန်ထရိုက်တာနှင့် လက်ခွဲဆောင်ရွက်သူ ဆပ်ကန်ထရိုက်တာ တို့ကို တာပန်ရှိသူက စစ်ဆေးခြင်းကိုခွင့်ပြုပါမည်။ (အပိုဒ် ၁၁၇ အရ)

၄။ အမျိုးသားပတ်ပန်းကျင်ဆိုင်ရာ အရည်အသွေး ထုတ်လွှတ်မှု လမ်းညွှန်ချက် (၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည် လမ်းညွှန်ချက်ပါ စံချိန်စံညွှန်းများနှင့်အညီ ထုတ်လွှတ်ခြင်း၊ စွန့်ပစ် ခြင်း ပြုပါမည်။

၅။ မြန်မာနိုင်ငံရင်းနီးမြှုပ်နှံမှုဥပဒေ (၂၀၁၆)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) ငှားရမ်းခွင့် ရရှိထားသည့် အစိုးရစီမံခန့်ခွဲခွင့်ရှိသော မြေ သို့မဟုတ် ပုဂ္ဂလိကမြေ ကို စာချုပ်စာတမ်းများ မှတ်ပုံတင်ခြင်း အက်ဥပဒေ နှင့် အညီ စာချုပ်စာတမ်း မှတ်ပုံတင်ရုံးတွင် မှတ်ပုံတင်ပါမည်။ (ပုဒ်မ ၅၀ အရ)
- (ခ) အဆင့်ဆင့်သော စီမံခန့်ခွဲမှု၊ နည်းပညာ၊ လုပ်ငန်းကျွမ်းကျင်သူ နေရာတို့တွင် နိုင်ငံသားများကို စွမ်းဆောင်ရေ မြှင့်တင်ပေးပြီး အစားထိုးခန့်ထားပါမည်။ (ပုဒ်မ၅၁ (ခ)အရ)

- (ဂ) ကျွမ်းကျင်မှု မလိုအပ်သည့် လုပ်ငန်းများတွင် မြန်မာနိုင်ငံသားများကိုသာ ခန့်ထားပါမည်။ (ပုဒ်မ ၅၁ (ဂ) အရ)
- (ဃ) မြန်မာနိုင်ငံသားနှင့် နိုင်ငံခြားသားများကို အလုပ်ခန့်ထားမှုဆိုင်ရာ သဘော တူညီချက် စာချုပ်ဖြင့် တည်ဆဲဥပဒေနှင့်အညီ ခန့်ထားပါမည်။ (ပုဒ်မရင်းနှီးမြှုပ်နှံမ ၅၁(ဃ) အရ)
- (င) တည်ဆဲဥပဒေများ နည်းဥပဒေများ၊ လုပ်ထုံးလုပ်နည်းများနှင့် နိုင်ငံတကာတွင် ကျင့်သုံးသည့် အကောင်းဆုံး စံချိန်စံညွှန်းများနှင့်အညီ သဘာဂပတ်ဂန်းကျင်နှင့် လူမှုပတ်ဂန်းကျင် ထိခိုက်ပျက်စီးမှု၊ ညစ်ညမ်းမှု မဖြစ်စေရန်နှင့် ယဉ်ကျေးမှု အမွေအနှစ်များကို ထိခိုက်ပျက်စီးမှု မဖြစ်ပေါ် စေရန် လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၆၅ (ဆ)အရ)
- (စ) အလုပ်ခန့်ထားမှုဆိုင်ရာ သဘောတူစာချုပ် ဖောက်ဖျက်ခြင်း၊ ရင်းနှီးမြှုပ်နှံမှု အပြီး ဝိတ်သိမ်းခြင်း၊ လွှဲပြောင်းရောင်းချခြင်း၊ ရင်းနှီးမြှုပ်နှံမှု ရပ်ဆိုင်ခြင်း၊ လုပ်သား အင်အား လျော့ချခြင်းတို့အတွက် အလုပ်သမားများကို တည်ဆဲဥပဒေ များနှင့် အညီ နစ်နာကြေးပေးပြီးမှသာ ရင်းနှီးမြှုပ်နှံမှုကို ရပ်ဆိုင်းပိတ်သိမ်းပါမည်။ (ပုဒ်မ ၆၅ (ဈ)အရ)
- (ဆ) ခိုင်လုံသော အကြောင်းပြချက်ဖြင့် ရင်းနှီးမြှုပ်နှံမှု ယာယီပိတ်သိမ်းပါက ပိတ်သိမ်း ထားရသည့် ကာလအတွင်း အလုပ်သမားများကို တည်ဆဲဥပဒေ၊နည်းဥပဒေများ၊ ညွှန်ကြားချက်များ၊ လုပ်ထုံးလုပ်နည်းများနှင့် အညီ လုပ်ခ၊လစာ ပေးပါမည်။ (ပုဒ်မ ၆၅ (ည) အရ)
- (ဇ) အလုပ်ကြောင့် ထိခိုက်ဒက်ရာ ထိခိုက်မှု၊ ကိုယ်အင်္ဂါအစိတ်အပိုင်း ချို့ယွင်း ဆုံးရှုံးမှု၊ ရောဂါရရှိမှု၊ သေဆုံးမှုတို့ ဖြစ်ပွားသော အလုပ်သမားများအတွက် သက်ဆိုင်ရာ အလုပ်သမား သို့မဟုတ် အမွေဆက်ခံခွင့် ရှိသူကို တည်ဆဲ

- ဥပဒေနှင့် အညီ ရထိုက် သည့် နစ်နာကြေးနှင့် လျော်ကြေးပေးပါမည်။ (ပုဒ်မ ၆၅(ဋ)အရ)
- (ဈ) လာရောက်အလုပ်လုပ်ကိုင်နေသည့် နိုင်ငံခြားသား ကျွမ်းကျင်ပညာရှင်များနှင့် ကြီးကြပ်သူများ၊ မိသားစုဂင်များသည် တည်ဆဲဥပဒေများ၊ နည်းဥပဒေများ၊ အမိန့်နှင့် ညွှန်ကြားချက်များ၊ ယဉ်ကျေးမှုနှင့် ဓလေ့ထုံးစံများကို လေ့လာ လိုက်နာ ရန် ကြပ်မတ်ပါမည်။ (ပုဒ်မ ၆၅(ဌ) အဂု)
- (ည) စီမံကိန်းလိုအပ်ချက်အရ ခွင့်ပြုထားခြင်း မဟုတ်သော ဆောင်ရွက်ခြင်းကြောင့် သဘာဂ ပတ်ဂန်းကျင် ထိခိုက်ပျက်စီးစေခြင်းနှင့် လူမှုစီးပွားအပေါ် ဆုံးရှုံးမှုများ ဖြစ်ပေါ် စေပါက အဆိုပါ ဆုံးရှုံးနစ်နာမှုအတွက် ထိရောက်သည့် လျော်ကြေးကို နှစ်နာသူထံသို့ ပေးလျော်ပါမည်။ (ပုဒ်မ ၆၅(က) အရ)
- (ဋ) ကော်မရှင်က စစ်ဆေးကြည့်ရှုရန် ကြိုတင်အကြောင်းကြားလာပါက မည်သည့် နေရာကိုမဆို ဂင်ရောက်စစ်ဆေးခွင့်ပြုပါမည်။ (ပုဒ်မ ၆၅(တ)အရ)
- (ဌ) ကော်မရှင်၏ ခွင့်ပြုမိန့် သို့မဟုတ် အတည်ပြုမိန့်ကို ပတ်ဂန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ငန်းစဉ်များ မဆောင်ရွက်မီ ဦးစွာရယူပါမည်။ ပတ်ဂန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ငန်းစဉ်များ ဆောင်ရွက်မှ အခြေအနေကို ကော်မရှင်သို့ တင်ပြပါမည်။ (ပုဒ်မ ၆၅(ထ)အရ)
- (ဍ) နည်းဥပဒေ၌ ဖော်ပြသတ်မှတ်ထားသော အာမခံအမျိုးအစားများကို အာမခံ ထားရှိပါမည်။ (ပုဒ်မ ၅၃ အရ)

၆။ လျှပ်စစ်ဥပဒေ(၂၀၁၄)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) စစ်ဆေးရေးမှူးချုပ်ထံမှ လျှပ်စစ်အန္တရာယ်ကင်းရှင်းကြောင်း လက်မှတ်ရရှိမှသာ လျုပ်စစ်ထုတ်လုပ်ခြင်း လုပ်ငန်းများခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၈ အရ)
- (ခ) ဤဥပဒေ၊ နည်းဥပဒေများ၊ အမိန့်ကြော်ငြာစာ၊ အမိန့်နှင့်ညွှန်ကြားချက်များကို လိုက်နာ ဆောင်ရွက်ရန် ပျက်ကွက်ခြင်းကြောင့် ဖြစ်စေ သတ်မှတ်ထားသည့် အရည်အသွေးနှင့် စံချိန်စံညွှန်းများကို လိုက်နာဆောင်ရွက်ရန် ပျက်ကွက်ခြင်း ကြောင့် ဖြစ်စေ၊ လူပုဂ္ဂိုဟ်တစ်ဦးဦး သို့မဟုတ် လုပ်ငန်းအဖွဲ့အစည်း တစ်ခုခုကို ထိခိုက်နှစ်နာဆုံးရှုံးမှု ဖြစ်ပွားပါက တာဂန်ယူပါမည်။ (ပုဒ်မ ၂၁ (က) အရ)
- (ဂ) မိမိ၏ ပေါ့ဆစွာဆောင်ရွက်မှုကြောင့် လူပုဂ္ဂိုဟ်တစ်ဦးဦး သို့မဟုတ် လုပ်ငန်း အဖွဲ့အစည်း တစ်ခုခုကို ထိခိုက်နှစ်နာဆုံးရှုံးမှု ဖြစ်ပွားပါက တာဂန်ယူပါမည်။ (ပုဒ်မ ၂၂ (က)အရ)
- (ဃ) လျှပ်စစ်ဓာတ်အား ထုတ်လွှတ်ခြင်းကြောင့် လျှပ်စစ်အန္တရာယ် မတော်တဆ ဖြစ်ပွားပါက စစ်ဆေးရေးမှူးချုပ်နှင့် သက်ဆိုင်ရာ ဌာနတာဂန်ခံထံ အမြန်ဆုံး အကြောင်းကြားပါမည်။ (ပုဒ်မ ၂၇အရ)
- (င) (န်ကြီးဌာနက ထုတ်ပြန်ထားသည် နည်းဥပဒေများ၊ စံချိန်စံညွှန်းများနှင့် လုပ်ကိုင်ဆောင်ဂွက်ပါမည်။ သက်ဆိုင်ရာ အစိုးရဌာန၊ အစိုးရအဖွဲ့အစည်းများ၏ လိုအပ်သော စစ်ဆေးမှုများကို ခံယူပါမည်။ (ပုဒ်မ၄()အရ)
- (စ) မိမိ သို့မဟုတ် မိမိက တာဂန်ပေးအပ်ထားသူ ပေါ့လျော့မှုကြောင့် ဖြစ်စေ တာဂန် ပျက်ကွက်မှုကြောင့်ဖြစ်စေ ဓာတ်လိုက်မှု သို့မဟုတ် မီးလောင်မှုဖြစ်ပွားပြီး ထိခိုက်ဒက်ရာရခြင်း၊ မသန်မစွမ်းဖြစ်ခြင်း သို့မဟုတ် သေဆုံးခြင်းဖြစ်လျှင် ထိခိုက်နှစ်နာသူက တောင်းခံခွင့်ရှိသည့် လျော်ကြေးကို ပေးလျော်ပါမည်။ (ပုဒ်မ ၆၈ အရ)

ဂု။တိုင်းရင်းသားလူမျိုးများအကျိုးစီးပွားကာကွယ်စောင့်ရှောက်ရေးဥပဒေ (၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) စီမံကိန်းကို အကောင်အထည်ဖော်မည့် ဒေသရှိ ဌာနေတိုင်းရင်းသား လူမျိုးများအား စီမံကိန်း၏ အကြောင်းအရာများကို ပြည်စုံတိကျစွာ ကြိတင်ချပြ အသိပေးပါမည်။ (ပုဒ်မ ၅ အရ)
- (ခ) စီမံကိန်းကို အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် စီမံကိန်းကို အကောင်အထည်ဖော်မည့် ဒေသရှိ ဌာနေတိုင်းရင်းသားလူမျိုးများနှင့် ညှိနှိုင်း ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၅ အရ)

၈။ ပြည်သူ့ကျန်းမာရေးဥပဒေ (၁၉၇၂)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) ပြည်သူ့ကျန်းမာရေးအတွက် ပုဒ်မ ၃ ပါ ကိစ္စများနှင့် စပ်လျဉ်း၍ မည်သည် စည်းကမ်းသတ်မှတ်ချက်များ၊ ညွှန်ကြားချက်များကိုမဆို လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၃အရ)
- (ခ) လိုအပ်ချက်အရ ဤဥပဒေအရ တာဂန်ရှိသူများက လာရောက်စစ်ဆေးခြင်းနှင့် စပ်လျဉ်း၍ မည်သည့်နေရာ၊ မည်သည့်အချိန်တွင် မည်သည့် စစ်ဆေးမှုကိုမဆို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၅ အရ)

၉။ ကူးစက်ရောဂါ ကာကွယ်နှိမ်နှင်းရေး ဥပဒေ(၁၉၉၅)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) အလုပ်သမားများကို ကူးစက်ရောဂါ မဖြစ်ပွားစေရေးအတွက် လုပ်ငန်းခွင်တွင် ကျန်းမာရေးနှင့် ညီညွှတ်သော နေအိမ်ဆောက်လုပ်ပေးပါမည်။ကျန်းမာရေးနှင့် ညီညွှတ်သော သောက်ရေနှင့် သုံးရေရရှိအောင် ဆောင်ရွက်ပေးပါမည်။ အညစ်အကြေးများကို စနစ်တကျ စွန့်ပစ် စေရန်ဆောင်ရွက်ပေးပါမည်။ (ပုဒ်မ ၃(က) (၉) အရ)
- (ခ) ကျန်းမာရေးပန်ကြီးဌာနနှင့် ကျန်းမာရေးဦးစီးဌာနတို့က ညွှန်ကြားသည်နှင့် အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၄ အရ)
- (ဂ) အောက်ပါကိစ္စရပ်များ ဖြစ်ပွားကြောင်း သိရှိလျှင် သိရှိခြင်း အနီးဆုံး ကျန်းမာရေး ဌာန သို့မဟုတ် ဆေးရုံသို့ ချက်ချင်း သတင်းပို့ပါမည်-
- (၁) ကြက်နှင့် အပါအဂင် တိရစ္ဆာန်များ အစုအလိုက်၊ အပြုံလိုက် သေဆုံးခြင်း၊
- (၂) ကြွက်ကျခြင်း၊
- (၃) ကူးစက်မြန်ရောဂါဖြစ်သည်ဟု သံသယရှိခြင်း သို့မဟုတ် ယင်းရောဂါ ဖြစ်ပွားခြင်း
- (၄) တိုင်ကြားရမည့် ကူးစက်ရောဂါဖြစ်ပွားခြင်း၊
- (ဃ) ကျန်းမာရေးအရာရှိက လိုအပ်၍ လာရောက်စစ်ဆေးလျှင် မည်သည့်နေရာ၊ မည်သည့်အချိန်တွင်မဆို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၁အရ)

၁၀။ ဆေးလိပ်နှင့် ဆေးရွက်ကြီးထွက်ပစ္စည်း သောက်သုံးမှု ထိန်းချုပ်ရေးဥပဒေ(၂၀၁၆)

စီမံကိန်းပိုင်ရှင်သည်-

(က) ဆေးလိပ်သောက်သုံးခွင့်မရှိသော နေရာများတွင် ထိုသို့ ခွင့်မပြုကြောင်း ဖော်ညွှန်းသည် စာတမ်းနှင့် အမှတ်အသားများကို သတ်မှတ်ချက်နှင့်အညီ ထားရှိပါမည်။ (ပုဒ်မ ၉(က)အရ)

- (စ) ဓာတ်အားပေး စက်ရုံ ဇရိယာအတွင်း ဆေးလိပ်သောက်သုံးရန် နေရာကို စီစဉ်ပေးပြီး သတ်မှတ်ချက်နှင့်အညီ ယင်းသို့ခွင့်ပြုသည့် နေရာဖြစ်ကြောင်း ဖော်ညွှန်းသည် စာတမ်းနှင့်အမှတ်အသား ထားရှိပါမည်။ (ပုဒ်မ ၉ (စ) အရ)
- (ဂ) ဆေးလိပ်သောက်ခွင့်မရှိသော နေရာ၌ မည်သူမျှ ဆေးလိပ်သောက်ခြင်းမပြုရန် ကြပ်မတ်ပါမည်။ (ပုဒ်မ ၉(ဂ) အရ)
- (ဃ) ကြီးကြပ်ရေးအဖွဲ့ လာရောက်စစ်ဆေးသည့်အခါ စစ်ဆေးခြင်းကို ခံယူပါမည်။ (ပုဒ်မ ၉(ဃ) အရ)

၁၁။ မြန်မာနိုင်ငံ မီးသတ်တပ်ဖွဲ့ ဥပဒေ(၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) သီးသန့်မီးသတ်တပ်ဖွဲ့ ဖွဲ့စည်းပါမည်။ (ပုဒ်မ ၂၅ (က)အရ)
- (ခ) မီးဘေးလုံခြုံရေးဆိုင်ရာ ပစ္စည်းများကို ထားရှိပါမည်။ (ပုဒ်မ ၂၅(ခ)အရ)

၁၂။ မော်တော်ယာဉ် ဥပဒေ (၂၀၁၅) နှင့် မော်တော်ယာဉ် နည်းဥပဒေများ (၁၉၈၇)

စီမံကိန်းပိုင်ရှင်သည်-လေထုညစ်ညမ်းစေခြင်း၊ အသံဆူညံစေခြင်းနှင့် အသက်အန္တရာယ် လုံခြုံစိတ်ချမှုတို့နှင့် သက်ဆိုင်သည် ဤဥပဒေနှင့် နည်းဥပဒေများပါ ပြဌာန်းချက်များကို လိုက်နာ ဆောင်ရွက်ပါမည်။

၁၃။ မြန်မာ့အာမခံလုပ်ငန်း ဥပဒေ(၁၉၉၃) စီမံကိန်းပိုင်ရှင်သည်-

- (က) ကိုယ်ပိုင်ယာဉ်များ သုံးစွဲမည်ဆိုပါက လူထိခိုက်မှုဆိုင်ရာ အာမခံ ထားရှိပါမည်။ (ပုဒ်မ ၁၅ အရ)
 - (ခ) ပတ်ဂန်းကျင်ကို ထိခိုက်စေခြင်းနှင့် ပြည်သူလူထုကို နှစ်နာစေခြင်း ဖြစ်ပေါ် လျှင် ယင်းအထွေထွေ ဆုံးရှုံးနှစ်နာမှုကို ပေးလျော်နိုင်ရန် ထားရှိရမည့် အာမခံကို ထားရှိပါမည်။ (ပုဒ်မ ၁၆ အရ)

၁၄။ အလုပ်သမားအဖွဲ့အစည်းဥပဒေ (၂၀၁၁) စီမံကိန်းပိုင်ရှင်သည်-

- (က) အလုပ်သမား ဥပဒေနှင့် မညီဘဲ အလုပ်ထုတ်ခံရသည့် အလုပ်သမားကို ပြန်လည်အလုပ် ခန့်ထားရန်တောင်းဆိုသည်ကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၈ အရ)
- (ခ) အလုပ်ဂွင်နှင့် အလုပ်သမားအကြား အငြင်းပွားမှုကို ညှိနှိုင်းဖျန်ဖြေရေးအဖွဲ့က ဖြေရှင်းရာတွင် ယင်းအဖွဲ့သို့ အလုပ်သမားကိုယ်စားလှယ် စေလွှတ်ခြင်းကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၉ အရ)
- (ဂ) အလုပ်သမား ဥပဒေများပါ အလုပ်သမားအခွင့်အရေး သို့မဟုတ် အကျိုးစီးပွားနှင့် စပ်လျဉ်း၍ အစိုးရ၊ အလုပ်ဂွင်နှင့် တောင်းဆိုသူ အလုပ်သမားတို့ ဆွေးနွေးရာတွင် အလုပ်သမားအဖွဲ့အစည်း၏ ကိုယ်စားလှယ်ကို ပါဂင်ဆွေးနွေးခွင့်ပြုပါမည်။ (ပုဒ်မ ၂၀ အရ)
- (ဃ) အလုပ်သမား ဥပဒေများနှင့်အညီ အလုပ်သမားများ၏ စုပေါင်းအရေးဆိုမှုများကို ဖြေရှင်းရာတွင် အလုပ်သမားအဖွဲ့ အစည်းကို ပါဂင်ဆောင်ရွက်ခွင့်ပြုပါမည်။ (ပုဒ်မ၂၁ အရ)

(င) အလုပ်သမား အဖွဲ့ အစည်းက သက်ဆိုင်ရာ အလုပ်သမားအဖွဲ့ချုပ်က ချမှတ် ထားသော လုပ်ထုံးလုပ်နည်းများ၊ စည်းမျဉ်းစည်းကမ်း၊ ညွှန်ကြားချက်များနှင့်အညီ အစည်းအပေးများပြုလုပ်ခြင်း၊ သဝိတ်မှောက်ခြင်းတို့ကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၂၂ အရ)

၁၅။ အလုပ်သမားရေးရာအငြင်းပွားမှု ဖြေရှင်းရေးဥပဒေ (၂၀၁၂) စီမံကိန်းပိုင်ရှင်သည်-

- (က) တောင်းဆို တိုင်ကြားချက်နှင့် စပ်လျဉ်း၍ သတ်မှတ်ကာလအတွင်း ဆွေးနွေးညှိနှိုင်း ဖြေရှင်းရာတွင် ပျက်ကွက်မည်မဟုတ်ပါ။ (ပုဒ်မ ၃၈ အရ)
- (a) ခုံသမာဓိအဖွဲ့ သို့မဟုတ် ခုံအဖွဲ့က အငြင်းပွားမှု စစ်ဆေးနေစဉ် ကာလအတွင်း ထိုအငြင်းပွားမှု မစမီက ချမှတ်ထားသော အလုပ်သမားများနှင့် သက်ဆိုင်သည့် စည်းကမ်းများကို အလုပ်သမားများ၏ အကျိုးစီးပွားထိခိုက်စေရန် ရုတ်တရက် ပြောင်းလဲခြင်း မပြုပါ။ (ပုဒ်မ ၃၉ အရ)
- (ဂ) အငြင်းပွားမှ တစ်ခုနှင့် စပ်လျဉ်း၍ ဤဥပဒေနှင့်အညီ ဆွေးနွေး ညှိနှိုင်းခြင်း၊ ဖျန်ဖြေခြင်းနှင့် ခုံသမာဓိအဖွဲ့ဖြင့် ဆုံးဖြတ်ခြင်းတို့ကို မပြုဘဲ အလုပ်မထုတ်ပါ။ (ပုဒ်မ ၄၀ အရ)
- (ဃ) ခုံသမာဓိ သို့မဟုတ် ခုံအဖွဲ့က ပုဒ်မ၅၁ အရ ဆုံးဖြတ်သည့် လျော်ကြေးငွေကို ပေးဆောင်ပါမည်။ (ပုဒ်မ ၅၁ အရ)

၁၆။ အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ (၂၀၁၃) စီမံကိန်းပိုင်ရှင်သည်-

(က) အလုပ်သမားခန့်ထားရာတွင် ဤဥပဒေ ပုဒ်မ ၅ ပါ ပြဌာန်းချက်များနှင့် အညီ စာချုပ်ချုပ်ဆို၍ ခန့်ထားပါမည်။ (ပုဒ်မ ၅ အရ)

- (စ) ခန့်ထားရန် လျာထားသော အလုပ်သမားနှင့် လုပ်ငန်း၌ လုပ်ကိုင်လျက်ရှိသော အလုပ်သမားများ၏ အလုပ်အကိုင်ဆိုင်ရာ ကျွမ်းကျင်မှုအဆင့် မြင့်မားစေရန် လေ့ကျင့်ရေး အစီအစဉ်များကို လုပ်ငန်းလိုအပ်ချက်အရ ကျွမ်းကျင်မှု ဖွံ့ဖြိုး တိုးတက်ရေး အဖွဲ့၏ မူဂါဒနှင့်အညီ ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၁၄အရ)
- (ဂ) မိမိ၏ လုပ်ငန်း၌ အလုပ်သမားကြီးကြပ်သူအဆင့် နှင့် ယင်းအဆင့်အောက်ရှိ အလုပ်သမားများကို ပေးချေရသည် စုစုပေါင်းလုပ်ခ၊ လစာ၏ ဂ.၅ ရာခိုင်နှန်းအောက် မနည်းသောငွေကို ရန်ပုံငွေသို့ထည်ဂင်ခြင်းအဖြစ် လစဉ်ပေးသွင်းပါမည်။ ယင်းထည်ဂင်ကြေး အတွက် အလုပ်သမားများ၏ လုပ်ခ၊ လစာမှ ဖြတ်တောက်ခြင်း မပြုပါ။ (ပုဒ်မ ၃၀ အရ)

၁၇။ ၂၀၁၃ ခုနှစ်၊ အနည်းဆုံးအကြေးငွေ ဥပဒေ စီမံကိန်းပိုင်ရှင်သည်-

- (က) ပုဒ်မ ၁၂ ပါ သတ်မှတ်ချက်များနှင့်အညီ အခကြေးငွေ ပေးချေပါမည်။ (ပုဒ်မ ၁၂ အရ)
- (စ) သတ်မှတ်ထားသော အနည်းဆုံးအစကြေးငွေ နှန်းထားများကို အလုပ်သမားများကို အသိပေးမည့်အပြင် လုပ်ငန်းခွင်တွင် မြင်နိုင်စေရန် ကြော်ငြာထားပါမည်။ (ပုဒ်မ ၁၃(က)အရ)
- (ဂ) ပုဒ်မ ၁၃ ပါ ပြုစုရမည့် စာရင်းဇယားနှင့် စာတမ်းအမှတ်အသားများကို ပြုစုခြင်း၊ သက်ဆိုင်ရာ ဦးစီးဌာနသို့ သတ်မှတ်ချက်များနှင့်အညီ အစီရင်ခံခြင်း၊ ယင်းတို့ကို တောင်းခံသည့်အခါ တင်ပြခြင်းတို့ ပြုပါမည်။ (ပုဒ်မ ၁၃ (ခ)၊ (ဂ)၊ (ဃ) တို့အရ)
- (ဃ) ပုဒ်မ ၁၃ (င) နှင့် ပုဒ်မ ၁၈ အရ စစ်ဆေးရေးအရာရှိများက လာရောက် စစ်ဆေးခြင်းကို ခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၃(င) နှင့် ၁၈ အရ)

- (င) အလုပ်သမား ဖျားနာ၍ အလုပ်မလုပ်နိုင်သည့်အခါ ဆေးကုသရန် သတ်မှတ်ချက်များ နှင့်အညီ နားခွင့်ပေးပါမည်။ (ပုဒ်မ ၁၃ (စ) အရ)
- (စ) အလုပ်သမားများ၏ မိသားစုဂင် သို့မဟုတ် မိဘနာရေး ဖြစ်သည့်အခါ အနည်းဆုံးအခ ကြေးငွေမှာ ဖြတ်တောက်ခြင်းမပြုဘဲ သတ်မှတ်ချက်များနှင့် အလုပ်နားခွင့်ပြုပါမည်။ (ပုဒ်မ ၁၃ (ဆ) အရ)

၁၈။ ၂၀၁၆ ခုနှစ်၊ အ<mark>ခေကြးငွေပေးချေရေး ဥပဒေ</mark> စီမံကိန်းပိုင်ရှင်သည်-

- (က) အခကြေးငွေ ပေးချေခြင်းနှင့် စပ်လျဉ်း၍ ပုဒ်မ ၃နှင့် ၄ ပါပြဌာန်းချက်များ နှင့်အညီ ပေးချေပါမည်။ (ပုဒ်မ ၃နှင့် ၄အရ)
- (စ) သဘာဂဘေးအန္တ ရာယ်အပါအဂင် မမျော်လင့်သော ထူးခြားသည် အခြေအနေ ပေါ် ပေါက်ပါက အခကြေးငွေ ပြောင်းလဲပေးချေလိုကြောင်းကို သက်ဆိုင်ရာ အလုပ်သမားများ၏ သဘောတူညီချက်ဖြင့် တင်ပြပါမည်။ (ပုဒ်မ ၅ အရ)
- (ဂ) အလုပ်သမားထံမှ နတ်ယူရန် လိုအပ်သည့်ငွေကြေးနှင့် စပ်လျဉ်း၍ အခန်း(၃) ပါ ပြဌာန်းချက်နှင့် အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (အခန်း၃ အရ)
- (ဃ) အချိန်ပို လုပ်ကိုင်ရသည့် အလုပ်သမားကို ဥပဒေက သတ်မှတ်သည့် နူန်းထားအတိုင်း အချိန်ပို လုပ်ခ ပေးပါမည်။ (ပုဒ်မ ၁၄ အရ)

၁၉။ အလုပ်သမားလျော်ကြေးအက်ဥပဒေ (၁၉၅၁)

စီမံကိန်းပိုင်ရှင်သည် ရရှိသည့် ထိခိုက်နစ်နာမှ အမျိုးအစားအလိုက် ကိစ္စရပ်တစ်ခုချင်း အပေါ် တွင် ဤဥပဒေပါ ပြဌာန်းချက်များနှင့်အညီ လျော်ကြေးငွေကို ပေးလျော်ပါမည်။

၂၀။ <mark>ခွင့်နှင့် အလုပ်ပိတ်ရက်များ အက်ဥပဒေ (၁၉၅၁)</mark> စီမံကိန်းပိုင်ရှင်သည် ဤဥပဒေပါ ပြဌာန်းချက်များနှင့်အညီ ခွင့်နှင့် အလုပ်ပိတ်ရက် များကို ခွင့်ပြုပါမည်။

၂၁။ လူမှုဖူလုံရေး ဥပဒေ(၂၀၁၂) စီမံကိန်းပိုင်ရှင်သည်-

- (က) သက်ဆိုင်ရာ လူမှုဖူလုံရေးရုံးတွင် မှတ်ပုံတင်ထားရှိရပါမည်။ (ပုဒ်မ ၁၁(က)အရ)
- (ခ) ပုဒ်မ ၁၅၊ ပုဒ်မခွဲ (က) ပါ ကျန်းမာရေးနှင့် လူမှုဖူလုံရေး စောင့်ရှောက်မှု ရန်ပုံငွေ၊ အလုပ်လုပ်ကိုင်နိုင်စွမ်းမရှိမှု အကျိုးခံစားခွင့်၊ သက်ပြည် အငြိမ်းစား အကျိုးခံစားခွင့်နှင့် ကျန်ရစ်သူ အကျိုးခံစားခွင့် ရန်ပုံငွေ၊ အလုပ်လက်မဲ့ အကျိုးခံစားခွင့် ရန်ပုံငွေနှင့် သတ်မှတ်ထားသော မထည့်မနေရ ထည့်ဂင်ရမည့် ရန်ပုံငွေများကို မှတ်ပုံတင် ထည့်ဂင်ပါမည်။ (ပုဒ်မ ၁၅ (ခ)အရ)
- (ဂ) အလုပ်သမားက ပေးသွင်းရမည့် ထည်ဂင်ကြေးကို ယင်း၏ လုပ်စထဲမှ နတ်ယူပြီး မိမိကပေးသွင်းရမည် ထည်ဂင်ကြေး ငွေနှင့်အတူ သက်ဆိုင်ရာ လူမှုဖူလုံရေး ရန်ပုံငွေသို့ ပေးသွင်းပါမည်။ ထိုသို့ပေးသွင်းရသည့် ကုန်ကျစရိတ်ကို မိမိက ကျစံပါမည်။ (ပုဒ်မ ၁၈(စ)အရ)
- (ဃ) အလုပ်တွင် ထိခိုက်မှု အကျိုးခံစားခွင့် ရန်ပုံငွေသို့ သတ်မှတ်ထားသော ထည်ပင်ကြေးပေးပြီး အာမခံထားရှိရပါမည်။ (ယင်းရန်ပုံငွေသည် အလုပ်သမား လျော်ကြေး အက်ဥပဒေပါ ပြဌာန်းချက်များနှင့် သက်ဆိုင်ခြင်းမရှိကြောင်း သိရှိပါသည်။) (ပုဒ်မ ၄၈ (ခ) နှင့် ၄၉ (က) တို့အရ)

(င) ပုဒ်မ၁၇ တွင် ဖော်ပြထားသည့် မှတ်တမ်းနှင့် စာရင်းများကို မှန်ကန်စွာ ပြုစုပြီး သက်ဆိုင်ရာ လူမှုဖူလုံရေးရုံးသို့ သတ်မှတ်ချက်များနှင့်အညီ တင်ပြပါမည်။ (ပုဒ်မ ၇၅ အရ)

၂၂။ ရေနံအက်ဥပဒေ (၁၉၃၄)

စီမံကိန်းပိုင်ရှင်သည် စီမံကိန်းအတွက် လိုအပ်သည့် လောင်စာ ဆီများကို တင်သွင်းခြင်း၊ သယ်ယူပို့ဆောင်ခြင်းနှင့် သိုလှောင်ခြင်းတို့ အတွက် ပုဒ်မ ၃အရ လိုအပ်သည့် လိုင်စင်ကို ရယူပါမည်။ ထို့ပြင် ယင်းလိုင်စင်ပါ စည်းကမ်းချက်များ ကိုလည်း လိုက်နာပါမည်။

၂၃။ ရေနံနည်းဥပဒေများ(၁၉၃၇)

စီမံကိန်းပိုင်ရှင်သည် စီမံကိန်းအတွက် လိုအပ်သည့် လောင်စာဆီများကို တင်သွင်းခြင်း၊ သယ်ယူပို့ဆောင်ခြင်းနှင့် သိုလှောင်ခြင်းတို့အတွက် နည်းဥပဒေများ အခန်း(၃) နှင့် (၄)ပါ သတ်မှတ်ပြဌာန်းချက်များနှင့်အညီ လိုက်နာဆောင်ရွက်ပါမည်။ (အခန်း(၃) နှင့် (၄) အရ)

၂၄။ မြေအောက်ရေအက်ဥပဒေ

စီမံကိန်းပိုင်ရှင်သည် မြေအောက်မှ ရေစုပ်ယူရန်အတွက် ပုဒ်မ ၃အရ Water Officer ထံမှ လိုင်စင်ရယူပါမည်။ (ပုဒ်မ ၃အရ)

၂၅။ ရေအရင်းအမြစ်နှင့် မြစ်၊ရောင်းများ ထိန်းသိမ်းရေး ဥပဒေ(၂ပဂ၆)

စီမံကိန်းပိုင်ရှင်သည်-

- (က) ရေအရင်းအမြစ်နှင့် မြစ်၊ ချောင်းများထိခိုက်ပျက်စီးစေရန် ရည်ရွယ်၍ တစုံတရာ ပြုလုပ်ခြင်း မပြပေ၊ (ပုဒ်မ စ(က)အရ)
- (ခ) ဦးစီးဌာနက မြစ်၊ချောင်းအတွင်း ရေထုညစ်ညမ်းမှု မဖြစ်ပေါ် စေရေးနှင့် ရေလမ်းကြောင်း မပြောင်းလဲစေရေးအတွက် သတ်မှတ်ထားသော စည်းကမ်းချက် များကို ဖောက်ဖျက်ခြင်းမပြုပါ။ (ပုဒ်မ ၂၄(က)အရ)

၂၆။ ရေရျိုငါးလုပ်ငန်း ဥပဒေ(၁၉၉၁)

စီမံကိန်းပိုင်ဂွင်သည် ရေချို ငါးလုပ်ငန်း ရေပြင်အတွင်း ရေထုညစ်ညမ်းစေခြင်းနှင့် ငါးနှင့် အခြားရေနေသဂတ္တဂါများကို နောင့်ယှက်ခြင်းမပြပါ။ (ပုဒ်မ ၄ဂ အရ)

၂**၇။ ယဉ်ကျေးမှုအမွေအနစ်ဒေသများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ(၁၉၉၈)** စီမံကိန်းစရိယာသည် ရှေးဟောင်းအမွေအနှစ် ဒေသအတွင်းကျရောက်ပါက စီမံကိန်း ပိုင်ရှင်သည် ပုဒ်မ ၁၂ နှင့် ၁၃ တို့ပါ ပြဌာန်းချက်များနှင့်အညီ လိုက်နာ ဆောင်ရွက် ပါမည်။

၂၈။ ရှေးဟောင်း ပတ္ထုပစ္စည်းများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ(၂၀၁၅)

စီမံကိန်းပိုင်ရှင်သည် မိမိ၏ စီမံကိန်းဖရိယာအတွင်း ရှေးဟောင်းပတ္ထပစ္စည်းကို တွေရှိပါက အနီးဆုံးရပ်ကွက် သို့မဟုတ် ကျေးရွာအုပ်စု အုပ်ချုပ်ရေးမှူးထံ အကြောင်းကြားပါမည်။ (ပုဒ်မ ၁၂အရ)

၂၉။ ရှေးဟောင်းအဆောက်အအုံများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ(၂၀၁၅) စီမံကိန်းပိုင်ရှင်သည်-

- (က) စီမံကိန်းနယ်နမိတ်အတွင်း မြေအောက် သို့မဟုတ် မြေပေါ် တွင် ရှေးဟောင်း အဆောက်အအုံကို တွေရှိပါက အနီးဆုံးရပ်ကွက် သို့မဟုတ် ကျေးရွာအုပ်စု အုပ်ချုပ်ရေးမှူးထံ အကြောင်းကြားပါမည်။ (ပုဒ်မ ၁၂ အရ)
- (ခ) စီမံကိန်းရေိယာသည် ရှေးဟောင်းအဆောက်အအုံ ဧရိယာအဖြစ် သတ်မှတ်သည် ဧရိယာအတွင်း ကျရောက်ပါက ရှေးဟောင်းသုတေသန ဦးစီးဌာန၏ ကြိုတင်ခွင့်ပြုချက် ကို ရယူပါမည်။ (ပုဒ်မ ၁၅ အရ)
- (ဂ) ရှေးဟောင်းအဆောက်အအုံ နယ်နမိတ်အတွင်း အစိုင်အခဲများ စွန့်ပစ်ခြင်းနှင့် ဓာတုပစ္စည်းများ စွန့်ပစ်မည်ဆိုပါက ရှေးဟောင်းသုတေသန ဦးစီးဌာန၏ ကြိုတင်ခွင့် ပြုချက်ကို ရယူပါမည်။ (ပုဒ်မ ၂၀ (စ) အရ)

၃၀။ လယ်ယာာမြေ ဥပဒေ (၂၀၁၂)

စီမံကိန်းပိုင်ရှင်သည် လယ်မြေမဟုတ်သည့် လယ်ယာမြေကို အခြားနည်းအသုံးပြုခွင့်ကို မကွေးတိုင်းဒေသကြီး အစိုးရအဖွဲ့ထံမှ ရယူပြီးမှ ယင်းမြေပေါ် တွင် စီမံကိန်း ကို ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၃ဂ (ခ) အရ)

၃၁။ သစ်တောဥပဒေ (၁၉၉၂)

စီမံကိန်းပိုင်ရှင်သည် သစ်တောနယ်မြေ သို့မဟုတ် သစ်တောဇုံးလွှမ်းသော နယ်မြေတွင် စီမံကိန်းကို ဆောင်ရွက်ရမည်ဖြစ်ပါက သယံဇာတနှင့် သဘာဂပတ်ဂန်းကျင် ထိန်းသိမ်းရေး ဂန်ကြီးဌာန၏ ခွင့်ပြုချက် ရယူပြီးမှ ဆောင်ရွက်ပါမည်။ (ပုဒ်မ ၁၂(က) အရ)

13.59 Profile of Magwe Region

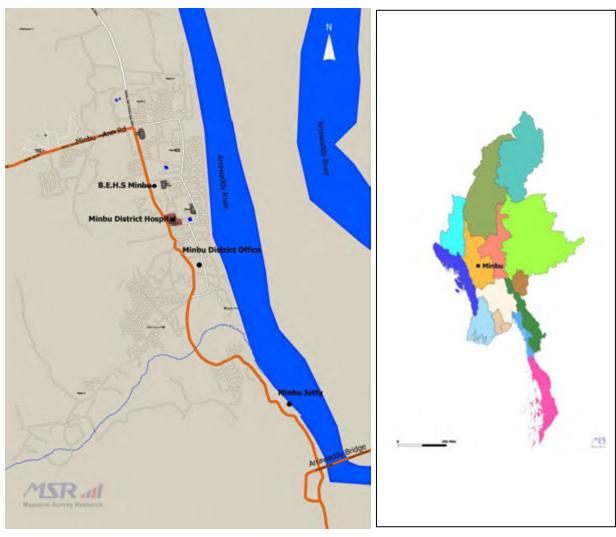
Name:	Magwe Region (alternative spelling: Magway) (one of the 14 chief administrative divisions, known as 7 states and 7 regions)	F BANNY	
Location:	Central Myanmar	- CA / Lan	
	N latitude 18° 50' to 22° 47' E longitude 93° 47' to 95° 55'	Magwe Region	
Chief Minister:	U Aung Moe Nyo (NLD)	1 1 /2 3	
Area:	17,306 sq-miles (44,820 km²)		
Immediate neighbours:	Sagaing Region to the north, Mandalay Region to the east, Bago Region to the south, Rakhine State to the west, Chin State to the west		
Population:	3,917,055	- I W S	
Ethnicitiees:	Bamar, Chin, Rakhine, Shan, Kayin Over 95% the people are Bamar, with very small numbers of indigenous minorities such as Chin, Rakhine, Kayin, Shan, and others, including a tiny Anglo-Myanmar population. During colonial times, this part of Myanmar had a large Anglo-Myanmar population, descended from Western oil workers and their Myanmar partners. Approximately 98% of the population is of Buddhist faith. Buddhism, Christians and	MAP 12: Location of Magwe Region	
Districts under Magwe Region:	animism 1 Magwe District 2 Minbu (Sagu) District 3 Thayet District 4 Pakokku District 5 Gangaw District		
Townships in Magwe Region:	25 townships		
Wards/village- tracts:	1,696 wards/village-tracts		
History:	<u>Fossils</u> of the early <u>primates</u> over 40 million years old were excavated in the Pondaung and Pon-nya areas in Magwe Region, leading the government to proclaim that Myanmar as "the birthplace of humanity in the world". An ancient city of the <u>Pyu</u> , Beik-thano-myo, about 2,000 years old, is located in Taungdwingyi Township, Magwe Region.		

	The history of Magwe Region mirrors that of the other regions of central Myanmar.	
	The <u>Ayeyarwady River</u> is the major transportation system in Magwe Region, both in terms of volume of goods and population served. Most major towns in the region are river ports on the Ayeyarwady—among them are <u>Magway</u> , <u>Pakokku</u> , <u>Minbu</u> , <u>Yenangyaung</u> , <u>Chauk</u> , <u>Myayde</u> (Aunglan), and <u>Thayetmyo</u> .	
Transport:	For those areas not on the Ayeyarwady, the major form of transport in this region is by road. The region is divided by the Ayeyarwady. Towns are connected with two-lane roads. Most towns have regular bus transportation to Yangon and Mandalay .	
	The <u>Pyay</u> to <u>Nyaung-U</u> and <u>Myingyan</u> railway runs through eastern Magway with connections to the capital <u>NayPyi Taw</u> , <u>Yangon</u> and <u>Mandalay</u> . The major stops in Magwe on that line are <u>Taungdwingyi</u> and <u>Natmauk</u> . In addition, there are two rail lines running north from the Ayeyarwady port of Pakokku, one to <u>Chaung-U</u> in <u>Sagaing Region</u> and the other to the <u>Myittha River valley</u> past <u>Myaing</u> and <u>Kyaw</u> .	
	The capital Magwe has a small non-commercial airport with air traffic for the city of Magway mostly coming in through Bagan Airport at Nyaung U some 113 km to the north along the Ayeyarwady. There are commercial airports at Gangaw, Kyauktu, Pakokku, and Pauk. As of 2010, however, none of them have regularly scheduled flights.	
Economy:	The principal product of Magway Region is <u>petroleum</u> . It produces most of the oil and <u>natural gas</u> in Myanmar. The following oil fields are located in the Mage Region: the Mann, Yenangyaung, Chauk, Kyauk-khwet, Letpando and Ayadaw oil fileds.	
	Other industries include <u>cement</u> , <u>cottonweaving</u> , and <u>tobacco</u> , <u>iron</u> and <u>bronze</u> . Magwe Region produces a large quantity of <u>edible oil</u> as well as petroleum, hence gaining a reputation as the "oil pot of Myanmar".	
	Agriculture is also important. The major crops are <u>sesamum</u> and <u>groundnut</u> . Other crops grown are <u>rice</u> , <u>millet</u> , <u>maize</u> , <u>sunflower</u> , <u>beans</u> and <u>pulses</u> , <u>tobacco</u> , <u>toddy</u> palm, <u>chili</u> , <u>onions</u> , and <u>potatoes</u> . Famous products of Magway Region include: <u>Thanaka</u> (Limoniaacidissima)—a kind of tree whose bark is ground on a stone slab and the paste obtained is applied on the cheeks like a makeup—and <u>Phangar</u> (Chebulicmyorobalan) fruit.	

13.60 Profile of Minbu Township

MAP 14: Downtown Minbu Township map

MAP 15: Location of Minbu Township





	Minbu District, Magwe Region		
	Between N Latitude 19° 53' and 28°19'		
Location:	Between E Longitude 94° 28' and 95° 00'		
	642.71 sq. mile (46 miles from east to west and 42 miles long from south to west)		
Shares border with Magwe Township in MagweDistrict to the e Minhla Township in ThayatDistrict to the south, Ngape Township the west and Pwintbyu Township to the North			
Condition of terrain	Minbu (Sagu) has plenty of hills and mountains and it is covered with forests. The prominent rivers and creeks are the Ayeyarwaddy River, Sarput Creek and Man Creek.		
Drainage	Minbu (Sagu) is rich with rivers and creeks and the Ayeyarwaddy flows from North to South and Sarput Creek and ManCreek flow from west to east.		
Sea level	Minbu is located at a 164-foot heightfrom the sea level. The highest mountain is Mt Phalanyone and the lowest mountain is Mt Khwaymatat.		
Weather and environment			
Heat	Highest temperature – 39°C and Lowest temperature – 14°C		
Environment condition	The environmental condition of Minbu (Sagu) is "parched" area.		

Population					
Race (Residents)	Kayin	12			
	Chin	1,631			
	Mon	1			
	Bamar	176,669			
	Rakhine	74			
	Shan	12			
	Total ▶	178,399			
No of Houses	39,695	39,695			
No of Households	41,899	41,899			
Language	The main language is Bamar language and other languages such as Chin, Kayin, Kachin, and Chin are also used within Minbu Township.				
Religion	Buddhists	176,531			
	Christians	97			
	Hindus	56			
	Islams	1,663			
	Total ▶	178,399			
Political parties	National Unity Party, NLD, USD	P			
Economic overview		Minbu (Sagu) is a slow economic growth region even though it is situated at the central part of Myanmar			
Dams	Government owned – 1, Earth o	Government owned – 1, Earth dyke – 7 (self-help)			
	No industrial zone				
	No government-owned industrie	es			
	Private ice factory	1			
	Private oil mills	22			
	Private rice mills Private textile mill	81			
Forestry	Timber production: Government – 7 saw-mills	t owned – No s	aw-mill, Private owned		
	Government-owned sawmill	Nil			
	Private-owned sawmill	7	<u> </u>		
Mineral resources	Mineral extraction: coal product	Mineral extraction: coal production – 400 tons per month			
	Petroleum production:				
	Government oil wells	1,823			
	Private oil wells	233			
	Total petrol production per day	3,068	barrels		
	Natural gas:				
	Mann Oilfield	1.5435	cu-ft per day		
	Htauksharbin Oilfield	1.1808	cu-ft per day		
	i itaaksiiaibiii Oililelu	1.1000	ou-it poi day		

Fuel	Diesel and petrol shops	2	
	Gas shop	1	
Electricity (production & availability)	Electric power station (government)	1	
	Diesel engines (private)	58	
Communication	Post office	1	
	Telegraph station	1	
	Digital telephone	1,163	
	Mobile phones	11,790	
	Manual dialing phones	70	
Broadcast stations	Broadcasting station	1	
	Re-transmitting station	1	
	Microwave station	1	
	Rail road	1	78 miles
	Roads	7	1,069 miles
	Roads connecting with districts and townships	7	1 mile 1 furlong
	Roads connecting with villages	7	14 miles 1 furlong
	Bridges above 180 feet	5	
	Bridges below 180 feet	216	
Cooperatives	Cooperative organizations	69	
Education	High schools/branch high school	8	
	Middle schools/branch middle schools/post primary schools	56	
	Primary schools/branch primary schools	134	
	Kindergarten	27	
	Monastic education schools	11	
	Governmental hospital	4	
	Private hospital	1	
	Rural health departments health departments	6	
	Rural branch health centres	30	
Social organizations	International NGOs	2	
	Local NGOs	5	

Minbu is a city in Magwe Region, Myanmar. As of 2004, the city has a population of 56,200. The area consists of low plainlands towards the Ayeyarwaddy River, and of undulating country inland rising higher and higher westwards towards the Rakhine hills. Between the plains and RakhineYoma range is a distinct line of hills running north and south, and usually called the Nwa-Madaung hills. The submontane valleys are largely

cultivated, but are deadly except to those born in them. The chief streams besides the Ayeyarwaddy are the Man, the Maw, and the Salin, which are largely used for irrigation. At Minbu the Ayeyarwaddy is 3 miles wide, with many islands and sand banks. There are considerable fisheries along the Ayeyarwaddy and on the Paunglin Lake, which is a lagoon fed from the Ayeyarwaddy. Oil has been discovered near the mud volcanoes of Minbu, but it seems to lie at too great a depth to be profitably worked.

There is a larger area of reserved forest near Minbu. The chief crops raised are rice, gram, millet, beans, peas, sesamum and tobacco. The betel-vine is largely cultivated along the Mon River. The annual rainfall varies greatly in the area. It is very considerable on and under the RakhineYomas, and very slight towards the Ayeyarwaddy. The thermometer rises to over 100°Fahrenheit in the hot months, and the mean of minimum in December is about 49° F.

Place of interest (Minbu Shwesettaw – the Footprint Pagoda)

A pair of Buddha's footprints are located in Settawya, a forest retreat at 34 miles' distance west of Minbu on the opposite bank of Magwe which is 331 miles from Yangon by road. The footprints are well preserved and shrines have been constructed nearby. The place is known as the Pagoda site of the forest. The pilgrimage is combined with photography for young people, as the scenery is picturesque. One can go there also by Minbu – A road following branches lane at 22 miles post. The site is on the river Man. The pagoda festival is held on the 5th Waxing Moon of the Myanmar calendar month, Tabodwe (February and March) annually. Many people, from different parts of the country, gather there and do meritorious deeds singly or collectively.

On the way from Minbu, visitors can pay homage to Sandalwood Monastery at Legging where the lord Buddha had visited in his life time. The history of that Footprint Pagoda is dated back to the time of the Buddha. Once the lord Buddha came to that site in the country of Sunapranta. He met the OrahatSicca Vanda and Naga Nammada on his way and on their humble request, the lord granted their reverence. The footprints have been enshrined ever since. The lower footprint on the salt is under water during the monsoon months as the river Man is flooded. Therefore the festival is celebrated in the later winter months. Minbu is very hot in summer.

There are a series of stalls selling different things for the pilgrims and villagers nearly. Souvenirs can be bought there also. Minbu new market is a place where things are very cheap to buy. Shops sell goods at wholesale prices. There are a great number of motorcycles inMinbu. From Minbu, there is a road leading to Rakhine State.

Crabs and dried fish and dried prawns—transported from Rakhine State—are available in Minbu.

13.61 Recycling Plan



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FOR MINBU SOLAR POWER PLANT PROJECT SAGU TOWNSHIP, MINBU, MAGWAY REGION



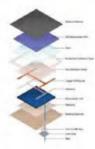
Submitted by GEP (Myanmar) Co., Ltd.

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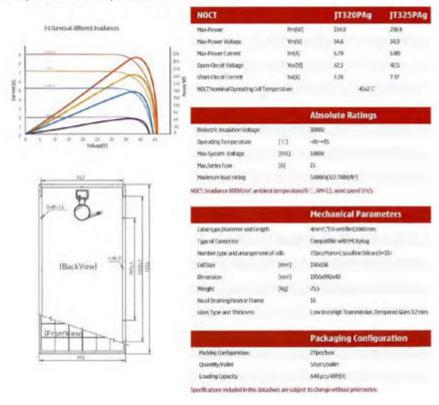
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1. Product



The most common type of solar panel is constructed from thin wafers of crystalline silicon, 150mm by 150mm by 180 – 360 microns thick. The silicon cells are fragile and brittle, so they are built into a sandwich construction behind a glass cover sheet to provide protection from mechanical damage. The cells are encapsulated between films of polymer protecting the cells from the effect of moisture which would corrode the electrical connections. Cells are connected in series by flat strips of copper soldered onto the front face of one cell and the rear face of the next. To complete the PV panel or module, a frame of extruded aluminum is fitted around the edges of the glass sheet to protect and stiffen the panel and provide a means to fix down.

The specification of PV panel which will be installed.





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2. Causes of PV panels Damage

2.1. Hotspots

If a part of the solar cell is shaded, the cell can heat up to such extreme temperatures that the cell material as well as the encapsulation (EVA) and back sheet will be permanently damaged. A so-called hot spot develops. Under normal operation condition the cell generates current. In contrast, a shaded cell does not produce any electricity any more; but uses the current from the other cell. The current from the other cells of the strings is driven through the darkened cell. The current flow is then converted into heat. Other reasons for hotspots can be high contact resistance at the bus bars of the cells. Reasons for high contact resistance can be cracked solder joints on the bus bars. The power loss of a module with a hotspot is often very low, unless there are already big areas with hotspots. Nevertheless, these modules should be replaced, especially when the cell or cell and the surrounding encapsulation materiasl have been burned.





Hotspots

2.2 Delamination

In a PV module, the solar cells are encapsulated with the so-called EVA (ethylene vinyl



acetate). The EVA protects the sensitive cells from weather influences such as moisture and UV radiation. During manufacturing the module composite is laminated under a precisely defined pressure and process temperature. It is important to keep the defined process temperature and time to ensure that the EVA cures correctly during the lamination process. Wrong process parameters or cheap material can result in a delamination of the EVA later in the lifetime. The layers of EVA can dissolve and render the "milky" colour. Delaminated solar modules should also be replaced. Due to the delamination, moisture can get

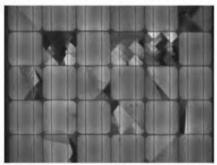
into the cells that leads to cell corrosion and loss of the ongoing performance.

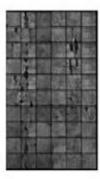


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2.3. Cell cracks and micro cracks

Micro cracks in the cells can occur not only during the production, but also due to external influences such as transportation and installation. In general micro cracks cannot be completely avoided and do not usually lead to loss in performance. However, there is always a potential risk that a micro-crack proceeds to a cell fraction with a performance loss. Furthermore, in some cases "snail tracks" on the modules develop from micro cracks. Such situation usually occurs during the early months after the installation, due to certain combinations of materials having micro-cracks in the cells. Cell breaks itself can lead to a loss of yield. A broken corner or a small local plan does not result in yield loss. However, when an entire cell area was separated from the bus bars, a yield loss is expected. In this case, the module should be replaced.





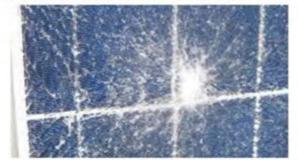


Cell cracks and micro cracks

2.4 Glass Breaks

In most cases, glass breaks are caused by external effects such as poor packaging during transportation, during installation or by storm and stone throwing. Very rarely, the glass breaks due to manufacturing or material defects. Especially for frameless modules, typically thin-film modules, glass breakage can also occur through the module clamps. Because of the missing frame, the clamps must be fixed directly on the glass. Thermal expansion during operation can cause cracks. Modules with broken glass should always be replaced.





Glass Breaks



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2.5 Defect Connectors

The connectors have same specification as MC4, but not produced by Multi Contact. However, the connectors are tested as well and quality standard needs to be the best at installation. Low quality connectors can lead to problems such as breaking during assembly, especially at cold ambient temperature, or to poor electrical contact. An unclean crimping also results in a poor contact connection with the risk of sparks and eventually a burned connector.





Defect Connectors

2.6 Burned Solar Junction Box

The junction box contains the bypass diodes of the solar module. Bypass diodes are electric components which are necessary to install for cut off. However, badly contacted bypass diodes dues to a manufacture failure can also overheat itself and lead to a fire in the junction box. In photovoltaics, fire-resistant materials are usually installed, so that fire does not spread out in most cases.



Burned Solar Junction Box

2.7 Browning

Browning is a yellow or brown discoloration of the EVA (cell encapsulation). The EVA contains additives to improve the UV resistance and to prevent it from the Browning effect. If low quality EVA is used, or if the EVA is stored under improper conditions or long period before manufacturing, the additive in the EVA partly disappears and, due to UV radiation and heat, the EVA starts to get yellow or brown color. As a result of browning cell bleaching and bubble formation at the EVA and back sheet, cell corrosion can happen too. The heat absorption increases with browning. Higher heat absorption enforces further browning. Modules showing browning shall be replaced.

2.8 Storms

Solar cells have a cover made up of protective glass that can be damaged by hail storms. An area that is prone to hail storms determines the kind of solar panels to be installed. Hail can damage the larger solar cells that results in more expensive replacement or repair costs and reduces energy output dramatically.



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2.9 Water

Water is another cause of damage to a solar panel. The connections and seals around the solar panel will begin to deteriorate over time, allowing water to penetrate into the solar cells and connections. Periodically resealing the connections and protective glass will ensure that water does not penetrate into the modules causing them fail or lose energy output.

2.10 Rocks and Foreign Materials

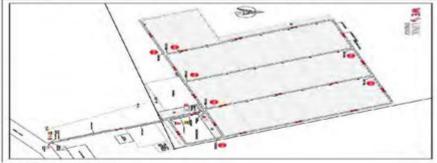
Broken or damaged solar panels can result from rocks thrown at the panels or falling debris. This type of damage typically breaks the protective glass of the solar panel. Even just replacing the glass can cause condensation to build up inside the glass allowing moisture to get into the solar cells and connections.

2.11 Fire

Damage to solar panels can also be caused by fire. There are also reports that describe that some of the fire damages are caused by the solar panel itself. Individual solar panels are connected together creating a high voltage. Wires can get worn over time. Animals can damage the exterior of the wires or the wires are not installed properly. Thus, it can cause the wires to short-circuit creating a fire hazard.

3. Maintenance and replacement

During construction phase and operation phase, PV solar panels will be damaged by above mentioned causes. The developer will check and inspect the damaged places and these will be replaced to generate proper power production. The skillful persons and trained workers will remove the damaged PV panels and replaced whe those which were already stacked and stored at the stacking yards S1, S2 and S3. The damaged parts each panel will be systematically packed and bundled. The damaged will be kept in the boxes and covered with plastic sheets. Temporary shelters will be constructed at S1, S2 and S3 yards to avoid rainwater. It is expected that at the end of the concession period of (30) years (as per PPA Terms), the solar panels shall degrade and output will decrease up to about (25%) of the total output at the time of Commissioning. Therefore, additional solar panels shall be installed in order to compensate the loss on the total generation output.



Storage Management Plan



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4. Recycle Plan





The project will keep about 780,000 pieces of PV solar power panels at the site mounted on fixed positions. More than this amount of PV solar panels will be imported and stacked at the work site for construction phase by 40Ft containers which will contain 648 sheets of panels in each. The rest will be stacked at a designated storage area for replacement (spare). At the operation phase, the stacked and systematically kept damaged panels will be sent back to abroad to recycle. The recycle process will be done at the factory from which the developer has purchased these panels. As soon as about 600 pieces of old PV solar panels are collected, the developer will store them in the 40ft containers and send them back to factory abroad for recycling. Other material such as metal frames from the mounting structures shall be scrapped.

