ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE DEVELOPMENT OF SOLAR POWER PLANT IN THE REGION OF MANDALAY MYANMAR

MEIKTILA DISTRICT

Prepared for Convalt Energy LLC
and
ACO Investment Group LLC

Conducted and Approved By

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ASSUMPTIONS AND LIMITATIONS

- The strategic level investigations undertaken prior to the commencement of the ESIA process, concluded that the development site is suitable and technically acceptable
- The point of connection with the grid is feasible and that the grid has capacity to accommodate the additional load
- It is not always possible to involve all Interested and Affected Parties individually. However, every effort has been made to involve as many interested parties as possible
- The information provided is accurate by the date of completion.
- The scope of this investigation is limited to assessing the environmental and social impacts associated with the construction and operation as well as decommissioning of the proposed Solar Photovoltaic (PV) plant.

Note that this is the first utility scale Solar Power Project in Myanmar. As such, this is the first ESIA of a utility scale Solar Power Project in the country of Myanmar.

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LIST OF ACRONYMS AND ABBREVIATIONS

CO2	Carbon Dioxide
CE	Consulting Engineer
DSCR	Debt-Service Coverage Ratio
EERT	External Emergency Response Team
EHS-MS	Environmental Health & Safety Management System
EMS	Environmental Management System
ESMP	Environmental and Social Management Plan
ERT	Emergency Response Team
ERTL	Emergency Response Team Leader
EHS	Environmental Health and Safety
ESO	Environmental Site Officer
GHG	Greenhouse Gas
GoM	Government of Myanmar
GW	Giga Watt
GoRD	Group of Rural Development
HHC	Households with connection to electric grid
HHN	Household without connection to electric grid
IPs	Indigenous Peoples
K	Kyat
KII	Key Informants' Interview
LCoE	Leveled Cost of Electricity
MEPE	Ministry of Electric Power Enterprise
MoECAF	Ministry of Environmental Conservation and Forestry
MoEE	Ministry of Electricity and Energy (formerly MOEP)
MW	Megawatt
IRR	Internal Rate of Return
SIA	Social impact assessment
USD	United States Dollar
WB	World Bank

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Archaeological: Remains resulting from human activities that are in a state of disuse and are in or on land and which are older than 100 years, including artifacts, human and hominid remains and artificial features and structures.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future. Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Endangered species: Creatures in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are creatures whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

- The land, water and atmosphere of the earth;
- Micro-organisms, plant and animal life;
- Any part or combination of (i) and (ii) and the interrelationships among and between them; and
- The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the IFC Performance Standard and in relation to an application to which scoping must be applied, means the process of collecting, organizing, analyzing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management plan: An operational plan that organizes and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a project and its ongoing maintenance after implementation.

Feed-in tariffs: Feed-in Tariffs have been set to promote socio-economic and environmentally sustainable growth. They are essentially guaranteed prices for electricity supply as opposed to conventional consumer tariffs. The basic economic principle underpinning the FIT is the establishment of a tariff that covers the cost of generation plus a "reasonable profit" to entice independent power producers to invest in generation projects.

Heritage: That which is inherited and forms part of the nation's history (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Paleontological: Any fossilized remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels, rock intended for industrial use, and any site which contains such fossilized remains or trace.

Photovoltaic cell: Semiconductors, which absorb solar radiation to produce electricity

Photovoltaic effect: Electricity can be generated using photovoltaic panels (semiconductors) that are comprised of individual photovoltaic cells that absorb solar energy to produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect

PV solar power: Solar generating facilities uses the energy from the sun to generate electricity using photovoltaic panels are used.

Rare species: Flora or Fauna with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These flora and fauna are usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Structure (historic): Any building, works, device, or other facility made by people and which is fixed to land, and includes any fixtures, fittings, and equipment associated therewith. Protected structures are those, which are over 60 years old.

Executive Summary

Introduction

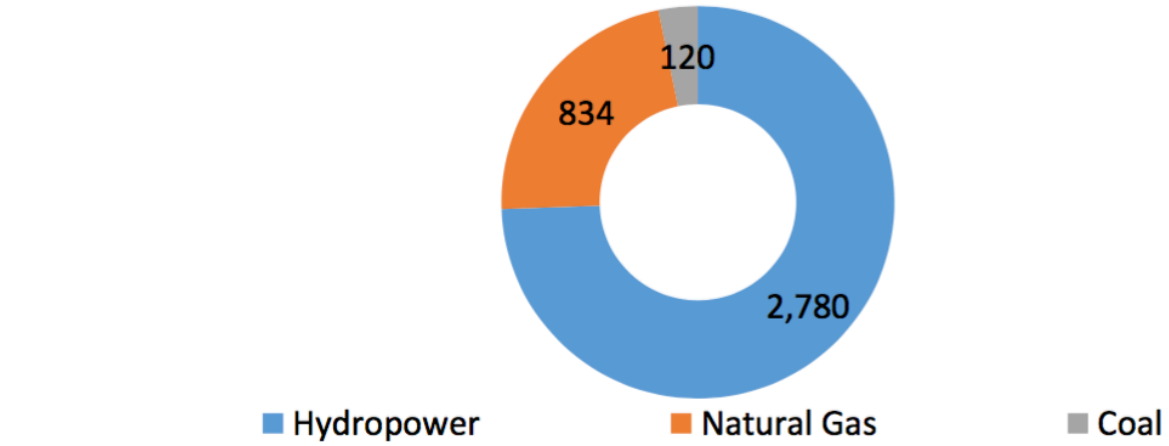
Myanmar is a country that is currently going through a historic transformation. The power sector is generally identified as a promissing area for investment opportunities. Available capacity is significantly below installed capacity and demand forecasts continue to grow. Four years ago Convalt recognized the potential for investment in Myanmar's power sector and began to pursue project development opportunities in the country.

Myanmar's energy demand is growing in concert with other members of the Association of Southeast Asian Nations (ASEAN). With one of the fastest growth rates in the world, this region's energy demand has collectively risen by two and a half times since 1990 and is now equivalent to approximately 75 percent of India's energy demand. With Myanmar's economic and political transformation, the country's annual power sales rose by 30% from 6,312 to 8,254 gigawatt-hours (GWh) between 2011 and 2013. However, compared to Vietnam's 104,000 GWh, Indonesia's 156,000 GWh, and Thailand's 169,400 GWh, Myanmar's electricity consumption remains one of the lowest in the region.

The country's electricity consumption is 44 percent for general purpose (residential), 32 percent industrial, 20 percent commercial, and 3 percent other uses per the NEMC, National Energy Policy.

According to the Government of Myanmar, the country's electricity production mix within the national grid in 2012–2013 consisted of 71 percent hydropower, 27 percent natural gas, and 2 percent coal. Myanmar currently sources these supplies domestically. Despite its resource base the country experiences supply shortfalls, resulting in substantial load shedding on the national grid. This is due to a variety of factors, including seasonal fluctuation of hydropower, degraded infrastructure, limited investment in recent years, and long-term contracts that lead Myanmar to export 83 percent of its offshore gas production to neighboring Thailand and China.

Figure 1: Sources of Energy in Myanmar (MW)



- Data from a presentation by Myanmar's Ministry of Power

ACO Investment Group is proposing the development of 300MW´s of Solar Power to be built in two locations with 150MW each in the Mandalay Region of Myanmar.

During the site selection phase an analysis was conducted to ensure that no threat would come to the local population, cultural heritages, nature, water or wildlife. As a result, two locations were identified as ideal for the development of the solar power plant. The potential impacts associated with the construction of a 300MW facility is assessed in this document with eventual mitigation methods proposed to ensure a safe development.

The Mandalay Regional Government and Mandalay Ministry for Electric Power have proposed two main sites in the Mandalay Region that is appropriate for the setup of solar farms, each with a proposed installed capacity of 150MW. Extensive grid studies have been completed in coordination with the Ministry of Electric Power with the addition of 150MW solar installations each in Myingyan and Meiktila districts for a total of 300MW.

This environmental and social assessment covers the phased construction of one 150MW Solar Power Plants in the Meiktila District of the Mandalay Region, Myanmar.

Methodologies and Approach of ESIA

The Environmental and Social Impact Assessment has been conducted based on data which includes but is not limited to the following:

- Baseline information about the environmental, social and economic conditions surrounding the project area; to determine the existing status and post project scenario in respect to these parameters;
- Identify potential impacts of the project and the characteristic, magnitude and distribution of the impacts;
- Compile information on potential mitigation measures to minimize the impact including mitigation costs; so as to incorporate the same in Environment and Social Management Plan;
- Formulate basis for Environmental Safety and Management Plan

This ESIA report is undertaken to meet the environmental assessment requirements of IFC Principles, Laws of the Union of Myanmar and relevant rules and regulations.

Various environment and social parameters were identified and examined as per standard methods.

Baseline Environment

The proposed Solar PV project is proposed in the Meiktila District of the Region of Mandalay in the Country of Myanmar. An area within 3 km around the project can be considered as influence zone and hence it has been taken as study area to understand even setting in the vicinity of the proposed project.

However, as the environmental setting is arrived based on secured and credible data, all available data has been used for the purpose of Environmental understanding.

There are no water bodies or perennial river near project area. No forest area is near project site. The sparse distribution of xerophytic vegetation is observed near the study area. There is no any wildlife sanctuary within 25 km of project area.

Objectives of the ESIA Study

The objective of Environmental and Social Impact Assessment (ESIA) was to prepare a document based on anticipated Environmental Impact due to setting up of 150MW Photovoltaic based Solar Power Project and to applicable local and national regulations and laws.

The proposal is for a PV based Solar power project and there are no potentially significant adverse and irreversible social and environmental impacts. Therefore, according to the findings of the environmental and social impact assessment study conducted with respect to the establishment of the Project and a review of the broad IFC Principles criteria and requirements for the classification of Category ‘A’, ‘B’ & ‘C’ projects has indicated that the Meiktila Solar Power Project is more closely aligned to ‘Category C’ project due to limited adverse social or environmental impacts and these are limited to site-specific, largely reversible and readily addressed through mitigation measures.

The Environmental and Social Impact Assessment (ESIA) study will be used to:

- Support the application for environmental approval from the Ministry of Environmental Conservation and Forestry (MOECAF) in line with the Environmental Impact Assessment ("EIA") Regulation No. 37 for year 2005.
- Evaluate the likely environmental, social and health impacts that may potentially be generated from the project.
- Minimize / eliminate negative impacts, maximize positive impacts.
- Ensure that environmental, social and health factors are considered in the decision making process.
- Inform the public about the project.

ESIA Reporting

This ESIA report is submitted to MOECAF and MOEE (formerly MOEP) which includes the key environmental issues, existing (baseline) conditions, anticipated activities that will cause impacts, a general suite of mitigation measures, and assessment on the likely remaining (residual) impact following mitigation. The ESIA report has been prepared in compliance with the requirements of the Environmental and Conservation Law of Myanmar, Labour Laws of Myanmar as well as MOECAF requirements.

The report is written in English as per the professionals who produced it.

The final ESIA report, which this document is called when approved, will form the basis of the Environmental Standards, together with supporting environmental, social and health management plans.

The ESIA includes but is not limited to:

Executive Summary	Summary in English of the project, main findings and recommendations
Introduction	Overview and purpose of the project and scope of the ESIA
Review of Legislation and Standards	Details of the applicable legislation and regulations and other standards in Myanmar with potential implications
Project Description	Clear description of different activties over the life of the project. The description is sufficient to allow the risks and impacts to be identified, described and evaluated
Environmental and Social Baseline	Assessment of conditions against which the impacts of the project can be assessed
Assessment of Impacts	Assessment of the impacts of the project, which shall include a listing, description, assessment, and discussion of the possible negative and positive impacts of the project on the environment and socio-economic context
Stakeholder Engagement	Summary of the stakeholder engagement process which will identify the affected parties and details how the project will communicate, inform and discuss the substantive issues with all interested and effected parties
Mitigation and Monitoring measures	Recommendations for mitigation measures to minimize the identified impacts and any ongoing monitoring requirements
Environmental & Social Management Plan	Details of activities to be carried out during different phases of the project as well as project activities to ensure identification of mitigation measures are implemented.

Environmental and Social Policy and Guidelines

The Environmental Policy in Myanmar is as per Law for Environmental Conservation, enacted in 2012. The Ministry of Environmental Conservation and Forestry (MOECAF) administers the legal framework and environmental legislation in Myanmar. At this time the regulations on environment and social impact assessment are only in draft form and have not been officially released.

The Department of Environment under the MOEE (formerly MOEP) has indicated that the proposed development in the Mandalay Region would require environmental impact assessment.

In Myanmar there is no specific policy required for social impact assessment before a development project is implemented. There is no specific law governing ethnic minorities. The Ministry of Immigration and Population is the agency responsible for data and issues on ethnic minorities. Clear provision on the rights and access to properties especially for ethnic minorities has not been defined.

The current institutional capacity in Myanmar to administer an environmental and social impact process is somewhat limited. Recently, environmental authorities in Myanmar have gained knowledge and sufficient staff, training, facilities and resources to provide effective on-going environmental monitoring of new projects.

The Proposed Development

Convalt Energy, a directly owned company of the United States based investment firm ACO Investment Group (ACO), is proposing to set up 300MW of solar power generating facilities as an independent power producer and operator in Mandalay Division of Myanmar. The power generated from PV Solar Farms will provide substantial benefits to Myanmar and holds the potential to provide further benefits for the country if strengthened and extended.

The 300MW project would be in two locations with 150MW (solar PV technology) close to Nabuaing and another 150MW (solar PV technology) close to Wundwin and Thazi. At each location, the 150MW would comprise of three blocks of 50MW solar PV arrays each feeding DC power to 36 numbers of 1.4MW inverters. The inverter output, at 690V, would be stepped up to 33kV by means of a 1.4MVA transformer and fed to a common 33kV grid.

The 150MW solar PV power plant at Meiktila will tap into a 230kV transmission line which would be taken to the Thapyaywa primary sub-station. The 150MW solar PV plant in Myingyan would tap into the 33kV grid, at Nabuaing, to evacuate power through a transmission line to the Myothar Industry Zone and Semekhone Port development. Each 150MW solar PV power plant is expected to have energy generation of more than 303,000MWh per annum.

In 6-9 months, 50MW in each plant is expected to be completed, and while the entire project of 300MW is expected to be completed in up to 30-36 months. Total CAPEX of the project is estimated USD $480 Million excluding contingencies.

The positive and negative impacts and other considerations are summaries in this document. In consideration of the development of Solar Power Plant, there are no findings indicating that the proposed development should have any fatal environmental or social impacts that would prevent the construction. Certain potential impacts were identified but no “red flag” impacts were identified that are deemed to have significant negative impact to suggest that the proposed activity should not commence.

The implementation of the proposed mitigation measures will effectively mitigate all the identified potential impacts.

Project at a glance

S. No.	Parameters	Details
1	Project Name	Mandalay 300 MW AC Solar Power Project
2	Plant Capacity	2x150 MW Alternating Current (“AC”)
3	Location	Mandalay Division, Myanmar
4	Location Details	Site 1: Nabuaing Industrial Zone, Myingyan District
		Site 2: Wundwin Township, Meiktila Region
5	Connectivity	To National Grid at 230kV / Local Grid at 33kV
6	Climate	Tropical
7	Project size	Approximately 330MW DC
8	PV Technology	Poly-crystalline
9	Module Watt Class	315 Wp range
10	No. of Modules	Approximately 524,000 (For each site)
11	Solar Inverter Capacity	Expected 1,000 kW (AC)
12	Number of Inverters (Grid tied)	Approximately 150 (for each site)
13	Expected Inverter Efficiency	Approximately 98.7%
14	Inverter Technology	Central inverter with MPPT
15	Expected Solar Insolation (Global Horizontal)	Site 1- Nabuaing: 1,843 kWh/kWp
		Site 2- Wundwin: 1,898 kWh/kWp
16	Total Expected Energy Generation (Year 1)	Site 1- Nabuaing: 301,128 MWh/year
		Site 2- Wundwin: 311,817 MWh/year
17	Expected Specific Yield	Site 1- Nabuaing: 1,825 kWh/kWp/year
		Site 2- Wundwin: 1,890 kWh/kWp/year
18	Total Available Land Area	Site 1 – Nabuaing: 1,000 Acres
		Site 2 – Wundwin: 850 Acres
19	Power Evacuation	Power generated from SPV plant is evacuated at 33 kV and then stepped up to 230 kV
20	Estimated Project Cost	Approximately USD 480 Million (including Contingencies)

Environmental Issues

There are a number of environmental aspects to take into consideration when developing a power generating facility such as Solar Power Project. Below are the main environmental aspects;

Issue	Comment
Health and Safety	• There will be a number of trained full time staff with an even male/female ratio • There will be Health & Safety Manuals at sites in good quantity in both native Burmese language and English. • There will be regular safety training as well as safety audit will be conducted. • Staff will be issued Personal Protective Equipment (PPE). • There will be first aid trained staff in the Solar Power Plant as well as a medical clinic with sufficient facilities with staff. There will also be an ambulance in close proximity to the Solar Plant • Emergency fire prevention will also be on sites
Noise	• As solar power generation does not produce any noise, this is no issue.
Water supply	• The site will be on main water supply. A ground well will be installed where the water will be collected, filtered and purified to the point that consumption is safe and healthy.
Sanitation	• Septic systems and sewerage systems will be built on site. • Occasional collection from septic tanks will be as frequent as needed with proper disposal.
Solid waste	• There should be plans for waste the management of solid wastes. • Occasional collection of any solid waste should occur on a weekly basis and will be disposed of in an environmentally safe and responsible way.
Flooding	• Drainage systems should be constructed. Open drains carry away excess rainwater to the surrounding fields in the rainy season. Discharges to the surroundings will not be of any particular risk to nearby nature as there are no chemicals or other substances used during operations that is harmful to the surrounding nature.
Monitoring	• Environmental monitoring will be conducted full time. The Solar Power Plant will not produce any noise or air pollution.

The assessment concludes that the implementation of this project will only have minor impacts on the biophysical and socio-economic environment.

Environmental and Social Management Plan and Environmental, Health and Safety Management Plan

An Environmental and Social Management Plan is necessary to define roles and responsibilities to manage any possible environmental impacts and to implement mitigation measures as needed. The ESMP should include descriptions of the activities planned and how to mitigate any issues that are foreseen or may appear during construction as well as supply an important and clear monitoring and communication system in order to assess the progress of the ESMP implementation. Monitoring requirements should be defined in the ESMP to determine if all and any mitigation measures are successful which is often overlooked as it is relevant first when the proposed project is approved and commences but important nevertheless as it serves to provide evidence that compliance and specific mitigation measures are implemented by the Contractor.

Before construction, EPC Contractor should prepare for environmental, health & safety management systems, which draws together environment mitigation measures, ESMP recommendations, environmental, health & safety guidelines as well as priorities and monitoring procedures for both the construction as well as the operational phases.

The EHS-MS should ensure compliance with entities such as the EU Directives or equivalent and to the Word Bank Group Environmental, Health & Safety Guidelines. The General Guidelines contain information on crosscutting EHS issues, which are potentially applicable to all industry sectors and should be used together with the relevant industry guidelines. The guidelines can be retrieved from http://www.ifc.org/ehsguidelines. The documents are so called "living documents" and are occasionally updated.

In detail, the organizational structure for mitigation implementation, monitoring plan, performance indicators as well as the provisions for independent audit should be included in the EHS-MS along with cost allocation.

The provisional cost estimate for implementing the EHS-MS including the ESMP is USD 500,000.

Social Assessment

The data provided in this document is of baseline social data of the communities within the approximate surrounding of the proposed project location. Subjects such as living standards, gender dimensions livelihoods, religion, important sites and locations, education, electricity overview, sanitary conditions, income calculations are explained and explored.

The proposed location is south of the Wundwin Township and north of Thazi Township in the Meiktila District. The proposed location is (2) miles, east of Yangon-Mandalay Union Highway and (5) miles from the Thapyaywa Primary Power Station.

For the installation of a 150MW solar PV power plant, about (750) acres of land will be utilized. A land area of (850) acres is available and leased by the developer within the total Land Area of (3787) acres in the Industrial Zone.

The religion in in the Meiktila District is mainly Buddhism and any other religious minority is rarely seen.

The Meiktila District has 159,824 households and a total population of 915,616 people whereas 71,921 of the households are considered very poor with a total of 412,027 residents being among the countries poorest. On an average, one will find 5-7 members per household in the Meiktila District. The district is considered to be among the countries top 5 poorest districts according to the Rural Development Group Framework 2014.

The Township of Meiktila has a total population of 301,242 residents whereas 130,230 are male and 171,012 are female and all family members, men and woman, boys and girls participate in both household activities as well as economic activities. In the Township of Meiktila one would find on an average, 5-7 members per household.

The Township of Wundwin has a total population of 228,431 residents and 51,578 households. Among which 107,634 are male and 120,767 are female. Similarly to Meiktila, all members of the household do generally assist in household and economic activities.

The Township of Thazi is located south of the project site and is slightly smaller than Wundwin in terms of population with 191,695 citizens in 39,363 households with an average of 5-7 members per household. Approximately 90,776 of which are male and 100,919 are female.

To simplify the process, households have been categorized in two; households with connection (HHC) and households without connection (HHN). This is useful to create an understanding of the average household living standard and how a source of electricity impacts the local economic growth of each township and household.

There is no great variety to ethnic groups as there are mainly Burmese and Shan in the region of Mandalay. Social findings insist that community affairs work well in the majority of the townships. Women are involved with the social networks within the communities and, children attend the same schools and intermarriages are frequent.

Interview techniques of the local government officials were applied in order to collect reliable information from each community. While these interviews were conducted, discussions as to what needs each township have, was a major topic, which was focused on heavily. Interviews and discussions have taken place in each township mentioned in this document.

Positive Impact

- Regular electric supply will enable households; business sectors and health institutions to perform more efficiently. Potential increasing of opportunity for economic development through short-term employment
- A great increase in trade and industry as a result of both urban and rural improvement that is usually associated with a stable supply of electric power
- Villages that are currently not connected at all, such as Nabuaing, may connect to electricity
- Local road infrastructure will need to be refurbished which will lead to safer motor travel

Negative Impact

- Overall, there will be no displacement of households associated with the project development, no loss of business establishments, productive assets, cultural heritage or livelihood
- If deemed necessary the project will establish a committee, which will include agricultural community representatives and project management to implement and establish a culturally appropriate grievance redress system. A fully represented instance will be set up with the aim of settling any disputes amicably. Each case should be carefully documented and the nature of grievance, agreed actions to be taken and subsequent monitoring must be recorded

Stakeholder Workshop

A stakeholder's workshop was held in 2015 by Arbutus Consultants Pvt. Ltd. This is a necessity to gain an understanding of local needs as well as clarifying stakeholder's inputs and recommendations on the project.

Below are the main foreseen benefits and impacts of the implementation of the Solar Power Plant for the nearby communities within Meiktila District.

The stakeholder's workshop provided valuable knowledge and great acceptance towards the Solar Project as expected.

There is a clear demand for improved power supply as there are a tremendous amount of households whom are not connected to a power source and households that are currently connected already show interest, as the project will bring more stable electric power.

No cultural or historical heritage sites are in danger as a result of the project and there will be no displacement of farms or any loss of land during construction or operational phase.

Subjects such as the following are expected to be raised:

- Waste management

- Education
- Social and economic welfare
- Local infrastructure conditions

Safeguard Policies

No World Bank safeguard will be triggered regarding environmental, social or resettlement policies. No land acquisition will bring any loss of income associated with the development of the proposed project an all construction activities will be conducted within the designated site perimeter. The land is currently un-used land and highly fit for he proposed project.

Environmental Classification

According to the Word Bank classification system, the category "B" is selected for Myanmar based on the fact that there is a need to establish a best practice for environmental and social impact assessments, however as we are following all the standard practices established by World Bank/IFC the proposed classification should be category "C" for this project as it has very little environmental impact and we expect to follow IFC's corporate governances. Further, we expect to contribute to the local economy by providing jobs for the locals and providing career training in the field of renewable energy.

1 Introduction

1.1 Project Objectives

This environmental and social assessment covers the phased construction of a Solar Power Plant in the Meiktila District within the Mandalay Region, Myanmar. The project will be built in three (3) phases of 50 megawatts each. First 50MW to be installed and commissioned followed by the remaining blocks of 50 in phase 2 and phase 3.

Figure 2: Solar Power Plant location

The main objective of the proposed Solar Power Plant is to establish the first efficient utility scale Solar Power Plant and thereby helping reduce electricity shortages in the country. An additional objective is to support the Ministry of Electric Power in strengthening their institutional capacity.

ACO and Convalt Energy will seek to sign a Power Purchase Agreement (PPA) with Ministry of Electric Power on 30-year tenure at a fixed price of $0.13 per kWh. Convalt Energy and ACO may potentially partner with other U.S entities and suppliers like SunPower, First Solar, SMA, PowerOne, U.S Battery, S&C Electric, Canadian Solar and SunEdison, – a subsidiary of MEMC based in the United States for the supply of solar panels and EPC.

The project will act in synergy with the proposed project in Meiktila involving the installation and operation of solar farms in Mandalay Division, supplying renewable power to the National Grid of Myanmar.

Myanmar is facing large electricity shortages (about 20% of current demand) and high risk of blackouts. The development of Solar Power plants has been identified as the most environmentally friendly way to increase efficient electricity generation, increase generating capacity and have a positive impact on emissions.

A lack of legal requirements and limited institutional capacity for ensuring effective safeguard preparation and implementation in infrastructure projects is one of major hurdles for international financial institutions and responsible investors in Myanmar. While this issue is not limited to the energy sector, new and large energy and power projects will be among the first to experience this bottleneck.

Addressing this constraint will require concerted efforts among several government agencies to introduce and start implementing appropriate social and environmental protection policies.

A longer-term initiative to build institutional capacity and provide adequate training must be developed. Initiatives to improve safeguard capacity should build upon the lessons learned from other countries in the region and should ideally involve other key donors in Myanmar.

1.1.1 General Economics - Myanmar

Since the transition to a civilian government in 2011, Myanmar has begun an economic overhaul aimed at attracting foreign investment and reintegrating into the global economy. Economic reforms have included establishing a managed float of the Burmese kyat in 2012, granting the Central Bank operational independence in July 2013, and enacting a new Anti-Corruption Law in September 2013. The government's commitment to reform, and the subsequent easing of most Western sanctions, has begun to pay dividends.

The economy accelerated in 2012 and 2013 and Myanmar´s abundant natural resources, young labor force, and proximity to Asia's dynamic economies has attracted foreign investment in the energy sector, garment industry, information technology, and food and beverages. Foreign direct investment grew from US$1.9 billion in FY 2011 to US$2.7 billion in FY 2012. Despite these improvements, living standards have not improved for the majority of the people residing in rural areas.

Myanmar remains one of the poorest countries in Asia - more than one-fourth of the country's 60 million people live in poverty. The previous government's isolationist policies and economic mismanagement have left Myanmar with poor infrastructure, endemic corruption, underdeveloped human resources, and inadequate access to capital, which will require a major commitment to reverse. The Burmese government has been slow to address impediments to economic development such as an opaque revenue collection system and antiquated banking system. Key benchmarks of sustained economic progress would include modernizing and opening the financial sector, increasing budget allocations for social services, and accelerating agricultural and land reforms.

Myanmar has a number of agricultural industries such as agricultural processing of wood and wood products, copper, tin, tungsten iron, cement, construction materials, pharmaceuticals fertilizers, oil and natural gas, garments jade and gems. However, the vast majority of labor force (70%, 2001) is based on the production of agricultural products such as rice, pulses, beans sesame, groundnuts, sugarcane, fish and fish products. Only a mere 7% of the labor force is allocated within the industry sector while 21% is within the service sector. The main import commodities are fabric, petroleum products, fertilizers, plastics, machinery, transport equipment and construction materials. Myanmar's main import partners are China 36.9%, Thailand 20.2%, Singapore 8.7%, South Korea 8,7%, Japan, 8.2%, Malaysia 4.6% (2012, CIA Fact book).

1.1.2 Renewable Scenario

In recent years, government policies have evolved in response to dependence on foreign energy sources and the desire to foster the growth of the renewable energy industry. Federal and state governments have established renewable portfolio standards and incentives to further reduce the cost of solar energy for consumers, including investment tax credits and bonus depreciation. These federal and state incentives helped catalyze private sector investment in solar energy development, including the installation and operation of residential and commercial solar energy systems.

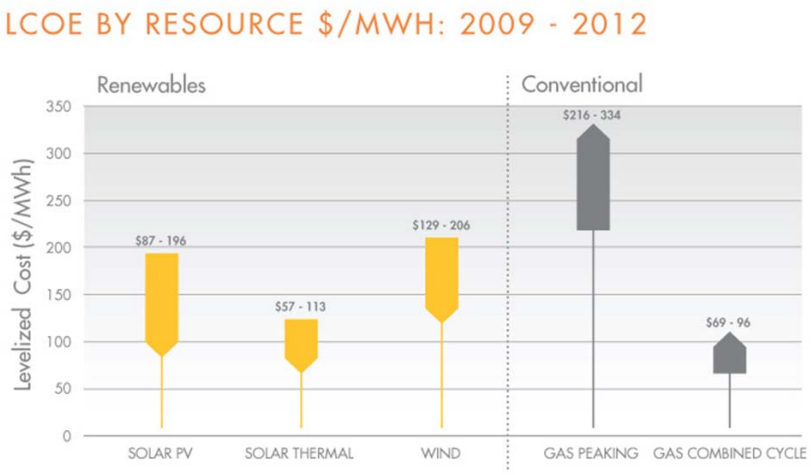
Historically, incentives have been instrumental in building the market for sustainable energy resources. However, rising retail energy costs, declining cost of solar energy components, and the increased affordability and accessibility of solar energy systems minimize the need for incentives. In line with this trend, while incentives on a dollar per watt basis have decreased over the last decade, installation of solar energy systems continued to grow. Renewable energy has made significant development all over the world in recent years and developing countries have been well progress with advance technology.

1.1.3 Solar Energy

The potential benefits of solar generated power connected with national grid will enhance the power requirements of the country as well as provide significant energy trade opportunities through the cross border inter-connections of energy systems and practical steps toward realizing them, should therefore be explored in depth. The price of PV system has decreased dramatically over the past years, particularly for large PV Solar System.

Large Solar Farms are mostly controlled by Utilities or IPPs, these results in greater political acceptance from utilities, which generally control energy transmission, and may allow easier acceptance of solar energy. The medium to large scale solar energy installation using PV cells often placed on large expanses of gently or non-sloping vacant land and designed to generate large amounts of electricity to be placed directly onto the large scale regional grid at a specific point. Solar PV technologies have improved significantly in efficiency, making them more economically attractive.

Figure 3: LCOE by Resource

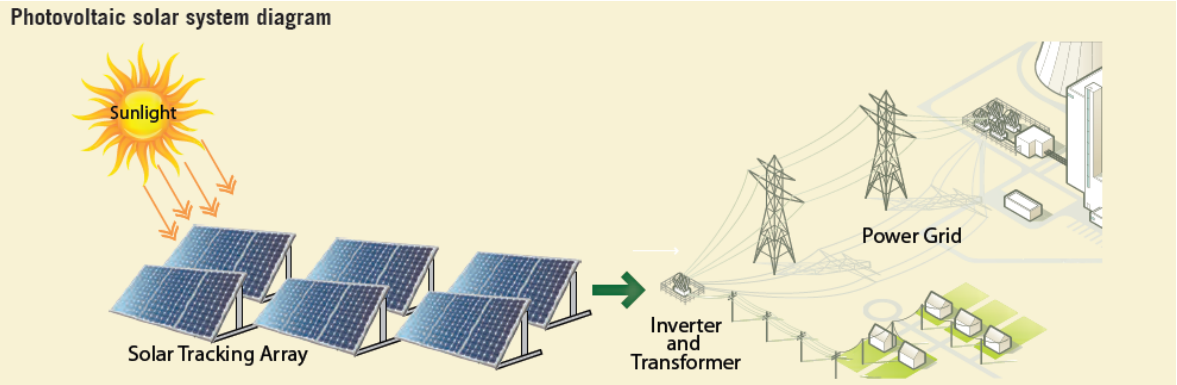


The world needs clean, cost-effective, renewable solar energy at the utility scale. The reasons range from the profound to the profit-driven. But they are all compelling. From reducing the impact of climate change to the rising cost of traditional fuel prices, from increasing regulation and the cost of capital to the public demand for responsible action on the part of utilities, solar power is fast becoming one of the most cost-effective energy resources available today.

Utility-scale PV solar power is now cost-competitive with thermal solar and wind energy. The cost of solar electricity continues to fall while the cost of conventional electricity increases. Advances in solar technology, conversion efficiency and installation have allowed utility-scale to achieve cost structures competitive with other peaking power sources. What's more, the cost of solar is known, and predictable, over the lifecycle of the power generating system.

The economies of scale inherent in utility-scale solar systems are similar to those found with other power options, but photovoltaic power plants have the benefit of being completely modular – PV solar can be deployed at a 2-kilowatt residential scale, at a 2-megawatt commercial scale or at a 250- megawatt scale. PV solar power has the unique advantage among renewable resources of being able to produce power anywhere: deserts, cities or suburbs.

Figure 4: Typical solar PV system



1.2 Environmental Policy

Myanmar has gone through an extensive amount of policy changes and reforms in the recent years, especially since sanctions were lifted. In 2012 the Environmental Conservation Law was enacted The Environmental Policy in Myanmar is as per Law for Environmental Conservation, enacted in 2012. The Ministry of Environmental Conservation and Forestry (MOECAF) administers the legal framework and environmental legislation in Myanmar. At this time the regulations on environment and social impact assessment are only in draft form and have not been officially released.

As with almost any other similar location, Myingyan and Meiktila would require an environmental impact assessment.

For social impact assessments, there is no policy required before a development project is implemented. There is also an absence of laws governing ethnic minorities. The Ministry of Immigration and Population is the agency responsible for data and issues on ethnic minorities.

Current projects undertaken in Myanmar such as construction of roads and dams, mining, logging, as well as coal, oil, and gas extraction do not yet have any standardized EIA and the local people are not generally consulted. There are no requirements in the laws of Myanmar for mitigation measures of potential adverse impacts such as involuntary resettlement. Public participation is not considered mandatory, and usually done at the latter stage, and is determined by the government's discretion whether public participation is required or not, allowing the government to avoid public participation for controversial projects.

Within the context of the project's social assessment, relevant policies have been reviewed to ensure the protection on rights of vulnerable groups such as women, children and particularly the ethnic communities.

Constitution 2008 – provision on the rights of the people and administration of the overall political, economic procedures of the nation, giving full power to the Union

Land Nationalization Act – established in 1948 and amended in 1953, stipulating that the state maintains ownership of all lands.

Laws on Human Rights

The State Protection Law 1975 – "The Law to safeguard the State against the dangers of those desiring to cause subversive acts". This law was amended in 1991 increasing the time someone could be held without arrest, trial or sentencing from 3 to 5 years.

Unlawful Association Act 1908 – Anyone deemed to be involved or connected with an organization that is declared unlawful by the President of the Union, can be imprisoned.

The Printer and Publishers Registration Law 1962 – All publications in Burma are subject to censorship and prior to publication must be approved by the Press Censorship Board. Individuals who violate this law can be sentenced to 7 years imprisonment and/or fined 30,000 Kyat (US$50).

Emergency Provision Act 1950 – individuals seen to be disrupting the morality and stability of the country can be sentenced to up to 7 years imprisonment.

Video Law 1985 – individuals making, copying or distributing unauthorized videos, including ammeter videos can be sentenced to up to 3 years imprisonment.

Law 5/95 – this law prohibits individuals from initiating discussion about the national convention in Burma, which was tasked with creating guidelines for the drafting of the 2008 Constitution. Violators of this law can be sentenced to 20 years imprisonment.

Penal Code – Legislation against child abuse, child pornography, kidnapping and human trafficking.

The Child Law, 1993, promulgated by the State Law and Order Restoration Council Law stipulating protection for children.

Article 371 of the Penal Code prohibits "habitual dealing in slaves" or buying or disposing of any person as a slaver (Article 370).

The Anti-Trafficking in Persons Law – prohibits human trafficking in any form.

The 1993 Child Law has noted national, divisional state and township child rights committees established. However, cases on violations of child rights continue, particularly the recruitment of children into the armed forces by the Burmese army and use of child labor are still rampant. There have been criticisms that these committees do not provide avenues for people to make complaints, particularly the forced recruitment of children in to the army, or assist families in locating children who have reported to be forced into the military.

1.2.1 U.N. Global Compact

The developing party will be following the U.N Global Compact 10 Principles of Human rights to further enhance a best practice in addition to IFC Performance Standards 1-8 as well as the current and future Laws and Regulations of the Government of Myanmar. The UN Global Compact's ten principles in the areas of human rights, labor, the environment and anti-corruption enjoy universal consensus and are derived from:

- The Universal Declaration of Human Rights
- The International Labor Organization's Declaration on Fundamental Principles and Rights at Work
- The Rio Declaration on Environment and Development
- The United Nations Convention Against Corruption

The UN Global Compact asks companies to embrace, support and enact, within their sphere of influence, a set of core values in the areas of human rights, labor standards, the environment and anti-corruption:

Human Rights

- Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights; and
- Principle 2: make sure that they are not complicit in human rights abuses.

Labor

- Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
- Principle 4: the elimination of all forms of forced and compulsory labor;
- Principle 5: the effective abolition of child labor; and
- Principle 6: the elimination of discrimination in respect of employment and occupation.

Environment

- Principle 7: Businesses should support a precautionary approach to environmental challenges;
- Principle 8: undertake initiatives to promote greater environmental responsibility; and
- Principle 9: encourage the development and diffusion of environmentally friendly technologies.

Anti-Corruption

- Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

The Developer also commits to follow local and national laws and regulations to ensure best practice throughout the project chain.

1.2.2 Institutional Capacity for Environmental Management in Myanmar

Capabilities to administer environmental and social impact processes are very limited in the country. The government is struggling with staff and resource constraints.

Myanmar has insufficient staff, training, facilities and resources to provide effective on-going environmental monitoring of new projects as of to date.

With this in regard, a qualified party or the Contractor will thoroughly environmentally and socially manage the development of the 150MW of Solar Power.

1.2.3 Application of World Bank Safeguard Policies

The study concludes that no World Bank safeguard polices will be triggered concerning indigenous people, biodiversity, disputed areas and involuntary resettlement.

Figure 5: World Bank Safeguard Policies that may be triggered

Safeguard Policies	Triggering
Environmental Assessment OP/BP 4.01	**Yes**
Natural Habitats OP/BP 4.04	**No**
Forests OP/BP 4.36	**No**
Pest Management OP 4.09	**No**
Physical Cultural Resources OP/BP 4.11	**No**
Indigenous Peoples OP/BP 4.10	**No**
Involuntary Resettlement OP/BP 4.12	**No**
Projects in Disputed Areas OP/BP 7.60	**No**

1.2.4 Environmental Classification

As Myanmar does not have a structured practice for environmental and social impact assessments and MEPE indicates that the project should undergo an EIA, the suggest category is “C”.

According to the Word Bank classification system, the category “B” is selected for Myanmar based on the fact that there is a need to establish a best practice for environmental and social impact assessments, however as we are following all the standard practices established by World Bank/IFC the proposed classification should be category “C” for this project as it has very little environmental impact and we expect to follow IFC’s corporate governances. Further, we expect to contribute to the local economy by providing jobs for the locals and providing career training in the field of renewable energy.

"A Category B project has potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats which are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects.

The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A assessment. Like Category A, a Category B environmental assessment examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance."

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

1.2.5 IFC Performance Standards

This document supports the International Finance Corporation´s Performance Standards 1-8 on Environmental and Social Sustainability, which shall be followed by the Contractor as project commences which includes the below:

IFC Performance Standard	
Performance Standard 1: Assessment and Management of Environmental and Social Impact Risks	PS1 underscores the importance of managing social and environmental performance throughout the life of a project by using a dynamic social and environmental management system. Specific objectives of this Performance Standard are: • To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence; • To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment; • To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and • To promote improved social and environment performance of companies through the effective use of management systems.
Performance Standard 2: Labor and Working Conditions	The requirements set out in this PS have been in part guided by a number of international conventions negotiated through the International Labour Organization (ILO) and the United Nations (UN). Specific objectives of this Performance Standard are: • To establish, maintain and improve the worker-management relationship; • To promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws; • To protect the workforce by addressing child labour and forced labour; and • To promote safe and healthy working conditions, and to protect and promote the health of workers.
Performance Standard 3: Resource Efficiency and Pollution Prevention	This Performance Standard outlines a project approach to pollution prevention and abatement in line with international available technologies and practices. It promotes the private sector's ability to integrate such technologies and practices as far as their use is technically and financially feasible and cost-effective in the context of a project that relies on commercially available skills and resources. Specific objectives of this Performance Standard are: • To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and • To promote the reduction of emissions that contribute to climate change.

IFC Performance Standard	
Performance Standard 4: Community Health Safety and Security	This PS recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase risks arising from accidents, releases of hazardous materials, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this PS addresses the project sponsor's responsibility in respect of community health, safety and security.
Performance Standard 5: Land Acquisition and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the use of renewable natural resources in a sustainable manner. This Performance Standard addresses how project sponsors can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources. Specific objectives of this Performance Standard are: • To protect and conserve biodiversity; and • To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.
Performance Standard 7: Indigenous Peoples	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from dominant groups in national societies.
Performance Standard 8: Cultural Heritage	Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to protect irreplaceable cultural heritage and to guide project sponsors on protecting cultural heritage in the course of their business operations.

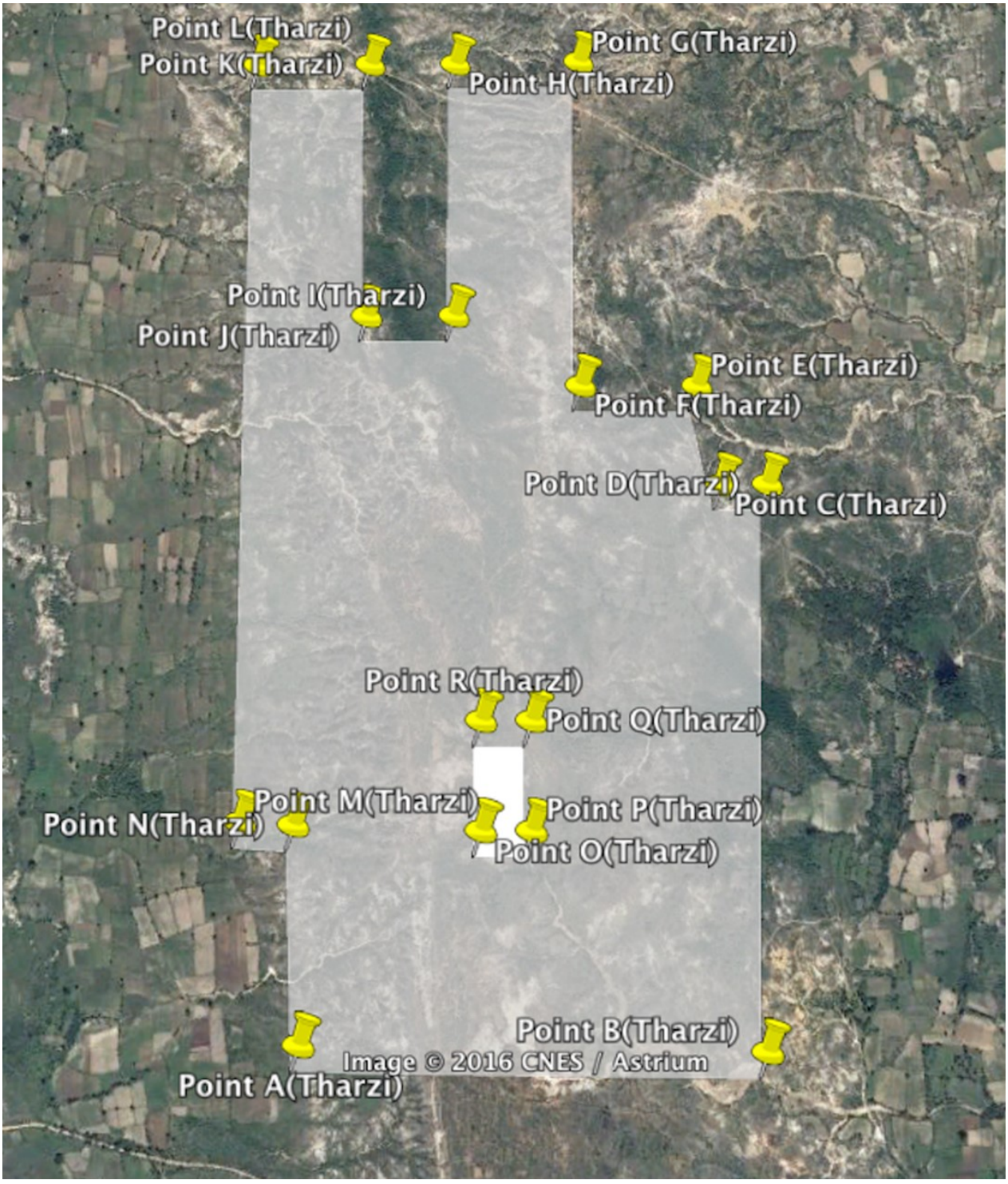
2 Project Contexts

Mandalay Region is one of Myanmar's central Regions, sharing borders with Sagaing, Shan, Kachin, Bago, Naypyitaw and Magway. Mandalay covers 29,686km^2, and consists of 28 townships. The capital city of Mandalay Region is Mandalay. It is Myanmar's third largest region by population with an estimated 5.76 million people (2011 HMIS data), and the second most densely populated with 194 people per square kilometer. 29% of the population lives in urban areas, and the remaining 71% in rural areas.

The project location is south of the Wundwin Township north of the Thazi Township in the Meiktila District. The proposed location is two (2) miles, east of Yangon-Mandalay Union Highway and five (5) miles from the Thapyaywa Primary Power Station.

For the installation of a 150MW Solar PV power plant, about 750 acres of land will be utilized. A land area of (850) acres is available.

Project location at Meiktila site


Point L(Tharzi)
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Point O(Tharzi)
Point B(Tharzi)
Image © 2016 CNES / Astrium
Point A(Tharzi)

2.1 Land use

Physically the land at the site is mostly flat with small hills rolling through the site and a full ground leveling will need to be conducted. Land surrounding the project sites is mainly low-hill landscapes and little to no agricultural activity. There are no perennial streams or rivers running through the sites or close to the immediate perimeter.

A fair amount of the generated solar power will be consumed locally, at or near the point of generation in addition to being fed into the national grid. This results in even distribution and high grid stability, with decreased instances of accidental or rolling blackouts and reducing in the use of electric lights in the city (brownouts).

The large flat expanses of open land in rural area or semi-wild areas, such as farmland, gentle hills are preferred. These preferred sites are nearer existing infrastructure such as substations and power line corridors. Land used can be naturally pristine, in agriculture or otherwise distributed or not in use. The land selected for this project is un-used land and there are no perennial streams or rivers running through the sites or close to the immediate perimeters.

It is physically possible to construct in urbanized settings, but the difficulty of coordination of many landowners and the probably substantial costs of permitting in urban zones would be prohibitive at present. A grid connection in itself leads to additional costs for solar farms along with the potential costs of new transmission lines.

Main characteristics and planning of the selected land are:

1) Total available land area for this Solar Power project in Wundwin is 850 acres. 750 acres is designated for the construction of this Solar Power facility of a total of 150MW. Preliminary plans for the remaining 100 acres include 20 acres of green area where the Developer intends to replant any plants removed and include a greenhouse to test the growth of vegetables and fruits and simultaneously employ additional local staff. The remaining land of 80 acres is preliminarily designated for the installation of storage technology to support the solar facility as it is intermittent and the Developer will be in need of dedicating area for storage. All of the additional activities will be subject to a separate ESIA upon final decision.
2) There are no perennial streams or rivers running through the sites or close to the immediate perimeter.
3) The proposed location is south of the Wundwin Township, Meiktila District. The proposed location is (2) miles, east of the Old Yangon-Mandalay Union Highway and (5) miles from the Thapyaywa Primary Power Station.
4) The site consists of flat expanses of un-used and mostly barren land.

2.2 Climatic Conditions

The climate at the site can be described as a tropical climate. It is characterized by strong monsoon influences during rainy season, has a considerable amount of sun, a high rate of rainfall, and high humidity. Data is collected from the Department of Meteorology and Hydrology and crosschecked with data from Nyi Pyi Taw Airport.

The following tables illustrate the main climatic characteristics of the site

Figure 6: Rainfall in Mandalay Region

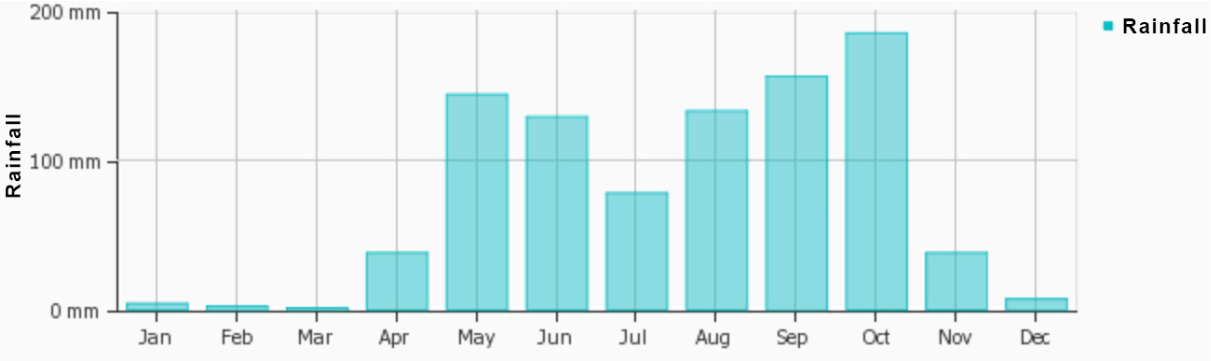


Figure 7: Temperatures in Mandalay Region

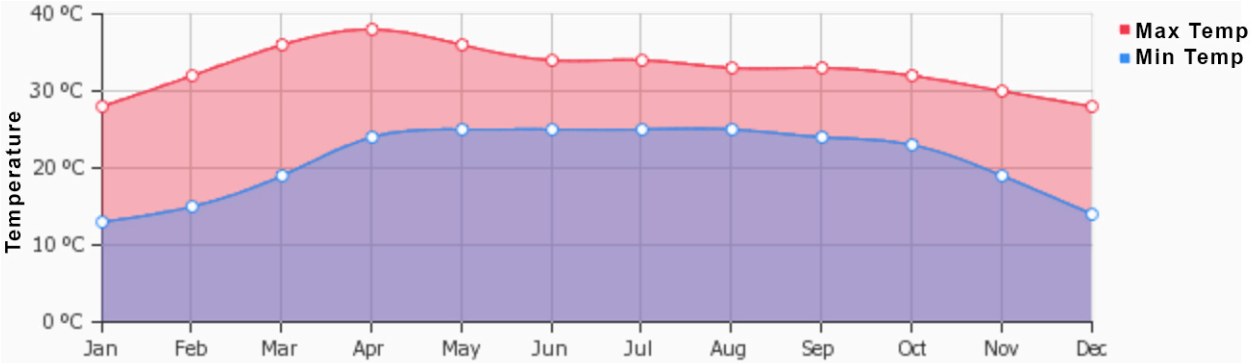


Figure 8: Humidity in Mandalay Region

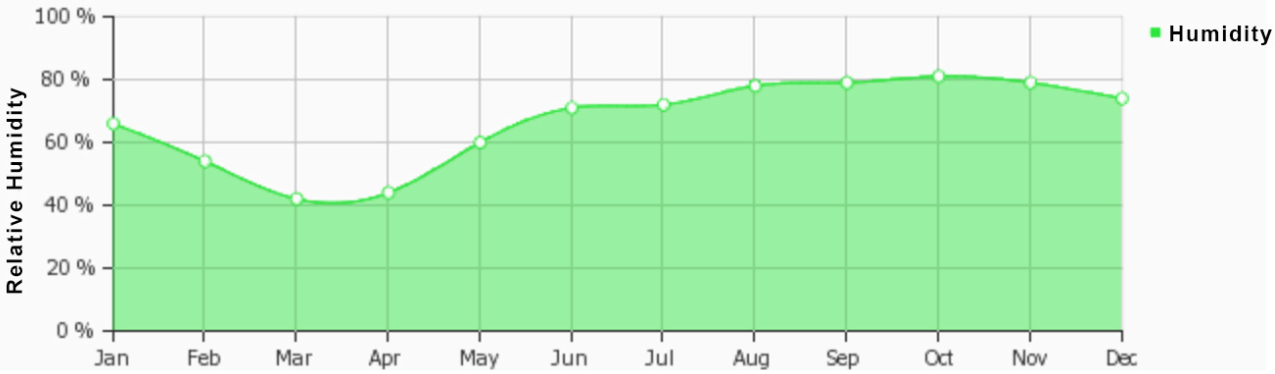


Figure 9: Sun hours in Mandalay Region

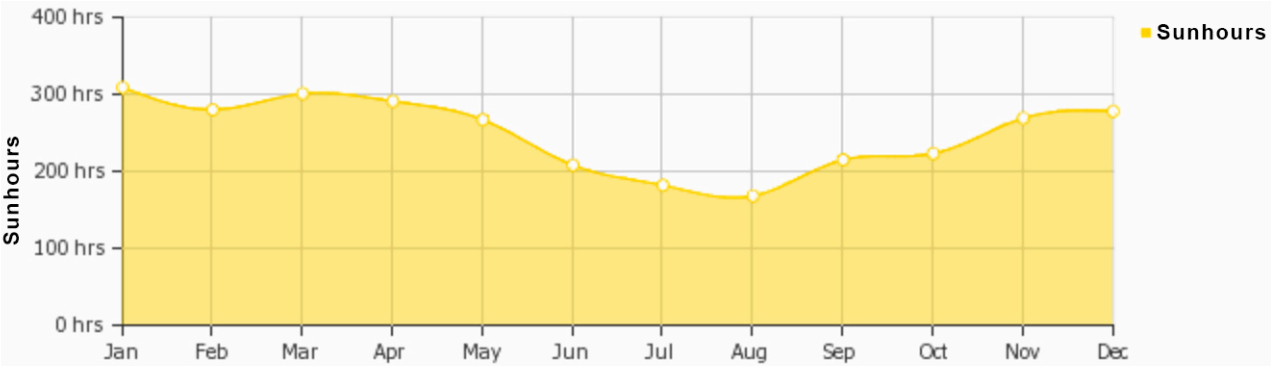
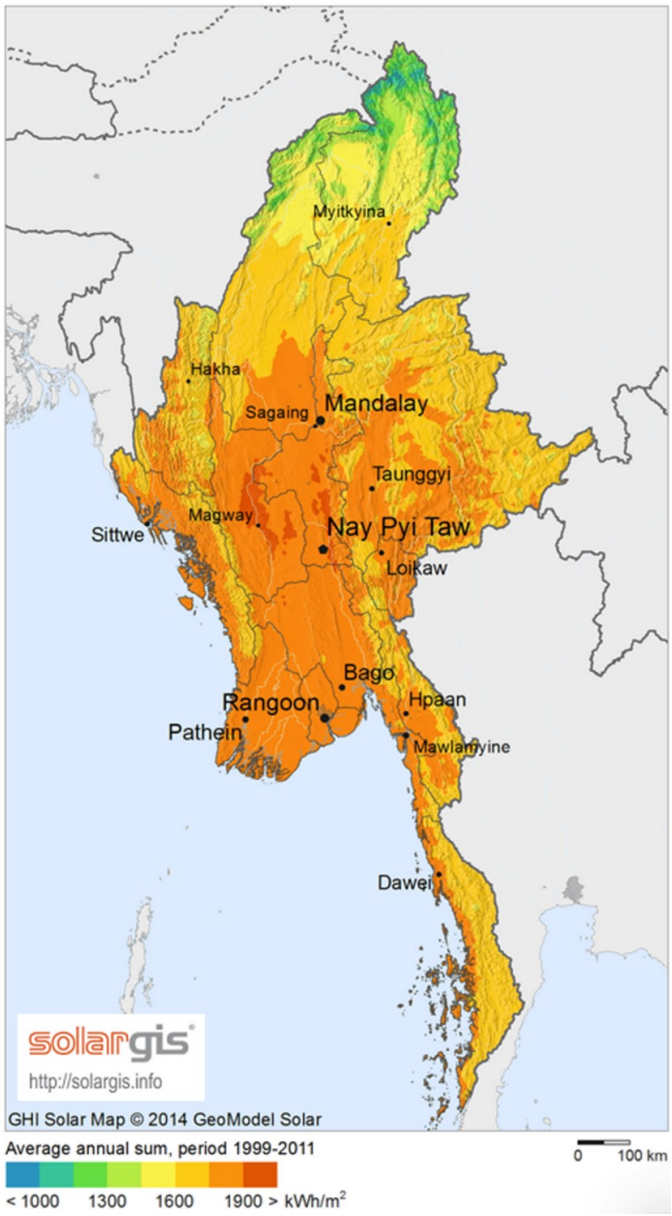


Figure 10: Solar Insulation in Myanmar



Mandalay lies within the most red zone, centre.

3 Project Description

3.1 Solar Power Plant

Convalt Energy, a directly owned company of the United States based investment firm ACO Investment Group (ACO), is proposing to set up 300MW of solar power generating facilities as an independent power producer and operator in Mandalay Division of Myanmar. The Power Generated from PV Solar Farms will provide substantial benefits to Myanmar and holds the potential to provide further benefits for the country if strengthened and extended.

The region of Mandalay as well as the entire nation of Myanmar is short on power and load shedding is frequent. The power demand is significantly larger than the power production. The consequence is reduced power availability and frequent load shedding of local areas. It is therefore a goal to establish an operational solar power plant as fast as possible whilst also ensuring that a future expansion and further development of the plant is possible and cost efficient.

The 150MW project is located between the Township of Wundwin and the Township of Thazi. The 150MW would comprise of three blocks of 50MW solar PV arrays each feeding DC power to 36 numbers of 1.4MW inverters. The inverter output, at 690V, would be stepped up to 33kV by means of a 1.4MVA transformer and fed to a common 33kV grid.

Phase One-A: Develop 50MW of Solar PV. Construct, install and commission the Solar Power Plant.

Phase One-B: Extend the development by 50MW of Solar PV, reaching 100MW at site. Construct, install and commission the Solar Power Plant.

Phase Two: Extend the development by 50MW of Solar PV, reaching 150MW at site. Construct, install and commission the Solar Power Plant.

A 230kV transmission line would be taken to the Thapyeywa primary sub-station, which is 3 miles south of the proposed location. The 150MW solar PV power plant is expected to have energy generation of more than 303,000MWh per annum.

Each 150MW solar PV power plant is expected to have energy generation of more than 303,000MWh per annum.

50MW blocks in each plant are expected to be completed in 6-9 months and the entire project of 300MW, combining Myingyan and Meiktila, is expected to be completed in 30-36 months.

3.2 Project Justification

If Myanmar targeted adding 700 megawatts of base load power a year over the next five years, it would cost $1000 a kilowatt or $700 million a year for gas-fired electricity. (It is not clear that sufficient gas is or would be available for this much gas-fired power in five years.) If it were hydroelectricity, it would be $1500 a kilowatt for full (wet season) capacity, but much more for reliable and year-round power. Transmission and distribution lines would add to the total investment cost. Finding a solution for doubling power is critical to fostering rapid growth of incomes. Myanmar is in desperate need for foreign capital throughout its economy, infrastructure and in nearly every sector. Myanmar has been burdened by foreign sanctions on the military government, which ruled the country from 1962 to 2011 – sanctions have now been lifted.

Electricity demand is growing 1.5 to 2 times as fast as GDP – real GDP growth is now projected at 6-7% per year. Myanmar lacks sufficient domestic energy recourses and needs foreign assistance. Over 70% of Myanmar's electricity is produced by hydroelectric sources, which cannot ensure stable supply.

Solar Power can potentially reduce the needs for conventional generating capacity and allowing cheaper fuel to substitute for more expensive fuel. The conventional power sources generating capacity can be adjusted downwards by allowing Solar Farms to operate during peak demand in one area to be served in part or by spare capacity in a neighboring area where demand is not at its peak. Allowing generation from Solar with Hydro and Gas-fired plants combination will help the country address power outages and peak demand especially during the day.

Construction of solar power as a new source of energy also has the following advantages:

- Utilize the most abundant energy as a source of power. It is estimated that in the past 1 billion years, the sun consumes only 2% of its own energy, it can be said to be inexhaustible.
- Even rainy and dry seasons can generate solar power as natural conditions in Mandalay Region are relatively balanced.
- Flexibility in Size. Can produce from10W-100GW; depending on the requirement.
- Ease of implementation. Short construction period, long life 20-50 years (25 years power with efficiency decreased by 20%); can be installed anywhere where power is lacking.
- Solar energy is a clean source of energy. The development and use will not produce waste, wastewater, polluting exhaust air, no noise, and will not affect the ecological balance.
- Grid connected solar power plant can feed the national power requirements.
- Based on the project's target annual output of 468,000,000 kWh, there will be an estimated reduction of 327,600 tons in CO2 emissions annually. Over a 30-year period, a total of 9,828,000 tons of CO2 emissions will be reduced.

  "Reduction of CO_2 emissions per 1 kWh of solar power = 0.7 kg of CO_2"
- Provided the country's exposure to Hydropower, we feel the combination of Hydropower and Solar are ideal as Hydro effectively acts as storage on summer days when solar power generation is strong and effectively this allows the Ministry of Electric Power to ramp down hydro production saving water for peak hours in the evening. During the rainy season due to the fact that hydropower generation is strong and solar power production drops, the two power generation sources effectively counter balance each other.

3.3 Evaluated Concept – PV Solar

At present the crystalline technology dominates the market with 78 – 80% market share, whereas thin film technology is with 18 – 20%. Thin-film solar cells are rapidly taking market share away from the established crystalline technology, with their portion of photovoltaic (PV) wattage more than doubling by 2013.

As per the future projections thin-film will grow to account for 25 percent of the global solar panel market in terms of watts by 2013, up from 18 – 22 percent in 2009-10. Thin-film market share dropped to 11% in 2011 because of decrease in prices of crystalline silicon by over 40%. Yet, despite the crystalline pricing madness, the future of thin film has not necessarily disappeared. Venture capital investment into thin film in Q4 2011 and Q1 2012 combined to reach nearly $300 million. Solar Frontier continues to ramp up its GW-scale CIGS facility. Tokyo Electron bought Oerlikon Solar for $275 million, affirming long-term faith in the thin-film silicon manufacturing space. With CdTe, GE continues to invest heavily in Primestar, and First Solar still intends to open new capacity in Vietnam and Mesa, Arizona. Over the long term thin film is likely to stay in the market as a cheaper alternative with comparable efficiencies to polycrystalline silicon but the competition has definitely become stiff in the present scenario.

Based on the plant scale and climatic profile of the site, poly-crystalline silicon technology fixed tilt is selected for the project as it would lead to a higher generation, optimized cost and hence, higher returns.

Key components of the solar PV power plant can be viewed below.

Figure 11: Solar PV Grid-connected System

3.4 Technical Description of the Solar Power Plant

3.4.1 The PV Array

By linking a number of solar panels mechanically and electrically by a certain manner and assembled together with a fixed support structure constitutes a DC power unit. PV array is divided into two categories: fixed and tracking. For ease of maintenance and reliability, the vast majority of solar power plants use a fixed mounting configuration at the expense of a slight reduction in performance efficiency.

3.4.2 The PV Array Combiner Box

PV array combiner box is to ensure connectivity and convergence of PV modules and orderly function of the wiring devices. The device is able to protect photovoltaic systems in the maintenance, inspection, and easy separation of circuits. It is common that a monitoring device is installed in the combiner box so that a fault can be easily identified. With a PV system failure, this reduces the scope of the blackout.

3.4.3 DC Distribution Cabinet with Lightning Protection

Mainly is for the combiner box output DC cable access after confluence, to be connected to the grid inverters. The DC input power distribution cabinet contains circuit breakers, leakage protection, anti- diodes, photovoltaic lightning and other major components, ensuring the system without leakage, short circuit, overload and lightning impulse and other damage at the same time, effectively ensuring the load equipment operation; at the same time, facilitate customer operation and maintenance.

3.4.4 Grid-tied Inverters

It converts DC current to AC current, including voltage control, internal power supply, and self- protection devices. It is the heart of the PV plant that connects the PV system to the grid. For transformer-less inverters, efficiency can reach over 98.5%. Solar Power Plants can use advanced inverters with monitoring, control, and management of solar electrical energy generation. The integration of advanced power management functions provides beneficial grid support such as enhanced grid stability and reliability, voltage regulation, and reactive power (VAr) support. This approach is applicable not only to PV, but also to other renewable distributed energy resources (DER), and will help accelerate utilization of renewable energy technologies.

3.4.5 AC Power Distribution Cabinet with Lightning Protection

AC distribution cabinet is to mainly provide through the inverter to grid interface, using breaker operation, including network side lightning protection, AC voltage meter and network interfaces to transformers and other devices.

3.4.6 Cables – DC/AC

1) DC cables including: combiner box to DC lightning distribution cabinet; DC distribution cabinet to grid inverter.
2) AC cable included: grid inverter to AC distribution cabinet; AC distribution cabinet to step-up transformer; booster transformer to grid access point.

3.4.7 Step-up Transformer and Booster Station Access Point (Switchyard)

The output of the inverter will be connected to a power transformer to step up the AC output from typical voltages like 690V to transmission voltages like 33kV. The 33kV transformers will then be connected to the booster transformer from 33kV to 230kV to connect to the power grid.

3.4.8 System Monitoring, Control and Communication Devices

To achieve operational control of the power generation equipment, power failures and data collection maintenance functions, and with the grid scheduling coordination level of automation to improve plant safety and reliability, will help reduce the impact of photovoltaic power generation on the grid. In the monitoring and control system, the hierarchical distributed architecture will be used so as to provide ease of management control over the automation of the operational and precise fault identification. From the central operations building or from a remote site, the entire Plant can be monitored and controlled up to the string level, which comprises of a number of solar panels.

Solar Power Plants can use advanced inverters with monitoring, control, and management of solar electrical energy generation. The integration of advanced power management functions provides beneficial grid support such as enhanced grid stability and reliability, voltage regulation, and reactive power (VAr) support.

Plant must provide at least two communications and Teleprotection equipment, which, at all times, which can be used for communications with the Grid. Teleprotection equipment shall be capable of simultaneously transmitting and receiving signals between the line protection equipment provided at each side. The equipment shall be divided to two types. One can be used for direct and permissive transfer trip scheme. The other can be used for blocking and unblocking scheme.

3.4.9 Lightning Protection and Grounding Devices

With large areas of open space, it is important that a carefully engineered lightning protection system be designed and implemented to protect the PV plant from voltage surges as a result of lightning or other atmospheric impacts.

3.4.10 Snapshot – Generation and Distribution

- **Total Consumption:** 6.312 GWh (FY 2011)
  - Households: 42%
  - Industry: 36%
  - Commerce: 20%
  - Others: 2%
  - Yangon: 45%
  - Mandalay: 16%
  - Ney Pyi Taw: 6%
- **Peak Demand:** 1850MW
  - Two Peaks: 6-11AM, 4-10PM
  - Up to 250MW load shedding
- **Installed Capacity:** 3.495 MW
  - Hydro: 2.660MW (Grid: 2.627 / Off grid: 33)
  - Gas: 715MW
  - Coal: 120MW
  - Off grid: Diesel: 63MW / Biomass: 3.7MW
- **Voltage Level:** 230kV/132kV/66kV/33kV/11kV
- **Transmission Line:** 9.250km (163 sub stations / 8282.1 MVA)
  - 230kV: 3.015km (24 sub stations / 3990.0 MVA)
  - 132kV: 2.058km (26 sub stations / 1.783.5 MVA)
  - 66kV: 587km (133 sub stations / 2.580.6 MVA)
  - 33kV: 27km
- **Distribution Line:** 21.290km
- **Losses:** **High technical and non-technical losses (27% in 2011)**
- **Low Electrification ration:** 28.86%

4 Environmental Impacts

4.1 Overview

During the course of the ESIA, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the ESIA phase of the process.

The ESIA phase aims to achieve the following:

- Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project
- Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility
- Comparatively assess identified site layout alternatives put forward as part of the project
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts
- Undertake a fully inclusive public participation process to ensure that interested and affected parties are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits associated with all phases of the project including design, construction, and operation and decommissioning, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project. The EIA process followed for this project is described in detail below.

During the construction and installation of phase one, a complete additional ground leveling needs to be conducted at site so that the site is ready for the rapid development of phase two and phase three in due course. This will also ensure that the development of phase two and phase three will have minor localized impacts on the biophysical environment during future development.

Construction related issues associated with for example, solid wastes are to be managed effectively through recycling and controlled, environmentally safe disposition.

4.2 Site Operations

Find below some key elements relating to the current development plan of the site:

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Is there a Security of Land use Agreements?	X				Yes. The developer has secured land lease and use permits by regional and national governments for the coming 40 years.
Is the land title clearly established and undisputed?	X				Yes. The land is clearly established and undisputed in regards to this Solar Power project.
Is the land zoned for purpose?	X				Yes. The land has been zoned for the purpose of constructing a solar power facility and will require further leveling of land.
Is the land occupation not subject to litigation?	X				Yes. The land belongs to the Mandalay regional Government and the developer has been assured of the ownership and have received all approvals pertaining to land use for the coming 40 years.
Is it certain that the land not classified as heritage site or otherwise protected?	X				Yes. The designated project land is not classified as a heritage site or otherwise protected. It is a mass of land which is currently un-used and considered a non-arable dry zone.
Does the project comply with Regulations?	X				Yes. The project complies with all national Regulations and good practice standards.
Is the construction and design works carried out in accordance with approved regulations?	X				Yes. The design works and construction scheme will be carried out in accordance with all approved regulations and will follow international good practice standards.
Does the site comply with Health and Safety policy and regulations?	X				Yes. The project site complies with all Health and Safety Policies and Regulations and the developer follows both national and good practice H&S Standards

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Buildings and site works received building and planning permission?	X				Yes. The developer has received all necessary approvals and permits needed to start construction.
Is there an organization and Risk Control policy?	X				Yes. An organization and risk control policy will be established along with manuals and procedures and training for the employees and will be maintained following regulations and good practice.
Will a manager be responsible for Risk Control?	X				Yes. Following the developers good practice standards, a risk control officer must be hired to maintain and assure that all employees have been trained on a periodic basis and follow risk and control procedures.
Will an emergency planning committee be present and meet frequently?	X				Yes. An emergency planning committee will be named prior to start of construction and will involve engagement from local officials to ensure regulations are followed.
Will a fire prevention and response policy be present?	X				Yes. Site will be equipped with fire hydrants, extinguishers at high-risk locations as well as strategic locations around the project site. An Emergency Response Unit will be located nearby in case of Emergency.
Will fire prevention and response be planned and organized?	X				Yes. The developer vows to mitigate and fire risk and produce a response scheme which any and all employees will be trained in.
Will a safety code exist?	X				Yes. The developer will follow safety codes as established according to IEC rules for solar power plants. Regional officials will be consulted for their regulations.

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will additional safety measures be planned and organized?	X				Yes. Staff will be trained in operating both sites safely, first aid and CPR. Medical Clinic will be located nearby and a standby ambulance will be on standby.
Will safety representatives be designated?	X				Yes. Designated primary and Safety officers will be present at all times and designated with primary and backup representatives for each site.
Will the knowledge of first aid be disseminated widely?	X				Yes. First Aid Kits will be located throughout the project site and staff will receive regular training on first aid and emergency response with continuous periodic retraining to maintain assured safety.
Will Risk Control be included in the introduction training?	X				Yes. The developer insists the Risk Control be present and lead the introduction training.
Will Risk Control inspections be conducted regularly?	X				Yes. Inspections will occur regularly (every three (3) months) to insure that the Risk Control policy is always active.
Will operations involve physically risky situations and processes?		X			Yes, to some extent. Maintaining and Operating the Solar Power Farm is highly risk-free as long as procedures are followed in the switchyard and transformer station areas of the Solar Power facility and personal protective equipment will be administered to the qualified O&M staff. In case of emergency, a “kill switch” will be present to shut down energy project in case of severe emergency.
Will risky places be enclosed and locked?	X				Yes. Only certain qualified staff will carry the access key to any areas of risk which is guarded, which are namely the switch yards and transformer stations.

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will access to risky places regulated?	X				Yes. Only certain qualified staff will have access into risky areas on the site through a security protocol by elected security personnel stationed at the risky zone perimeter.
Will a waste management policy exist?	X				Yes. A waste management system will be implemented to the handle any waste produced by either the site of its staff.
Will any groundwater contamination from the facility be recorded?	X				Yes. Although there will be no contaminating, the ground water will be monitored in accordance with regulations and good practice standards.
Will all other specific risks (other than fire) be mitigated?	X				Yes. Any other risks are mentioned in this document along with mitigation and prevention methods
Will the facility have functioning liquid waste treatment and disposal procedures?	X				Yes. The developer commits to properly manage the function which disposes of all liquid waste and sewerage in accordance with regulations and good practice.
Will precautions be taken in case of fire risk?	X				Yes. The developer commits to take maximum preventive measures to guarantee the safety around the site in regards to the risk of fires.
Will smoking of cigarettes or otherwise be prohibited at the site?	X				Yes. Smoking will be prohibited as part of the fire preventive measures.
Will there be fire hydrants in sufficient numbers and strategic locations with working guarantee and labeled?	X				Yes. Multiple fire hydrants will be installed at particular risky areas as well as other strategic locations and regularly maintained to ensure the units are in working condition always.

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will appropriate extinguishers make and model be chosen for the type of risk the facility has?	X				Yes. Appropriate extinguishers will be places at strategic locations for easy access. Make and brand to be chosen upon site construction phase and fit this particular Solar Power facility.
Will there be enough extinguishers?	X				Yes. Sufficient number of fire extinguishers will be located in all staff buildings as well as outside on the site. Spare extinguishers and backup extinguishers will be kept in storage in accordance with regulations.
Will extinguishers be clearly labeled?	X				Yes. All label instructions on fire extinguishers will be clearly written in Burmese and English in accordance will regulations and good practice.
Will extinguishers be part of the site inventory?	X				Yes. All extinguishers will be part of the site inventory and included in the monthly inventory recordings.
Will there be a maintenance schedule for extinguishers?	X				Yes. Extinguishers will be regularly maintained and checked in accordance with regulations.
Will clean water be able to reaches all parts of the facility?	X				Yes. In order to keep the site clean and panels dust-free, mains water supply will be available throughout the site.
Will special precautions be taken into account for electrical equipment?	X				Yes. As the Solar Power facility has a large number of electrical equipment, and a few risky areas this will be prioritized by the developer.
Will the facilities have installed alarms and detection systems?	X				Yes. Fire alarm and smoke detection systems will be installed and maintained regular

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will hose reel systems be present at the facility?	X				Yes. As extensive precautions are being taken by the developer, hose reel systems will be present at all fire hydrants
Will labels on equipment be present and clear?	X				Yes. All equipment will be labeled in Burmese and in English in accordance with regulations and best practice standards.
Will there be clear directions to safety?	X				Yes. Clear directions, training, manuals and assistance will is a priority by the developer.
Will equipment be labeled in local languages, as appropriate?	X				Yes. All signs and labels will be in local Burmese and English language in accordance with regulations.
Will there be security of premises and property?	X				Yes. Dedicated security staff will be ensuring the security of the premises and property is held to the highest standard. Staff will be assigned rotationally 24 hours per day, day and night.
Will there be any form of perimeter fencing?	X				Yes. Two layers of fencing will be surrounding the site to ensure security in accordance with regulations.
Will the facility have security lighting installed for safe exercises at night?	X				Yes. To ensure full time safety, the entire facility will be illuminated if there is a need for it.
Will there be any form of access control to the facility?	X				Yes. Access to the plant will only be available for those with necessary ID´s and clearances and this control will be practiced very thoroughly by dedicated entrance security

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will the facility utilize some form of identity card usage for staff?	X				Yes. All staff members and other who wish to enter the plant must carry a granted identity card which will be checked
Will the facility keep security records?	X				Yes. To ensure security, everything and everyone going in and out will be monitored and recorded both electronically and via manual logs.
Will any vehicle at the site be maintained?	X				Yes. All vehicles that are to be used at the site as well as to and from the site will be regular maintained for safety in accordance with regulations..
Does staff driving require a licenses to drive?	X				Yes. All drivers must have the appropriate license to drive in accordance with the national law.
Will the facility have waste management procedures?	X				Yes. Any and all waste will be managed via the environmental management program.
Will vehicles fueled safely?	X				Yes. All vehicles will be fueled at proper stations outside of site in accordance with regulations.
Will the facility have adequate accidents procedures?	X				Yes. Procedures for accidents and safety monitoring will be present and be exercised in accordance with regulations and good practice standards.
Will there be an elected health and safety representative or appointee?	X				Yes. In accordance with regulations, a Health and Safety representative will be appointed by a qualified party or contractor to further ensure a safe workplace.

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will any and all accidents be recorded?	X				Yes. Any unfortunate accidents will be recorded and based on the report, mitigation methods will be applied to minimize risk of further accidents.
Will there be regular safety training conducted?	X				Yes. Regular safety training will be conducted for all staff members and continuous retraining will be conducted in accordance with good practice standards.
Will the facility offer occupational health training?	X				Yes. In accordance with regulations, regular training on occupational health will be conducted to all staff members.
Will there be preventive maintenance methods conducted?	X				Yes. Regular maintenance will be conducted in accordance with good practice standards and will assure that all equipment and tools are in good working order.
Must visitors be logged in and out or can they access as seen fit?	X				Yes. All visitors will be recorded and access can only be granted to those with legitimate access cards or invite by facility management.
Will contractors on site advised of all procedures?	X				Yes. Yes, the developer commits to ensure that all contractors will need to adhere to safety procedures established by the consulting engineer and must undergo periodic training and fire safety exercises to further ensure safety.

Issue	Yes, With no doubt	Yes, To some extent	Unsure	Negative	Comment
Will safety be promoted by written operating instructions?	X				Yes. Operating manuals will be provided for each location along with periodic training where employees will need to undertake tests to maintain their knowledge. Further, appropriate signs will be present to manage and remind of critical risks and procedures in accordance with regulations and good practice standards.

4.3 Health and Safety

Health and safety at the site must a priority in regards to the electrical components. Health and safety manuals shall be present as an addition to safety-, first aid- and CPR training that will occur in periodic cycles of three (6) months. This training is very important and therefore obligatory. Staff must be issued with personal protective equipment (PPE) as needed.

A legitimate collection of health and safety measures will ensure that necessary and sufficient medical clinics with records kept as well as pharmacies are present within the vicinity of the site, close to or in neighboring communities. Project plans also include an ambulance present at the clinic, issued with equipment such as portable defibrillators.

Some of the main health and safety details that shall be implemented can be seen in the bullets below:

- Health and Safety Manuals, in English and Burmese
- First Aid Kits
- Personal Protective Equipment (PPE)
- Fire Extinguishers, labeled in Burmese and English
- First Aid Training – Every six (6) months
- Safety Training – Every six (6) months
- CPR Training – Every six (6) months
- Portable Defibrillator at site
- Staffed Medical Facility / Clinic in the vicinity not only for the site employees but also for the surrounding communities
- Ambulance on standby ready to deploy from and to the site and surrounding communities at a moment's notice

As part of the project development, medicine/medical facilities will be constructed and Wundwin and Tharzi Township will be the hub for medical services as Wundwin and Tharzi currently has the best options of the surrounding communities surveyed and would benefit from the project refurbishing and upgrading the current health care facilities in the Township. The facility, which the project developers will renovate & upgrade providing it with basic medical content such as antibiotics, vitamins packs and necessary medicine with qualified support & training.

The contractor must provide all necessary training on safety to the staff working during the construction phases. Any personnel working with construction and maintenance work must be issued personal protective equipment such as safety gloves, helmets and other safety relating equipment to minimize the risk of accidents that can be avoided.

As projects activities of this scale and size may create situations where accidental damage to both local infrastructure and local community may occur, the contractor should therefore take all necessary precautions to enhance personal safety during construction. Various mitigation measures are listed in this document.

4.4 Environmental Issues Associated with Construction and Operation

The project activities during construction phase will involve clearing of vegetation and land leveling using heavy vehicles that may wear on local road network of the Meiktila Region and emit small quantities of greenhouse gases. During the operation phase, most of the construction phase impacts will get stabilized and the impacts will be restricted only to the operation and maintenance of the Solar Power project facility, which will only include electrical equipment.

Below are sections that aim to provide the summarized findings that relate to the construction well as operational phases of the proposed Solar Power facility at the proposed project site in the Meiktila Region where the potential impacts are discussed.

Thereafter, mitigation methods and management methods are discussed for any potential impact that may occur as a result of project implementation on the 850 acres of land.

A Complete Biodiversity study was undertaken and the results with the full report can be found attached to this document. Below are key mentionable items that surfaced during the reporting.

Topography

Before construction can commence, the topographic layout will be altered as the proposed site will have to be fully leveled to prepare for phase two and phase three.

There are no topographical changes envisaged during the operation phase of the facility. The existing access routes must be widened in order to be utilized safely during construction as well as the operation and maintenance of the facility.

Climate

Impact on the climate conditions from the proposed project both during the construction and operation phases will not be significant, as no greenhouse gases or other possible climate altering emissions will be produced. Solar Power facilities are the number one choice of energy in cities and suburbs as a result of its "zero-emission" effect, thus effect on climate is not considered an issue for this project.

Air Quality

The construction activities during the initial phases will involve land leveling, movement of transportation vehicles carrying the construction materials and solar panels along local road networks. Rise of emission of dust particles will thereby affect the air quality marginally at the site during construction phases. The project will have a positive effect in regards to emissions once operational stages commence. Based on the project's target annual output of 468,000,000 kWh, there will be an estimated reduction of 327,600 tons in CO2 emissions annually. Over a 30-year period, a total of 9,828,000 tons of CO2 emissions will be reduced.

"*Reduction of* CO_2 emissions per 1 kWh of solar power = 0.7 kg of CO_2"

Noise

The major sources of noise pollution during the construction phases in Meiktila District close to Wundwin are the movement of transportation vehicles transporting the equipment and construction material to the project site. Most of the access roads along the sites are fit for motor vehicles. And much of the work will be carried out in the daytime throughout the construction phase. There will be a very limited presence of noise population being exposed to additional noise generated as a result of the construction phases due to the site not being located within the immediate perimeter of any of the surrounding communities. Various mitigation measures to keep noise and vibration to a minimum are listed in this document.

Sub and Surface Water Quality

The construction and operation of the Solar Power facility will not have any greater impacts on surface and ground water quality in the area. There is no risk of contamination of water bodies as a result of construction materials as there are no nearby water bodies in the immediate perimeter of the construction site and no chemicals or oils are used during construction.

Provision of adequate washing and toilet facilities at the project site shall be made obligatory and managed properly by the EPC Contractor and overviewed by the Developer. This will form an integral component in the planning stage before commencement of construction activity at the Wundwin Project Site.

Soil and Geology

Project activities include land leveling, removal of vegetation and the construction. Removal of vegetation will reduce the infiltration rate of rainwater and the excavation activity and land clearance is not expected to cause any significant soil erosion. The soil can best be described as reddish, sandy soil with little agricultural purpose.

Ecological Resources

There are no declared environmentally sensitive areas located within the proposed project areas. No creatures, whether mammal, reptile, or amphibian species around the proposed project site was identified to be of conservational concern. Should there be any unidentified creatures detected during construction, they are most likely to inhabit nearby habitats during the operational phase. The construction of this solar power plant is highly unlikely to have any impact of significance on the fauna.

Direct impacts on vegetation will occur during construction phase and there may be indirect impacts during the operational phase. Direct loss of vegetation will be a result of the land leveling which is not expected to be of any significance.

Although no endangered plant has been identified on the proposed project location that may become subject to habitat loss, any vegetation is vulnerable to construction related activities.

However, any possible ecological impacts are described below and for more details, please view the biodiversity report attached.

Flora and Fauna

The proposed site is not aligned with any forest or plantation areas. As there will be no removal of trees, only removal certain amounts of ground vegetation and bushes, it is not expected that any flora or fauna of rare, endangered, endemic or otherwise threatened origin will be affected as a result of project implementation. Only migratory paths of small mammas and reptiles may be affected during the period of construction but not during operations, as there are plenty of room for smaller species of mammal and reptile. However, noise and emission from vehicles carrying equipment and heavy construction vehicles will occur during pre-construction and construction phases temporarily. Overall, the impacts related to the construction and operations are of temporary nature and any possible mitigation measures are listed in this document.

Avifauna has also been taken into consideration as bird communities may be negatively affected due to habitat loss and disturbance as a result of construction related activities. However, the loss of habitat and disturbance is unlikely to have any significantly negative impact on bird communities in the area as bird species are generally able to adapt with most projects of this specific kind which may cause disturbance, mainly during construction activities. It is determined that the extent of the impact will be local as the construction activities are limited to the proposed project perimeter. Any loss of habitat would occur during the initial construction phase and be highly confined within the project perimeter.

There are five bird species, which are considered endemic in Myanmar. However, none of which have been identified on the proposed project site. The endemic species of bird include:

- Crypsirina cucullata (Corvidae) ***Hooded Treepie***
- Mirafra microptera (Alaudidae) ***Burmese Bushlark***
- Turdoides gularis (Timaliidae) ***White-throated Babbler***
- Sitta victoriae (Sittidae) ***White-browed Nuthatch***
- Jabouilleia naungmungensis (Timaliidae) ***Naung Mung Scimitar-babbler***

The detailed Biodiversity Study on Flora and Fauna can be viewed in the attached Biodiversity Report.

Local Road Network

Equipment such as transformers, steel bars, concrete materials, solar panels and other equipment will be transported to the project site via the local road networks.

There is one (1) identified bridge with insufficient carrying capacity for heavy vehicles carrying equipment and materials and must therefore, be reconstructed and should be reconstructed as part of the developing party's corporate social responsibility strategy.

Although heavy traffic is frequently traveling the local road networks around the proposed project site, caution should be taken to minimize any physical damages. The contractor should therefor in addition to the above, properly maintain all road sections that are being utilized for the construction activities.

Disposal of Debris

Debris will be generated during the construction phase of project implementation. Improper disposal of such debris would have a negative impact on the surround ecology and public health. In order to prevent any contamination, proper disposal procedures regarding any and all debris must be implemented by the EPC Contractor and the Developer should overview to ensure construction follows regulation and good practice standards.

Wildlife

No identified wildlife travel routes or mating areas are associated with or considered to be negatively affected by the project implementation and no mammal, reptile, or amphibian species of conservation concern are likely to occur in available habitats in the proposed location area and do therefor not require mitigation. Further, the full and extensive Biodiversity Study (also known as Flora and Fauna Assessment) can be found under Appendix 10.

Aquatic Ecology

The project implementation does not impact any aquatic ecology and is not envisioned to pollute or disturb any aquatic fauna of the area as there are no aquatic sources near or within the site perimeter.

Agriculture

There is not expected to be any permanent or temporary loss of agricultural land as a result of project implementation. There will be no land acquisition of farmed land and any other agricultural land will be avoided during the project implementation. The land selected is government owned and not cultivated. Most of the study area comprises of reddish, sandy soils, many of which are shallow to very shallow with only a limited portion of deep soils. The is considered to be among the driest in the country resulting in that the only means of cultivation would be by irrigation and aerial images show no signs of any agricultural infrastructure and none of irrigation. The climatic restrictions mean that this part of the land designated for the project is suited, at best for grazing and here the grazing capacity is very low as it is mostly barren land.

Socio-Economics

Construction of project will generate local employment, as a number of unskilled labor will be required at the time of construction, a significant amount of good jobs is expected to be created.

Local employment during this period will increase socio-economic standards for the surrounding communities and professions within services and trade is typically the main beneficiary

According to The Foreign Investment Law, Pyidaungsu Htluttaw Law, Dated, 2 November 2012 number (24A) and associated regulations regarding employment the first 2 years states that the Developer shall employ at least 25% local employees. This is followed by the following 2 years shall have a 50% local employment ratio. From 4 years and beyond, the project facility shall have 75% local employment. This is the Developers responsibility from first day of operations. Any law and responsibility pertaining to the construction phase lies with the EPC Contractor to ensure.

The Developer already has local employees and is committing to following the laws and regulations of The Foreign Investment Law regarding this Solar Power project / facility.

Temporary Outage of the Electricity

No temporary power outage is expected to occur and measures are to be taken to ensure safe and stable connection while construction commence.

Involuntary Resettlement

As the project does not intend to acquire any land that is currently being used on or near the project site, no involuntary or voluntary resettlement will be necessary.

Cultural Sites

There are no sites such as monasteries, pagodas or other structures of significant cultural or historical value located within or close to the perimeter of the proposed project sites.

Sparse population and limited evidence of historic human activities such as colonial times would suggest any likeliness to be any significant current heritage values associated with the proposed project location.

All and any pagodas and monasteries of significant historical values are listed in this document, sectioned after the relevant communities that have been surveyed.

Traffic and Transport

The traffic disturbance caused by logistics in the form of heavy vehicles transporting construction materials and equipment must be minimized. Utilizing traffic signs, ensuring safe access roads and avoiding very dense areas can minimize greater traffic disturbance and help prevent any disturbance with existing other utilities.

Solid Waste Disposal

Any solid waste that is generated within the project site, including all types of scrap metal, all types of packaging material, all types of waste from construction workers, all types of scrap produced as a result of maintenance will be collected and disposed of in an environmentally safe way that complies with rules and regulations.

In Myanmar there is no greater established waste management. What currently exists is undertaken primarily by the public sector. Solid waste is managed through the operation of landfills (or dumpsites) or burnt at or close to site.

Sanitary Waste Disposal at Construction Sites

Any housing for staff that may be implemented during construction phases will be temporary and any human waste produced is not expected to be significant or risk causing contamination in the ground water. In order to avoid any risk of water pollution, adequate drinking water facilities, toilet facilities and sanitary facilities along with drainage from any temporary housing will be obligatory and provided as the construction phase commences. In order to prevent any and all pollution and contamination of nature or general public health, a properly managed solid waste management procedure shall be in place during construction phases, reducing any possibilities of infection by water borne diseases or parasitic infections.

Liquid Waste Disposal

Limited risk for spilling of fuel from construction vehicles are foreseen but is not estimated to be of any significance.

As the operational phase will not require the use of either chemicals or oils, no risk is foreseen and therefor no mitigation methods are required.

Electric Shock

In order to minimize the risk of electric shock, security fencing around the project site will be implemented early on during pre-construction along with clear warning signs and the utilization of appropriate technologies to minimize any possible electric hazard.

Visual Impact

The components associated with the proposed solar power project will have a visual impact and, as such, impact on the landscape and rural sense of the area. Therefore, care needs to be taken to ensure that the development of a large renewable energy project such as this will not be an impact on visual character and sense of the landscape. Based on the observations during the site visits the visual impacts associated with the proposed solar power project are likely to be low.

5 Social Study

5.1 Objective

This social impact assessment (SIA) has been conducted in order to identify any communities affected as a result of the development of the Solar Power Project in Meiktila. The potential direct and indirect impacts on the local communities have been outlined with appropriate monitoring and mitigation measures. Heavy focus has been allocated to survey the communities closest to the project site.

The goal of this SIA is to provide mitigation measures and minimize identified social risks and vulnerabilities to enhance the opportunities and benefits of the project. It will act as an additional framework to integrate into the consultation process and social analysis into the operational framework.

5.2 Methodology

The ESIA is a collection of studies, which involves several activities from significant research, and reconnaissance of the sites and surrounding areas to further research to identify the zone of influence of the project as well as the nation. Surveys and interviews of the nearest townships, Meiktila, Wundwin and Thazi with their representative government officials were conducted on the 9th and 10th of November, 2014.

5.2.1 Key Informant´s Interview

This activity was conducted with semi-structured questionnaires to institutional stakeholders, NGOs and government ministries to gather their views and solicit recommendations to improve project planning. This exercise is useful to building initial awareness of the project and its objectives in developing local counterpart responsibility.

5.2.2 Focus Group Discussions

Focus group sessions are useful to understand the needs and in order to build or add something based on local needs. Parts of the focus group discussions are the interviews with community officials from the three (3) most immediate Townships.

5.2.3 Socioeconomic Survey of Households and General Population

Using the guidance of the Framework of the Group of Rural Development, a socioeconomic survey was administered with the goal of getting a clear assessment of the living conditions of the households within the communities closest to the project site. The various administrative leaders of the communities were interviewed and were able to provide information, which highlighted the socioeconomics, gender dimensions, ethnicity, religions, perceptions of the project and possible issues as a result of the project and more.

The information collected will serve as ground on which to stand on to get an accurate assessment of the living standards and poverty incidence and how the project implementation can help benefit the affected community.

Two categories of households have been taken into account, households connected to a power supply, (HHC) and households not connection to a power supply (HHN). The survey is useful to gain an understanding on the living condition of households, both HHC and HHN where electric power supply plays an important role in the economy.

There is no anticipated displacement of households, loss of land or productive assets as a result of project implementation. The nearby towns and villages will not be directly affected with land lease or involuntary resettlement. Ministry of Electric Power states that current supply is only about half of projected demand, and demand is growing 1.5 to 2 times as fast as GDP –real GDP growth is now projected at 6-7% a year.

5.2.4 Stakeholders Participation

As it is considered an important part of the project planning process of the Solar Power Project, a stakeholder's consultation was undertaken in 2015 to make sure that all involved stakeholders are informed of the planning which would enable stakeholders to assess any impacts and risks associated with project implementation. It is also important that the stakeholders and other involved parties have a clear view of their responsibilities during the complete phase cycle of the proposed project.

5.3 Social Context of the Townships consulted and surveyed

Information based on the data from the Framework of Rural Development Group, dated 1st of March 2014 is found below and acts as a socioeconomic overview of the districts of Meiktila and Myingyan.

Figure 12: Myingyan District and Meiktila District

Households		Population		Poor Population		Poverty Incidence	
Myingyan	Meiktila	Myingyan	Meiktila	Myingyan	Meiktila	Myingyan	Meiktila
199157	159824	1111596	915616	455754	412027	41%	45%
Total = 358981		**Total = 2027212**		**Total = 867781**			

Source: Group of Rural Development (2014)

Meiktila District comprises of 915,616 inhabitants from 199,157 households. A staggering number of 45% of the population of Meiktila are considered to be among the country's poorest.

Community and household data such gender dimensions, income and expenditures and sanitary facilities of the surrounding townships of the project development site based on interviews of administrative offices in Meiktila Township, Wundwin Township and Thazi Township can be found below. Meiktila District is very agriculturally orientated and produces the vast majority of the townships economic stimulation through farming and agriculture. However, the economic resources of Meiktila district are more diverse than the neighboring Myingyan district.

5.3.1 Meiktila Township

U Lin Kyaw Swar– Villager, U Htay Sein – Villager and Daw Kyawt Hkine - Villager

U Lin, U Htay and Daw Kyawt provided the additional necessary information pertaining to Economic Resources, Living Standard data, Sanitary conditions data, Source of water data, Education data, Community infrastructure data, Historical and Cultural site data of Meiktila Township and surrounding areas.

The township of Meiktila has the most recent history of violence of all the townships and villages surveyed. On March 22, 2013, a state of emergency was imposed in the township after dozens of people were killed and more than 12,000 were forced from their homes, the overwhelming majority of whom were Muslims, due to Buddhist mob violence. Because of its strategic position in the center of Myanmar, Meiktila is home to Myanmar Air Force's central command and Meiktila Air Force Base. Myanmar's main aerospace engineering university, Myanmar Aerospace Engineering University is also located in Meiktila.

The township is fairly sizeable with its 301,242 citizens inhabiting 57,090 households and the township is located on the banks of Lake Meiktila. In terms of gender dimensions, 130,230 of the citizens are male and 171,012 are female with an average of 5–7 members per household. It is considered that, as with all townships surveyed, that all households' members of all ages and genders participate in household as well economic activities. As a result of the Buddhist mob violence in 2013, it is considered that 100% of the citizens are of Burmese ethnic origin and practice Buddhism.

Figure 13: Economic Resources Meiktila Township

Economic sources	Percent (%)
1.Agriculture	67%
2. Services	9%
3.Industries	6%
4. Construction	2%
5. Livestock/fishery	3%
6. Electrical	1%
7. Forestry	1%
8. Other	11%

Source: Meiktila Administrational Office

The economic resources of Meiktila Township are diverse. Though agriculture accounts for approximately 67% of the economic resources, many other resources such as services (hotels, restaurants, car rentals) accounts for 9% industries (primarily tea production) represents 6% and construction at 2% are all present which are not typically seen within the Mandalay Region.. The main products harvested are peas, rice and other vegetables. The other (11%) account for services such as housekeeping and other employed, wage-earning staff.

The township citizens' main source of income is predominately through farming (70%) vegetables, peas, rice, nuts and beans. Secondly trade (12%) accounts for the second largest source of income and the products traded. The majority of which are the farmed products. Other sources of income are wage earning (6%), animal husbandry (5%) and other (4%) which account for small business and workshops.

Income and Expenditures

As with the economic resources, the estimated income of the citizens of Meiktila varies showing both severe poverty but also groups of citizens that do very well in terms of monthly income. The majority of the citizens make less than 200,000 kyats per month. A stunning 35% below 80,000 kyats, 25% make 80,000-120,000 kyats and 20% make approximately 121,000-160,000 kyats per month. However, the remaining citizens make between 220,000 - 400,000 kyats per month, which shows that the economy is growing compared to many other townships in the region which may be a result of the relatively high amount of households and businesses that have access to electricity (50%).

Figure 14: Estimated Income

Estimated Income	Percent (%)
80,000	35%
80,000 – 120,000	25%
120,000 – 160,000	20%
220,000 – 240,000	8%
240,000 – 280,000	6%
280,000 – 320,000	4%
320,000 – 400,000	2%

Source: Meiktila Administrational Office

As with the estimated income, the numbers for the estimated expenditures are strikingly similar. In Meiktila, the citizens can afford to spend more money towards food and entertainment than other surrounding communities. There are for example a number of cinemas and other arcade-like entertainment complexes. However, the majorities still spend less than 200,000 kyats per month and primarily the expenditures go towards the family in terms of food and other products to be able to exponentially enhance their living standard.

Figure 15: Estimated Expenditures

Estimated Expenditures	Percent (%)
80,000	35%
80,000 – 120,000	25%
120,000 – 160,000	20%
220,000 – 240,000	8%
240,000 – 280,000	6%
280,000 – 320,000	4%
320,000 – 400,000	2%

Source: Meiktila Administrational Office

Living Standard

The living standard of Meiktila Township is considered to be higher than the surrounding communities. Approximately 50% have access to electricity and small businesses such as tours, car rentals and other services seem to flourish more here than other communities and the living standard is generally higher for households with connection than households without connection. The Township has a working infrastructure with a sufficient amount of streetlights, although outdated ones.

Sanitary Conditions

In terms of sanitary facilities and toiletries, 20% of the private households have access to separate flush toilets while the majority, 70% have access to pour flush toilets and the remaining 5% account for pour flush toilets in hotels and other hospitality businesses. The sewerage system in Meiktila seems to function but like most areas in Mandalay it is also in need of modernization.

Source of Water

While the majority (40%) of the citizens acquire their water from sources such as filtered rainwater, a large percentage (30%) acquire their water from sources such as Lake Meiktila which is off towards the west side of Meiktila Township. Unfortunately, much of the townships garbage is currently seeping into the lake due to poor garbage management. The mismanagement of the townships garbage may lead to further contamination and eventually be hazardous to the general population even though the water is generally treated filtered or purified before consumption. However, 15% of the citizens have access to drill well pumps and 10% utilize hand-dug wells.

Figure 16: Source of Water

Source of Water	Percent (%)
1.Drill well pumps	15%
2. Hand dug wells	10%
3.Filtered spring water	0%
4. Well from neighbor	0%
5. Filtered Rainwater	40%
6. River / Lake Water	30%
7. Other	5%

Source: Meiktila Administrational Office

Education

In Meiktila Township there are a total of 259 schools. Of the 259 schools, 137 are primary schools, 14 are medium schools and 8 are high schools, which goes to show that the majority of the students find job opportunities before reaching either medium or high school. However, 98% of the citizens attend at least one level of education.

There are also one college (Meiktila Education College) and five universities in Meiktila, which include:

- Meiktila University
- Meiktila University of Economics
- Meiktila University of Technology
- Meiktila University of Computer Science
- Myanmar Aerospace and Engineering University

Community Infrastructure Facilities

Road – Conditions are above average compared to the other communities in the region. The roads are relatively well maintained and suitable for heavy transport vehicles, which is a frequent sight in the Township. Meiktila connects both the trans-country railway as well as acts as a junction for the Bagan-Taunggyi, Yangon-Mandalay and Meiktila-Myingyan highways

Drainage – The township of Meiktila structures its drainage system to funnel heavy rain water into the nearby Lake Meiktila and flooding is not as common in Meiktila as it is in other nearby communities.

Garbage collection – The current garbage management plan comes in the form of being driven out of town, dumped and burnt. Unfortunately, garbage on the streets and alleyways of the township is a frequent sight and rats are flourishing in the streets. There is a predominant risk of endangering the health of the general population with the amount of garbage that end up in Lake Meiktila as the lake serves as a source of water for many of the townships citizens.

Electricity – Approximately 50% of the township has access to electricity which is a higher number than many townships in the region. The administrational office of expresses great need for more and stable sources of power to satisfy the growing community as there are very good potential in the township to establish more businesses surrounding tourism for example.

Non-Governmental Organizations (NGO)

Ever since the incident of 2013, a fair number of NGO´s have rushed to aid Meiktila, among which are the following:

1) PEP Myanmar – Focus on micro finance for businesses
2) AMDA, Asian Medical Doctors Association
3) Save the Children – Which aims to prevent children from health and social problems. Save also recently assisted in opening a pre-school.
4) Action Aid – Who's goal is to enhance public health
5) PSI Myanmar – Who, similarly to Action aid, assists to enhance public health

Sites of historically and/or cultural importance

Within and surrounding Meiktila, there are a total of 1,088 Pagodas and 444 Monasteries. Of these, 9 are of high cultural and historical value, which include:

1) Pae Thida Ordinance Hall
2) Kat Htu Kan Ordinance Hall
3) Wat Kyauk Ordinance Hall
4) Shin Pin Ku Ordinance Hall
5) Thar Phan Ordinance Hall
6) Ka Lain Chae Ordinance Hall
7) Ku Phyu Ordinance Hall
8) Kun Taun Ordinance Hall
9) Htee Thoun Sint Ordinance Hall

The Bagan King, A Naw Ra Hta built all of the above and commenced the construction of the foundation for all nine ordinance halls on the same day. Lake Meiktila acts as the centrum for these nine ordinance halls, four are located north of the lake, one is located east side of the lake and the remaining four are located lower west side of the lake.

None of the pagodas, monasteries or any other structures or sites of historical or cultural importance are located within or near the perimeter of the project site.

5.3.2 Wundwin Township

Daw Yi Yi Swe – Villager, U Aung Hlaing Oo – Villager and Daw Myint Kyi - Villager

Daw Yi Yi U Aung and Daw Myint provided the additional necessary information pertaining to Economic Resources, Living Standard data, Sanitary conditions data, Source of water data, Education data, Community infrastructure data, Historical and Cultural site data of Wundwin Township and surrounding areas.

The township of Wundwin is located north of the project site. Wundwin is a sizeable township with a total of 228,431 citizens inhabiting 51,578 households. As with all the townships and villages surveyed, there are marginally less male than female citizens in the township. The male population account for 107,634 of the citizens while female population accounts for 120,797. It is considered that all household members of both genders and all ages participate in both household as well as economic activities. The Wundwin Administrative Office declared that there are only citizens of Burmese ethnicity, all of whom practice Buddhism.

Figure 17: Economic Resources

Economic resources	Percent (%)
1.Agriculture	60%
2. Services	0%
3.Industries	30%
4. Construction	0%
5. Livestock/fishery	3%
6. Electrical	0%
7. Forestry	0%
8. Other	7%

Source: Wundwin Administrative Office

The main economic resource of Wundwin Township is, as with many of the surrounding communities, agriculture (60%) where the most harvested products are rice and peas. Secondly, industries such as large-scale production of sugar cane or rubber wood account for 30% of the economic resources. Other economic resources include livestock (3%) such as cows and goats as well as other services (7%) such as car rentals, shops, cooking and housekeeping staff.

The main sources of income in the Township of Wundwin include farming and fishing (70%), animal husbandry (27%), wage-earners (3%) such as housekeeping and other staffing services. There are also a small amount of citizens living on subsidies or pensions (1%). As with the majority of communities within the Mandalay Region, agriculture is still the dominant economic source.

Income and Expenditures

In terms of monthly income, the majority (70%) of the citizens of Wundwin have an average income of 80,000-120,000 kyats per month, which is considered average in the region. Secondly, there is a group of 15% that have an estimated monthly income of 80,000 kyats or below which is considered very low. About 10% account for citizens earning an estimated 120,000-160,000 kyats per month while a mere 5% have a higher monthly income, 220,000-240,000 kyats which shows that there is a smaller amount of citizens that are considered to earn above average compared to surrounding communities. It is believed by the Wundwin Administrative Office that the lack of electricity is has direct effect on the economy as the township is only electrified to 15%.

Figure 18: Estimated Income

Estimated Income	Percent (%)
80,000	15%
80,000 – 120,000	70%
120,000 – 160,000	10%
220,000 – 240,000	5%
240,000 – 280,000	0%
280,000 – 320,000	0%
320,000 – 400,000	0%

Source: Wundwin Administrational Office

It is estimated that all the products produced are sold locally, whether it is agricultural products or industries as an approximate 100% of the citizens spend 80,000 kyats or less, which would result in a lower cost for said products.

Figure 19: Estimated Expenditures

Estimated Expenditures	Percent (%)
80,000	35%
80,000 – 120,000	25%
120,000 – 160,000	20%
220,000 – 240,000	8%
240,000 – 280,000	6%
280,000 – 320,000	4%
320,000 – 400,000	2%

Source: Wundwin Administrational Office

Living Standard

The general standard of living in the township of Wundwin is considered average by Burmese standards, while the standards of households are considered above average even with the low percentage of electrification in the township. As with all other townships surveyed, the standard of living is generally higher among the HHC as opposed to the HHN. The township does have a working infrastructure in terms of streetlights and road signals.

Sanitary Conditions

In terms of sanitary facilities and toiletries, 100% of the township has access to pour flush toilets and a working, but outdated sewerage system and the administrative office express the intent of developing the sewerage system further in the near future.

Source of Water

It is considered that 100% of the citizens of Wundwin have access to drill well pumps as a result of past investments by the local government ensuring a safer source of water for the citizens. The administrative office also expressed the need for the installation of water pipes to and from a currently unavailable source of water on the edge of the township.

Figure 20: Source of Water

Source of Water	Percent (%)
1.Drill well pumps	100%
2. Hand dug wells	0%
3.Filtered spring water	0%
4. Well from neighbor	0%
5. Filtered Rainwater	0%
6. River / Lake Water	0%
7. Other	0%

Source: Wundwin Administrative Office

Education

There are a total of 466 schools in Wundwin with an estimated student attendance of 86%. There are 89 primary schools, 29 medium schools and 13 high schools. Student attendance drops dramatically between primary school and high schools just as it does with the other communities surveyed.

Community Infrastructure Facilities

Road – The conditions of the local road network is considered to be average by Burmese standards. However, there are currently large areas of the road network that lack good roads or street infrastructure and the local government clearly express the need to fill this gap with new streets.

Drainage – The township of Wundwin does not have to rely as heavily on heavy rain drainage as many other communities in the region as Wundwin is located in one of the driest geographical areas. The community does however have a functioning drainage system.

Garbage collection – As the majority of the townships surveyed, Wundwin Township does not have an organized garbage disposal plan more than occasionally collecting the garbage, driving it out of town where it is then dumped and burnt on site. The trash is often dumped and burnt on the perimeter or within the proposed project site and there is clear evidence of garbage scattered around the site.

Electricity – Only a mere 15% of the township is electrified which leaves a lot to be expected from the proposed solar power project. The administrational office expresses great support as the lack of electricity is prohibiting the township from more rapid economic growth. A more stable supply of electric power would be of great benefit to Wundwin Township and its future businesses.

Non-Governmental Organizations (NGO)

There are currently no NGO´s active in Wundwin Township. However, two NGO´ are expected to start various processes in Wundwin this year. Among which are SVS, Social Vision Services Association, which aims to enhance communities' development in social knowledge. The second NGO is PEP Myanmar whose goal is to increase the power of woman in Myanmar.

Sites of historically and/or cultural importance

There are a total of 585 Pagodas and 323 Monasteries in and around Wundwin, 9 of which are considered to be of higher cultural value. The first 3 more valuable pagodas are located in the center of Wundwin while the remaining 6 are located west of the township.

None of the pagodas, monasteries or any other structures or sites of historical or cultural importance are located within or near the perimeter of the project site.

5.3.3 Thazi Township

U Kyaw Win – Villager, U Hla Myint – Villager and Daw Thein Kyi – Villager

U Kyaw, U Hla Myint and Daw Thein provided the additional necessary information pertaining to Economic Resources, Living Standard data, Sanitary conditions data, Source of water data, Education data, Community infrastructure data, Historical and Cultural site data of Thazi Township and surrounding areas.

The township of Thazi is located south of the project site and is slightly smaller than Wundwin in terms of population with 191,695 citizens in 39,363 households with an average of 5-7 members per household. Approximately 90,776 of which are male and 100,919 are female. Just as with the majority of the households surveyed, the township is slightly female dominated. Just as with Wundwin, it is considered that all household members of all ages participate in both household and economic activities. Also similarly like Wundwin, it is considered that all citizens are of Burmese ethnicity and practice Buddhism.

Thazi is one of the townships surveyed that are doing better by Burmese standards. Streets are on average tidy and infrastructure is organized and laws are upheld.

Figure 21: Economic Resources

Economic resources	Percent (%)
1.Agriculture	80%
2. Services	5%
3.Industries	5%
4. Construction	0%
5. Livestock/fishery	3%
6. Electrical	0%
7. Forestry	2%
8. Other	5%

Source: Thazi Administrative Office

The main economic resource of Thazi Township is corresponding with many of the surrounding communities as agriculture account for 80% and the most harvested products are rice and other vegetables. Secondly, services (5%) such as car rental and tours and thirdly, industries account for approximately 5% of the economic resources.

Other economic resources include livestock (3%) such as mainly cows and chickens. There is also a small percentage (2%) which account for forestry in the township,

The main sources of income in the township are by far farming which accounts for 75% of all citizens' economic income. Only 3% account for animal husbandry, 5% account for trade in vegetables and rice, 5% are considered to be wage earners and 10% account for small businesses such as workshops and stores. There is also a small presence of citizens living of pension or subsidies (2%).

Income and Expenditures

In terms of monthly income, the majority (65%) of the citizens of Thazi have an average income of 80,000 kyats of below per month, which is considered very low as the percentage is so high. Secondly, 20% of the citizens are considered to have an estimated monthly income of 80,000-120,000 kyats. Only 6% have an average monthly income of 120,000-160,000 kyats, 3% have monthly income of 220,000-240,000 kyats, 3 % have a monthly income of 240,000-280,000 kyats, 3% have a monthly income of 280,000-320,000 kyats and only a mere 2% have an estimated monthly income of 320,000-400,000 kyats.

Figure 22: Estimated Income

Estimated Income	Percent (%)
80,000	65%
80,000 – 120,000	20%
120,000 – 160,000	5%
220,000 – 240,000	3%
240,000 – 280,000	2%
280,000 – 320,000	3%
320,000 – 400,000	2%

Source: Thazi Administrational Office

The majority (75%) of the citizens of Thazi spend approximately 80,000 kyats or less on a monthly basis, which shows that, most of the products bought are produced locally as a result of the high percentage of agriculture in the township. Only 10% have estimated expenditures of 80,000-120,000 kyats per month while the remaining 15% have higher expenditures.

Figure 23: Estimated Expenditures

Estimated Expenditure	Percent (%)
80,000	75%
80,000 – 120,000	10%
120,000 – 160,000	6%
220,000 – 240,000	3%
240,000 – 280,000	2%
280,000 – 320,000	2%
320,000 – 400,000	2%

Source: Thazi Administrational Office

Living Standard

The general standard of living in the township is considered average to better by Burmese standards. The average household is well maintained in Thazi and the township definitely has cleaner streets and better local infrastructure than the other communities that have been surveyed.

As with all other townships surveyed, the standard of living is generally higher among the HHC as opposed to the HHN.

Sanitary Conditions

In terms of sanitary facilities and toiletries, 98% of the township has access to pour flush toilets and a working, but outdated sewerage system. Only a mere 2% have access to regular flush toilets.

Source of Water

Approximately 90% of the Thazi citizens have access to drill well pumps while 5% have access to hand dug wells. However, there are still 3% that utilize rainwater as their main water source. It is considered that 2% of the citizens acquire their water supply by means of water tanks or large liter bottles.

Figure 24: Source of Water

Source of Water	Percent (%)
1.Drill well pumps	90%
2. Hand dug wells	5%
3.Filtered spring water	0%
4. Well from neighbor	0%
5. Filtered Rainwater	3%
6. River / Lake Water	0%
7. Other	2%

Source: Thazi Administrative Office

Education

There are a total of 192 schools in Thazi with an estimated student attendance of 98%, which is higher compared to neighboring communities. Of the total 192 schools, 182 are primary schools with approximately 17,593 students, 8 are medium schools with approximately 5,647 students and 6 are high schools with approximately 7,746 students. Similarly to Wundwin, school attendance drop dramatically between primary school and high school, this is considered to be a result of students finding job opportunities in manual labor early on.

Community Infrastructure Facilities

Road – The conditions of the local road network is considered to be above average by Burmese standards. The local road network is well maintained and cleaner than many other townships. Heavy vehicles have no problem traveling through Thazi safely.

Drainage – Similarly to the township of Wundwin, Thazi Township does not have to rely as heavily on heavy rain drainage as many other communities in the region as both townships are located in one of the driest geographical areas.

Garbage collection – Thazi does have a more organized system to collect garbage in terms of planned garbage management. However, the method of disposal is the same; it is taken out of town, dumped and burnt away from the community. As with the garbage situation in Wundwin the garbage is often dumped and burnt on the perimeter or within the proposed project site and there is clear evidence of garbage scattered around the site.

Electricity – 18.47% of Thazi Township is electrified and the Thazi Administrative Office express
a great need for further development and grid connection.

Non-Governmental Organizations (NGO)

Two NGO´s are active in Thazi. Local Women's Care Society and the local Red Cross Society which both aim at health care as well as population and family planning.

Sites of historically and/or cultural importance

There are a total of 367 Pagodas and 303 Monasteries in and around Thazi. Among these pagodas are two that are of greater cultural importance. Shwe Gu Gyi Pagoda which is located south of Thazi and Shwe Yin Mwe Pagoda which is located west of Thazi.

None of the pagodas, monasteries or any other structures or sites of historical or cultural importance are located within or near the perimeter of the project site.

Communities' view of the Project

The common belief among the HHC as well as the HHN and the administrative office of the surveyed and interviewed communities of Meiktila Township, Wundwin Township and Thazi Township is that the additional supply of stable electric power would be very beneficial for all involved.

The communities also express sympathy towards each other as well as show great support and wishes to be able to do more business and grow as communities together, according to U Myint Htay, the Senior Staff Officer at the administrative office of Meiktila.

The chairman of Wundwin government, U Myo Min Naing express community needs in the following order:

Stable flow of electricity

1. Water pipe system for a currently unavailable water source
2. Renovation and extension of local road network
3. Renovation and upgrade of the current hospital

The second chairman of Thazi government, U Myo Thet Kyaw express community needs in the following order:

1. Stable flow of electricity
2. A new equipped hospital or medical office
3. Expanded water irrigation systems to community farms

5.4 Perceived Benefits and Impacts

Positive Impact

The Solar Power project activities, equipment, and infrastructure is anticipated to bring benefits to the local communities including employment, services, and opportunities for economic development.

The availability of a stable supply of electric power is clearly the most anticipated benefit among the community as the lack of stable energy often affects businesses directly as well as makes it difficult for healthcare facilities to function adequately. The increase of local job opportunities that may arise as a result of project implementation is expected to be highly beneficial. Temporary job opportunities are expected to be created alongside construction related activities that may be fit for less skilled labor workers. Service provides and traders may attract substantial business from construction workers.

The operational phase of the project may also provide long-term job opportunities within service and trade, which is highly anticipated by the community. An increase in trade and relating industries is anticipated along with rural improvements such as this Solar Power Project that, in most common cases, are related to the presence of a stable electric power supply. Significant benefits as a result of this project are:

- Producing clean energy contributes to lowering electricity generation costs compared to the current costs associated with liquid and fossil fuels and thus leads to a decrease in the Government of Myanmar's fiscal deficit;
- The clean energy produced from renewable energy resources such as this Solar Power project is expected to reduce consumption of alternative fossil fuels for electricity generation the country and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions; and
- This project is expected during the construction and operation phase to generate local employment and commit to other social responsibilities. As such, this is expected, to a certain extent, to subsequently enhance the socio-economic conditions and standards of living of the local communities.

Specific to this Solar Power project, it is highly important to highlight the substantial positive economic and environmental impacts which are a result the Project development activities, against the negative environment impacts anticipated at the site specific level in which this ESIA concludes to be of low significance in nature and can be adequately mitigated.

Myanmar is currently relying on the deficit in power supply which brings with it significant economic burdens to the economy, both local and national and the industry and economy of Myanmar will benefit significantly from this Solar Power Project through its substantial addition of power.

The developer's information which was provided, predicts that this Solar Power project will produce approximately 500 job opportunities during the total duration of the construction phase. This will not only include mechanical, electrical engineers and technicians but unskilled labour as well.

During the operational phase of the project, it is predicted that around 25-35 job opportunities will arise which may include plant various management roles, controlling engineers, administrators, technicians and unskilled labor such as cleaners, canteen personnel and security personnel for the total life duration of the Solar Power plant being up to 25 years.

Additionally, it is clear that any produced HSE and Labour policies for the construction and operation phase must be in line with the IFC Performance Standard (PS) 2: Labour and Working Conditions.

Negative Impacts

Some negative impact beliefs surface such as noise, pollution and waste, which can be effectively mitigated through a covering environmental management plan.

It is currently affirmed that there will be no displacement of households associated with land lease, no loss of business establishments, productive assets, cultural heritage or livelihood. The project is anticipated to bring both short-term and long-term employment and stable electricity as the main beneficial impact.

Since the Project has the potential to increase risks arising from accidents, exposure to diseases and more, the use of local medical staff and security personnel is recommended. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this Solar Power project developer understands and abides by its responsibility in respect of community health, safety and security.

5.5 Stakeholders Workshop

Stakeholder Workshop is an essential part of the ESIA process, and has been carried out in accordance with the regulatory requirements and international best practice.

In 2015, a stakeholder's workshop was organized in Wun Thar Village Monastery, in order to review the draft of this ESIA and assess any concerns and questions the communities may have.

The Minutes of the proceedings may be found in the annexure section of this document

6 Environmental & Social Impact Assessment

6.1 Main Expected Impacts of the Project Construction

6.1.1 Health and Safety

The installation and construction of the Solar Power Plant will proceed in accordance to world standard health and safety regulations and routines. Any and all waste will have the necessary faculties to handle, store and dispose of the waste via a new waste management system

6.1.2 Emissions

The project will have a very positive effect in regards to emissions. Based on the project's target annual output of 468,000,000 kWh, there will be an estimated reduction of 327,600 tons in CO2 emissions annually. Over a 30-year period, a total of 9,828,000 tons of CO2 emissions will be reduced as the Solar Power Plant does not produce or burna ny gas or other fuels.

"*Reduction of* CO_2 emissions per 1 kWh of solar power = 0.7 kg of CO_2"

6.1.3 Waste

The project will only produce some quantities of waste during the construction phase due to building and construction work. Wastewater is not considered to be a significant issue as the facility only needs clean regular water and it is not going to be mixed with chemicals of any hazardous kind. Solid waste is not of a significant concern as during the operation of the power plant as no such waste is generated. However, staff offices and canteen may produce such waste and there will be plans to collect and dispose of in a way that is environmentally safe. No waste will be burnt or buried at site, no matter the quantity or size. Regular municipal collection of waste or a contract with a private service provider will ensure the correct arrangements of handling waste.

6.1.4 Noise

Noise will only be produces during the construction phases of the Solar Power Plant due to an increase in traffic such as logistics vehicles and construction vehicles. During operational phase, noise is not considered an issue, as an operating Solar Power Plant does not produce any noise.

6.2 Potential Impact Assessment

The impacts have been assessed on a qualitative basis and are indicated as being of low, medium or high overall significance. The assessment covers both the installation and the operational phase of the project. All impacts are assessed assuming no specific mitigation or management measures applied. Given the scale of the project the assessment is essentially qualitative.

The key social issues associated with the construction phase include the following potential positive impacts:

- Creation of employment, business opportunities, and the opportunity for skills development and on-site training

The key social issues associated with the construction phase also include the following potential negative impacts:

- Impacts associated with the presence of construction workers on site
- Increased risk of stock theft, poaching and damage to farm infrastructure associated with presence of construction workers on the site
- Increased risk of fires associated with construction related activities
- Threat to safety and security of farmers associated with the presence of construction workers in the area
- Impact of heavy vehicles, including damage to roads, safety, noise and dust

The key social issues affecting the operational phase include the following potential positive impacts:

- Creation of employment and business opportunities, and opportunities for skills development and training
- The promotion of clean energy as an alternative energy source and establishment of Cleaner Development Mechanism (CDM) project

The key social issues affecting the operational phase include the following potential negative impacts:

- The visual impacts and associated impact on sense of place (refer to the assessment of the visual impacts)
- Impact on scarce water resources (refer to the assessment of the impact on water resources)

Approximately 500 employment opportunities is expected to be created as a result of the project implementation where the majority of which will be of low skill labor such as drivers and equipment operators. The remaining will be of skilled personnel for example, engineers, land surveyors and project managers. In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and high import content associated with solar energy facilities, opportunities for the local Mandalay economy and the townships of Meiktila and Wundwin and Thazi are likely to be limited but still present. However, opportunities are likely to exist for local contractors and engineering companies in the region of Mandalay.

Potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security and other businesses associated with the construction workers on the site. The majority of the construction workers will be accommodated in the nearest local towns, with Meiktila likely to be the most convenient due to its proximity to the site. This will create opportunities for local hotels, B&B's, guest farms. In addition, a proportion of the total wage bill earned by construction workers over the 6-9 month (50mw phase) and 30-36 month (300mw phase) construction phase is also likely to be spent in the regional and local economy. The injection of income into the area in the form of rental for accommodation and wages will create opportunities for local businesses in towns such as Meiktila, Wundwin, and Thazi. The benefits to the local economy will however be confined to the construction period.

In terms of training, the contractors are likely to provide on-site training and skills development opportunities. However, the majority of benefits are likely to accrue to personnel employed by the relevant contractors. The potential for meaningful skills development and training for members from the local communities are likely to be limited but not absent.

6.2.1 Potential Enhancements

Certain measures should be taken in order to enhance benefits, safety and positive impacts during the project implementation

- Where reasonable and practical, the turnkey EPC contractor should appoint local contractors, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- Prior to the construction phase the existence of a skills census for the area should be determined and if such as census exists it should be made available to the contractors appointed for the construction phase.
- Where applicable and feasible, training and skills development programs for locals should be initiated prior to the initiation of the construction phase.
- The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
- A list of potential service providers such as construction companies, waste collection companies, security companies should be composed by The Contractor before construction phase commence.
- Contractors should be held liable for damage to farm infrastructure that can be linked to construction workers for example alternative access roads and fencing.

- The ESMP must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.
- Contractors should ensure that all workers are informed of the conditions contained on the Code of Conduct such as trespassing on surrounding farms or otherwise.
- Where it is possible, increase the local skills levels through the implementation of training programs to local contractors contracted by the turnkey EPC contractor as applicable. Following construction, these skills will be available to following solar projects hence supporting the strategic goals of promoting local employment and skills.

Following the establishment of the baseline and the environment and social screening an initial assessment of potential impacts has been undertaken. The impacts considered are the changes that may be anticipated during the construction and installation phases as well as operational phase.

An assessment of impacts and changes that are perceived during construction and operational phases of any potential impacts has been conducted. The impacts in question are those that may appear during construction and operational phases and are highlighted below.

During the construction phase there may be small quantities of noise and dust emissions.

The development of this Solar Power project creates both direct and indirect employment and additional income in the regions where the development occurs. Potential adverse impacts to various resources associated with the construction, operation, and decommissioning of solar power plants are outlined below. Overall, the impacts are considered to have low significance but should nonetheless be predicted and mitigated.

Nothing which is installed will leave any permanent impact on the project site or its surroundings by the end of project life and solar power is today the main choice when building power generating assets in within or close to communities.

Figure 25: Construction Phase Assessment of Impacts

Ref.	Impact / Issue	Significance	Comment
Bio-Physical & Chemical			
BPC/1	Changes in water quality	Low	There will no chemicals used in the construction of the Solar Power Project. Water will be used only to wash the panels on dusty days and this does not require any chemicals or excessive water use.
BPC/2	Changes to surface water regime	Low	Drainage and sewerage will be installed as a precaution for heavy rain during wet season.
BPC/3	Changes to groundwater regime	Low	Groundwater will not be affected, as there will be no discharges as a result of construction and there are no water sources within or nearby the site perimeter.
BPC/4	Changes to air quality	Low	Negligible increase in gas exhaust during construction due to the trucking of construction material. Minor dusting during transportation and paving of roads.
BPC/5	Changes to ambient noise levels	Low	Only noise during construction and transportation of machinery and equipment.
BPC/6	Changes to aquatic biota	Low	There are no ponds of water or rivers near or within the immediate site perimeter.
BPC/7	Changes in disease vector populations	Low	There is not expected to be any increase from potential disease carrying mammals or insects as a result of construction
BPC/8	Changes to terrestrial biota	Low	Endangered species or plants will be at no risk following the construction of the site. The panels may, once installed, serve as additional shelter for insects and mammals.
BPC/9	Changes to land cover	Low	There is only expected to be minor changes in vegetation of the site as it is only minor regrowth vegetation due to past land leveling which needs to be removed.
BPC/10	Changes to areas of natural habitat	Low	The proposed site does not jeopardize any significant natural habitats of mammals or insects.
Socio- Economic & Cultural			
SEC/1	Changes involving loss of private assets	Low	There will be no loss of private assets in or around the designated sites as the land is barren dry land and un-used.
SEC/2	Changes involving loss of cultural heritage	Low	The project does not affect any archeological or cultural sites in or around the project area.

Ref.	Impact / Issue	Significance	Comment
SEC/3	Changes involving displacement of people	Low	All of the land selected for the project is un-used non arable dry zone land. No displacement or resettlement is necessary
SEC/4	Changes to traffic patterns	Low	Due to the transportation of construction material and equipment there may be minor effect on local traffic. This is only expected during construction phase and not during operations and is deemed insignificant.
SEC/5	Changes in public health status	Low	As no chemicals, hazardous materials or waste will be produced during construction there will be no risk for public health. Construction workers will be supplied with proper protection equipment and all possible safety measures will be exercised.
SEC/6	Changes in wage labor incomes/livelihood opportunities	Low	Only positive income opportunities as a result of the increased number of construction personnel and staff that the site will bring. Business owners will be able to profit from all personnel working in the area.
SEC/7	Changes in trade/commercial incomes/opportunities	Low	Surrounding businesses may benefit from selling services and products to contractors and suppliers and provide business opportunities for locals who seek to supply goods and services to employees.
SEC/8	Changes in visual	Low	The land is un-used. Site will need to be leveled to some extent. Visibility of the changes will be minimal and no aspect of the Solar Power Plant is a permanent installation.
SEC/9	Changes involving loss of public infrastructure/ community resources	Low	Public infrastructure associated with the project is only foreseen to benefit from the project development.

Figure 26: Operational Phase Assessment of Impacts

Ref.	Impact / Issue	Significance	Comment
Bio-Physical & Chemical			
BPC/1	Impact on water quality	Low	No contamination is expected, as there are no hazardous materials, oils or chemicals used during operations.
BPC/2	Impact on groundwater	Low	There will be no discharges to groundwater during operation.
BPC/3	Impacts on air quality	Low	As a result of operating 100% electrical, the project will have no impacts on air quality during operational phase and solar panels and technical equipment used does not produce any hazardous materials.
BPC/4	Impacts on noise levels	Low	No noise is expected during operational phase. A solar farm is the most silent way of producing electric power.
BPC/5	Impacts on aquatic resources	Low	No chemicals, oils or other hazardous liquids or solids are used during operations.
BPC/6	Impacts on disease among populations	Low	No increases in disease bearing mammals, amphibians or insects are expected during operations.
BPC/7	Impacts on sensitive flora	Low	Endangered species of plants will not be affected as a result of operations. Panels may even serve as shade on extra warm days.
BPC/8	Impacts on land cover	Low	During operational phase, no changes of land cover needs to occur.
BPC/9	Impacts on areas of natural habitat	Low	During operational phase there will be no changes to areas of natural habitat.
Socio-Economic & Cultural			
SEC/1	Impacts involving loss of private assets	Low	The operational phase will be entirely contained within the fenced project area. No risk of changes or losses of private assets.
SEC/2	Impacts involving loss of cultural heritage	Low	Cultural heritage is at no risk during operational phase.
SEC/3	Impacts involving displacement of people	Low	No displacement or resettlement needs to occur during the operational phase.
SEC/4	Impacts on traffic patterns	Low	No changes in traffic patterns are expected during operations. Limited amounts of organized busses with employees will frequent the local road networks during operations which will not impact current traffic patterns.

Ref.	Impact / Issue	Significance	Comment
SEC/5	Impacts in public health status	Low	No waste will be generated as a result of operations. Limited amounts of waste from canteen and employees will be generated which will be managed effectively.
SEC/6	Impacts wage labor, incomes and livelihood opportunities	Low	There is expected to arise certain job opportunities during the operational phase. Local business owners may benefit from the staff of the solar power plant. No negative impacts identified.
SEC/7	Impacts on commercial trade and other opportunities	Low	Local commercial establishments and other businesses may benefit by selling goods and services to the operator and plant personnel.
SEC/8	Impacts on visuals	Low	Visual assessment to be conducted upon facility construction.
SEC/9	Impacts involving loss of public infrastructure / community resources	Low	Public infrastructure and community resources will not be affected negatively during operational phase.

Decommissioning

Typically, the major impacts associated with the decommissioning phase of a Solar Power facility are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning.

In addition, the social impacts associated with final decommissioned are likely to be limited due to the relatively small number of permanent employees (25-35) affected. The potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be of low significance.

Recommended mitigation measures

The following mitigation measures are recommended:

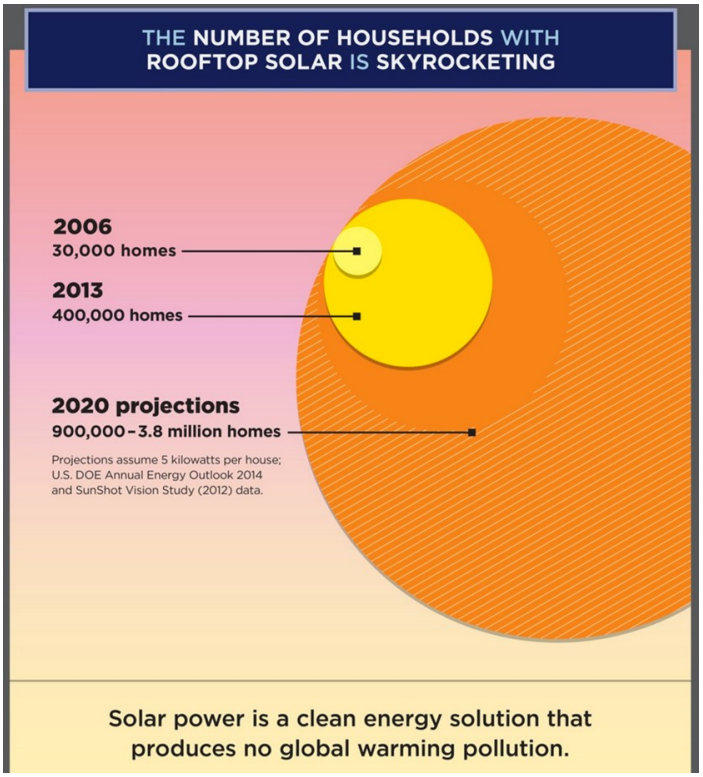
- The Developer should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the plant is decommissioned;
- All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning;
- The Developer should investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 30 year operational life of the facility.

The assessment can draw the conclusion that there will only be impacts of low significance regarding biophysical and socio-economic environments as a result of project implementation, operation and decommissioning.

In line with the results of the findings within this ESIA it is widely recognized that Solar Power Plants are of low level impact both environmentally and socially. If designed efficiently and the utilization of top tier technical equipment, potential impacts are of very low significant as the technology is proven. Today, solar panels on house roofs are growing due to the safety of the modern solar PV systems and installation methods.

The assessment can draw the conclusion that there will only be impacts of low significance regarding biophysical and socio-economic environments as a result of project implementation.

Figure 27: Solar Rooftop Growth in U.S (example)



7 Environmental and Social Management Plan

7.1 Purpose

The purpose of the initial ESMP is to describe the measures that should be implemented by the Contractors and project proponents during the construction phase to eliminate or reduce to acceptable levels key potential marine impacts and social and health impacts related to construction activities. Any measures mentioned recommended in the ESMP must be fully complied with by all involved project parties.

The project must always aim to avoid significant impacts on the environmental, social, and economic or health aspects during construction. Well-detailed design of specific works and through well prepared detailed site-specific contractors and a strong ESMP will help avoid any significant impacts. In the event that impacts are un-avoidable, they must be mitigated using appropriate measures. The ESMP shall be developed to reflect the environmental and social impacts that have been identified in this Environmental and Social Management Plan as well as comply with the laws and principles of ISO14001. The ESMP should also provide an operational reference tool for environmental management during construction activities.

The ESMP should accompany the construction phase of the project alongside any health and safety routines that must be implemented and enforced for both construction workers and permanent operational staff. This section is important, as there are needs to be actions taken to ensure that there is an independent third party inspection and validation of the effectiveness of the ESMP.

The EPC Contractor should prepare for an environmental, health and safety management system (EHS-MS) before the facility is commissioned. The purpose of which is to combine environmental mitigation measures, environmental and social management plan recommendations as well as health and safety priorities and monitoring procedures.

7.1.1 Environmental and Social Management

The ESMP should be considered a main document that will list the environmental and social requirements as well as detailing the necessary procedures in terms of managing any social or environmental issues that may be caused during the implementation as well as operation of the project based on the impact assessments. The ESMP should be developed to ensure that all and any impacts are identified and as such, mitigated and monitored properly throughout the construction and operational phases while remaining flexible to change in order to adapt to new, unforeseen circumstances. The ESMP is also meant to act as a standalone document for the Developer and other involved parties during the various phases of the proposed project development.

Relevant environmental and social standards as well as the development of an Environmental Health and Safety Management System (EHS-MS) should also be included in the ESMP.

Two main points generally acts as guidance for the successful implementation of any ESMP:

1. Proper identification of roles and responsibilities for the entities involved
2. Effective controls and monitoring of the implementation process

The majority of the management responsibilities are often linked and the following describes how the two main points can be achieved, which will assist in ensuring that the objectives of the ESMP are met.

Clear definition of roles and responsibilities of all involved parties in the ESMP should identify where, when and how each responsible party should participate, what degree of responsibility and involvement and what tasks that are expected by the party in question. This is useful to mitigate any questions regarding authority and to ensure proper and effective communication and management of the ESMP as well as ensuring that the ESMP recommendations are implemented both during construction and operation and assess how the environmental resources are used.

A self-compliance approach is usually advocated where the party responsible for the action should ensure that the objectives and requirements mentioned within the ESMP are met. This mainly includes the appointment of a qualified Environmental Site Officer (ESO) by the EPC Contractor during the Construction Phase, while during the Operational Phase this is to be undertaken through the appointment of a competent and qualified appointee of the Developer. Due to the limited and often most insignificant mitigation and monitoring measures during operations, there is no need to appoint a separate ESO during operations.

The Developer is required to review the reporting requirements as per the ESMP and undertake all necessary auditing to ensure that the EPC Contractor, sub-contractors and Project Operator meets the requirements stated in the ESMP, which could be conducted via the appointment of a competent CE by the Developer or through a qualified third party. The World Bank recommends undertaking any auditing practices on a monthly basis during the construction phase and on an annual basis during the operational phase.

The following steps should be followed during the implementation of the proposed project to adequately insure development of an EHS-MS alongside the implementation of the ESMP:

- The Developer and the Contractor should nominate a qualified person on the implementation of the ESMP to give regular support and know-how as well as supervise the project development of the EHS-MS
- The selected EPC Contractor shall prepare an EHS-MS plan for construction activities, which is in turn subject to review by the World Bank and the Developer. The EHS-MS by the contractor must ensure compliance with the ESMP and specify any additional environmental measures such as the management of waste produced by construction related activities.
- The Solar Power Plant EHS-MS shall be completed and executed prior to commissioning of the proposed project facility. EHS-MS in draft form is subject to review by the World Bank and the Developer. The EHS-MS should include subjects such as environmental monitoring, personnel health and safety measures, emergency procedures, training and reporting for any and all environmental and social impacts.

7.1.2 Environmental Policy

Construction Phase

The Developer and the construction Contractors should commit and respect the principles that are to be followed during the entire construction period of the construction phase.

- Construction activities should be managed effectively with awareness and highlighting the importance of protecting the environment and mitigate any negative impacts they may be produced as a result of the construction activities by nominating procedures and processes within the economic feasibility limits.
- Ensure effective implementation of Solid Waste Management Procedures
- Ensure compliance with the Government of Myanmar and the World Bank requirements regarding self-monitoring.
- Commit to international good practices standards.
- Ensure that effective environmental training and personal protective equipment are made available for construction workforce.
- Ensure commitment and compliance to the ESMP during the entire lifecycle of the construction phase.
- Ensure that any and all mitigation measures provided by the Contractors ESMP are implemented and conduct and provide regular records and monitoring.

Operational Phase

The Developer should abide to and respect certain principles during the entire life of the project operations. The principles include but are not limited to:

- Effective waste management system to be implemented at the project facility.
- All staff and site personnel must be trained regarding their responsibilities on environmental and safety as well as provide all of the necessary equipment and skill to ensure compliance.
- Avoid any operational activities that may have negative impacts on cultural, environmental, social and economic welfare in and around nearby communities.
- Ensure compliance and commit to all present and future national as well as international regulations, standards and guidelines as well as specific agreements and regulations that the proposed Project entails.
- Ensure that the EHS-MS is reviewed, audited regularly and update accordingly during the life cycle of the Project.

Decommissioning Phase

The Developer shall abide to and respect certain principles, laws as well as rules and regulations during the phase of decommissioning of this Solar Power facility.

Electrical equipment will be sold or sent to a recycling facility. The project contains large amounts of copper, aluminum and other conductive metals which are easily recyclable.

All non-recyclable materials will be taken to the nearest approved disposal facility for environmentally friendly disposal. Inverters, Transformers, & Switchgear will be removed from their respective concrete pads. Combiner boxes assemblies will be pulled off of the ground mounting structures intact, including the ballasts from the mounting system. Petitioner shall undertake the following activities upon decommissioning:

- PV Panels will be detached from the racking system and stacked for removal;
- Sections of the racking system will be scissored together and stacked for removal;
- Pile Driven Racking systems will be taken out of the ground using a pile rig;
- The concrete foundations for the inverters, transformers, and switchgear will be lifted, secured onto flat beds, and transported off-site for processing;
- AC and DC wiring, after proper disconnection, will be pulled out and all tranches will be backfilled with the native soils removed;
- On site power poles for above ground wiring at the collector substation will be removed;
- The 13.2 KV electric lines will be removed by the local utility; and are not the subject of this plan;
- Developer shall be responsible for all decommissioning costs;
- Developer shall obtain any additional permits required for the decommissioning, removal and legal disposal of Project components prior to commencement of decommissioning activities;
- Developer shall complete the decommissioning, including component removal and disposition, grading and re-vegetation in accordance with permits and in compliance with all applicable rules and regulations then in effect governing the disposal thereof;
- Developer shall remove all hazardous materials and transport them to be disposed of by licensed contractors at an appropriate facility in accordance with rules and regulations governing the disposal of such materials; and
- Developer shall preserve and reclaim the agricultural soils on the Project site in accordance with the local law.

- Developer shall reclaim agricultural soils in the driveway and inverter areas by removing any imported soils and/or stone and geotextile fabric that has been placed to form the a driving surface, and replace with the agricultural soils that were stockpiled during the construction of the project;
- Petitioner shall plow with a subsoiler in the areas underneath any concrete blocks and the roadways where soils may have become compressed;

In addition to the above, the developer shall:

- Per the lease agreement with the landowner, decommissioning shall occur at the end of the land lease and shall be the full responsibility of the lessee, Convalt Energy LLC
  - Decommissioning will be initiated following any continuous 12 month period during which no electricity is generated.
- Per the lease agreement with the landowner, the land shall be fully restored to its pre-solar facility condition to the best of the contractor and developers ability.
  - All above and below ground non-utility owned equipment conduit, structures, fencing, roads and foundations shall be removed if nothing dictates otherwise.
- Decommissioning of the solar facility will be completed within 18 months of a decommissioning initiating event.
- The anticipated lifespan of the solar facility is 25-30 years.
- According to the labor laws of the Union of Myanmar, 50 % of the personnel working on decommissioning shall be employed locally.

Over the life of the facility (estimated to be approximately 25-30 years) the existing groundcover on the site will be maintained as grass by regular mowing.

The soil stockpile is to be monitored for a maintained strong stand of vegetative growth and for erosion of soils. If additional vegetative cover is needed, the stockpile shall be reseeded and mulched. If erosion is noted, additional protective measures shall be implemented in accordance with the with international standards.

The items below are to be prioritized for removal along with any waste, solid or liquid that may be produced as a result of the Solar Facility Decommissioning.

Item No.	Item
1	Fence Removal
2	Racking Frame Removal
3	Racking Post Removal
4	Solar Panel Removal
5	Inverter Removal
6	Transformer(s) Removal
7	Wire (Copper) Removal
8	Wire (Aluminum) Removal
9	Concrete Removal

WASTE MANAGEMENT PLAN

Scope & Purpose of the Plan

This Waste Management Plan identifies the wastes that are likely to be generated during the construction and operation of the proposed Solar Power Facility and proper waste management practices to be employed for their collection, storage, treatment and/or disposal.

Specifically, the waste covered by this WMP includes the following sources:

- Construction and commissioning of facility and the associated facilities
- Operation of facility and the associated facilities throughout the project life-cycle.
- Temporary accommodation during construction phase for the workers.
- Other operations like equipment maintenance, road construction, site preparation and so forth.
- Operation and maintenance of infrastructures both during construction and operation phase.

The Waste Management Plan is intended to serve as a guideline for the project proponent & the contractor(s) to manage wastes effectively during construction and operation phase. The contractor(s) should prepare their own WMP in compliance with this WMP and implement the same during the construction phase. The EPC Contractor should implement the WMP throughout the operational phase.

The WMP describes how wastes will be managed during the construction and operation phase of the project and how the project will:

- Minimize the potential to cause harm to human health and the environment.
- Comply with IFC´s social safeguards policy statement and with Myanmar Environmental Regulations.
- Reduce operational costs and any potential liabilities which may arise from waste handling operations.

This plan also ensures that every waste stream and solid waste materials from the main plant site and the associated facilities will be managed effectively.

Solid and Hazardous Waste Management

The mitigation measures with respect to waste treatment, storage, handling and disposal during both phases of the project have been discussed below:

Construction Phase

- A waste inventory of various waste generated will be prepared and periodically updated.
- The excavated material generated will be reused for site filling and leveling operation to the maximum extent possible.
- The scrap metal waste generated from erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers.
- Food waste and recyclables paper, plastic, glass and such will be properly segregated and stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers while food waste will be disposed through waste handling agency.
- Hazardous waste, waste oil and such will be collected and stored in paved and bounded area and subsequently sold to authorized recyclers. Necessary manifest for the same will be maintained.

Operational Phase

There shall be no solid wastes likely to be generated during operation phase

Road Safety & Traffic Management Plan

The plan encompasses the addresses of community safety related impacts that may arise from the increased vehicular traffic due to movement of equipment/machineries and vehicles along the site access and approach roads particularly during construction phase. The plan will be regularly reviewed and as vehicle movement requirements are identified in detail.

During Construction Phase

The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.
- Any road diversions and closures will be informed in advance to the project vehicles accessing the above route. Usage of horns by project vehicles will be restricted near sensitive receptors, schools, settlements and such.
- Traffic flows will be timed wherever practicable during period of increased commuter movement in the day.
- Temporary parking facilities should be provided within the work areas and the construction sites to avoid road congestion.
- Vehicular movement to be controlled near sensitive locations, schools, colleges, hospitals identified along designated vehicular transportation routes.
- Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.
- Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with local authorities to sensitize target groups, school children, commuters on traffic safety rules and signage's.

During Operational Phase

Since limited vehicular movement is anticipated during operational phase considering only the daily movement of project personnel any impacts arising from the same can be effectively addressed through implementation of mitigation measures as discussed during the construction phase.

During Decommissioning Phase

Since the decommissioning is not set to begin until the end of the life-cycle of the Solar Power Facility, a Contractor will be organized 12 months prior to decommissioning date and will then have a new Waste Management Plan incorporated which fills the standards of that period in time.

7.1.3 Environmental Standards and Verification

It is considered a standard that the EHS-MS should comply with EU Directives and World Bank Environmental, Health and Safety (EHS) General Guidelines. A qualified third party should be assisting in the development of an effective EHS-MS with the overall cost be built into the project allocation.

The EHS-MS may become subject to third party audits in order to ensure the success of various measures that comprise within the management system. Appropriate systems and routines should be developed, implemented and monitored which may become subject to third party audits in order to ensure effectiveness and compliance with national and international standards. If the Government of Myanmar lacks the ability and resources to monitor and certify the environmental performance of the proposed project, a qualified entity should be

nominated to assist in the development of the audit system and the cost of this should be built into the project allocation.

The regularity of environmental audits should be designed into the project phases with oversight during implementation and should, after construction, transform into annual performance audits during the operational phase. A reporting system should be implemented in order to allow the operator and any senior management that is involved to take part in all the results and recommendations so that all and any problems can be dealt with accordingly which would improve procedures in the future.

7.2 Environmental and Social Management Plan (ESMP)

An Environmental and Social Management Plan (ESMP) aims to define roles, resources and responsibilities, which are required to manage environmental impacts and implement adequate mitigation measures as necessary. An ESMP should include a description of what activities are planned in order to mitigate any impacts.

The central elements of an ESMP should include a prioritized description of the activities planned to mitigate impacts, a time line and identification of resources to ensure the ESMP can be delivered, and a communication plan that indicates how progress in the implementation of the ESMP will be disclosed. The ESMP should also define monitoring requirements to determine whether any implemented mitigation is successful. Although monitoring is often overlooked since it occurs once the project has been approved and is underway, it is important for providing evidence that the company is achieving compliance and allowing for any necessary remedial measures to be put in place.

7.2.1 Implementation

All and any legal and contractual necessity, which relates to the implemented ESMP, shall apply to both the Contractor and any possible sub-contractor. It is within the Contractors responsibilities to provide all necessary resources to ensure that the implementation and control of the ESMP is effective. All and any sub-contractor will be responsible to its respective Contractor regarding compliance with any measures stated in the ESMP. The Contractors and they sub-contractors should also ensure that all and any personnel are briefed and educated on procedures that are to be followed.

7.2.1.1 Environmental Awareness

It lies within the Contractors responsibilities to inform and educate its employees on the ESMP and make all personnel aware of the ESMP, legal requirements and obligations concerning the environment. An introduction workshop on environmental awareness should be made available to all personnel in the adequate language, which is relevant to the employees.

Key elements of training and education should be enforced through effective site seminars or workshops. They include but are not limited to the following:

- The Contractor and its possible sub-contractors should conduct an Environmental Awareness workshop which is to be made available to all personnel, raising any possible environmental issues related to conservation, solid and liquid waste management, health and safety as well as hygiene.
- Health and Safety Awareness, including STD awareness information.
- Specific Environmental Training of all personnel, which have more sensitive environmental activities such as waste management, vehicle maintenance and refueling.

7.2.1.2 Health & Safety Awareness

It is required of the Contractor to acknowledge any and all regulations and guidelines on health and safety by the World Bank as well as the Government of Myanmar and as a basic minimum the Contractor should be required to prepare a Health and Safety Plan for any construction related activities and to ensure and monitor implementation of such plan. The insurance of compliance with national health policy, construction policy and occupational health and safety, falls under the responsibility of the Contractor. Health and safety measures are important for the construction work force as well as the general public. The Contractor should in particular be aware of their obligations regarding the health and safety of the work force.

Personal protective equipment (PPE) must made available and be provided by the Contractor for the all work force as necessary to prevent any severe injuries or other situations as a result of contact with electrical, mechanical or other hazards. The Contractor should enforce usage.

Key consideration for Health and Safety include:

- A responsible person should be appointed for the project to ensure implementation monitoring and review of requirements
- Personal protective equipment should be provided and used on site as appropriate and usage should be enforced
- The construction site should be secured and fenced
- Warning and control signs should be used effectively
- First aid facilities and competent medical personnel should be available
- Appropriate welfare facilities should be available at both construction sites, accommodation camps and workshops
- Disposal of wastes should be managed environmentally safe and in the scope of regulations.

7.2.2 Roles and Responsibilities for the ESMP

7.2.2.1 Consulting Engineer (CE)

The Developer should appoint a Consulting Engineer (CE), which is qualified and trained before construction commences. Responsibilities of the CE should consist of:

- Ensure that all environmental mitigations are implemented
- Conduct routine inspections and audits of the Contracts activities to ensure records are kept as part of ESMP reporting
- Act as a bridge between Contracts, MEPE and the developer in relation to implementation of the project and mitigations of the ESMP
- Review site-specific contractor ESMP together with MEPE and the Developer and other affected parties and make sure the ESMP is followed by the Contractor

7.2.2.2 Environmental Site Officer (ESO)

The Contractor should appoint an Environment Site Officer (ESO) from the site personnel to:

- Participate in any and all construction related meetings at site location
- Conduct any and all activities required by the terms in the ESMP
- Inform all personnel and construction workers prior to construction commencement
- Conduct regular construction monitoring
- Supply the CE with conditions of approval and implementation of any and all mitigation measures in the ESMP
- Thoroughly inform the CE of reports regarding any and all deviations from the active ESMP and reasons to such deviations

7.2.3 ESMP Non-Compliance

Non-compliance monitoring should be separated into levels of three on the basis of importance with communication requirements for the identified setting in order to prioritize management attention regarding the most important issues.

The non-compliance monitoring should also assess the seriousness of the non-compliance setting as soon as the issue has been identified.

The non-compliance settings are:

Non-Compliance Level I

Any non-compliance setting, which is not consistent with the ESMP requirements, but also not believed to represent an immediate or serious threat to social or environmental welfare. If Level 1 is repeated and neglected, it may be prompt to becoming a Level II Non-compliance issue.

Typically, the Environmental Site Officer (ESO) should address Level I situations. Remedial actions should be planned internally and implemented as soon as possible.

Non-Compliance Level II

Any non-compliance setting, which has not immediately resulted in clearly identified damages or permanent impacts, but which has potential significance requires swift remedial measures and site- specific attention to prevent permanent effects. If Level II is repeated and neglected, it may be prompted to becoming a Level III Non-compliance issue.

Generally, within a week of the initial identification of any issue that requires attention, remedial actions should be agreed upon and be initiated. The Consulting Engineer (ECO) must monitor the remedial measures, which will be formally noted in the records of the monthly environmental reporting.

Non-Compliance Level III

Any crucial non-compliance setting, which generally includes damages of a significant nature on the environment or expectation of impending damage and/or danger to employees or local welfare.

It is also classified as a Level III non-compliance issue if intentional neglecting of prohibitions, which are specific. The CE should inform all involved parties of Level III.

Remedial measures should be agreed upon and initiated no less than 24 hours of original identification of the issue at hand unless certain un-controllable circumstances that would require a longer period. The intent should be to initiate remedial actions as soon as possible to minimize any temporary or permanently negative effects even if a certain initial timeframe for remedial responses are not achievable for certain issues.

The CE should, if necessary, request that the Contractor pause affected activities so that remedial measures can be implemented.

7.3 Environmental and Social Management Plan

The ESMP below is designed for the project, specifying the potential impacts, mitigation measures, responsibilities, indicators and time frame as well as costs that shall be overseen and managed by Convalt Energy. The list is not limited to its content and remains subject to change and adding of additional content.

Construction Phase

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Public Consultation and Community Engagement	• Release of project information • Public safety • Minimize disturbance • Inform about construction schedule and time-frame	Convalt Energy	Consultation/community engagement meetings to be held	Meeting report	Continuous
Employment	• Statement of Intent.	Contractors			
Management of change and procedures for natural and cultural habitat	• Organize environmental management and health and safety training. All contractors, employees, long-term and short-term must attend this training • Fence the construction area	Contractors	Trained staff	Training Report	Training to be conducted at least 1 month prior to construction start on-site
Training	Prepare Health and Safety Plan for employees and all impacted communities. Key issues are: • -Education of employees and impacted communities • Supply of personal protective equipment (PPE) for employees during construction • Accident reporting through monitoring and record-keeping of accidents or otherwise and remedial measures for any foreseen issue. • Emergency action plan • Instruction of work tasks • Prohibit child labor	Contractors	• Always protect all employees at the construction site • Ensure employees are using personal protective equipment (PPE)	• Monthly site inspections • At least, monthly meeting minute reports	To be conducted prior to construction start

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Safety of roads	• Ensure that speed limits for construction related vehicles are enforced. Always use, if possible, the main site entrances for all construction related vehicles. Install all necessary motor signage for all vehicles that may enter the premises. • Ensure appropriate road safety signs • Ensure all drivers obey the local traffic rules and laws as required. • Install road speed controllers (road bumps) where traffic is heavy and there is a high chance of vehicles interfering with communities.	Convalt Energy and Contractors	Reduce all and any risk of accidents	Reports of complaints or otherwise from community residents and report of inconvenience from visiting motorists	To be conducted continuously during the entire construction phase
Leak and/or spills of oil or chemicals	• Regular site equipment maintenance • Procedures for safes storage of fuel and adequate safety measures for refueling • Disposal of any oil or chemical remains safely • Use modern construction machines	Convalt Energy and Contractor	Inspections by Convalt Energy	Regular inspections to be conducted	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Noise	• Inform all employees and on issues regarding equipment maintenance • Oversee all construction related traffic • Maintain the facility and its equipment • Construction to be conducted during daytime only • All employees to wear ear protective gear as part of their personal protective equipment • Avoid working during night time	Convalt Energy and Contractor	• Noise should not exceed 50 decibels • Employee working hours per week should not exceed 40 hours • Utilize sound proofing technologies and materials as needed	Regular inspection	To be conducted continuously
Employees canteen/eating areas and other facilities	• Standards for housekeeping and cleanliness must be of international standard for all employees employed by the contractor and sub-contractors. • No eating or drinking should take place within or near areas of intense work or construction • Hand washing and changing of clothes when needed, should be conducted before proceeding to the canteen areas	Convalt Energy and Contractors	Enforce housekeeping	Regular inspection, monthly or at least every 2 months	To be conducted during construction

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Contractor accommodation	• All sewage and waste water discharges from contractor employees must be collected and treated with international standards • Solid wastes must be collected and disposed properly. Preferably using a trusted private or public company using disposal techniques approved by the government • Run-off collection measures must be present at all refueling or servicing areas	Convalt Energy and Contractors	Enforce environmental practices where any contractor employee resigns during construction	Regular inspections every 2-3 months	To be conducted continuously
High weight loads	• Implement mitigation measures to prevent any and all damages to local road network • Ensure that all contractor and sub-contractor vehicles abide with the set load limit of local road networks	Convalt Energy and Contractor	Keep roads in good or better motor able condition	Regular inspections every 2-3 months	To be conducted continuously
Control of storm water	• Apply any necessary measure to ensure that storm water is controlled safely using measures such as drains, filtering fences, dam or otherwise • Install temporary ditches to adjust water flow out of construction area	Convalt Energy and Contractor	Ensure safe storm water control		To be conducted during construction phase
Land Acquisition • Loss of land, temporary or permanent access routes during construction	• All necessary land acquisition, if any, must be completed with the Government of Myanmar and listed in the relevant documents prior to start of construction	Convalt Energy		Regular inspections every 2-3 months	To be conducted prior to start of construction

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Earthbound habitat	• Ensure opportunities for regrowth if necessary • Clear as necessary, plan and monitor area designated for clearing • Ensure no pesticide usage during clearing	Convalt Energy and Contractor and MOEF	Regrowth of any disturbed area	Regular inspection	To be conducted continuously
Erosion of soil	• Any earth that is excavated during construction should be re-used as appropriate for land-fill or otherwise • Re-plant any local vegetation as appropriate to improve ground cover. • Manage excavated soil	Contractors	Ground cover status in and around the construction site	Re-vegetation	To be conducted continuously
Dust and other emission leading to air pollution	• Speeds of construction related vehicles should be controlled and monitored • Ensure that no vehicle is left running when not necessary • Ensure that water is sprayed during construction to avoid dust emissions as necessary • Supply dust filter masks when employees are working in dusty situations • Limit heavy transportation speed in residential areas	Convalt Energy and Contractor	• Particles that are visible when airborne • Monitor status of PPE • Service vehicles	Supply protective breathing equipment	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Ground and surface water contamination	• Maintain all construction related vehicles at safe, designated areas or garages • Ensure proper handling and disposal of wastes from machinery. • Avoid servicing and maintenance of construction related vehicles within the construction site • Ensure safe storage of all and any fuels, oils or chemicals on site • All leaked oils or chemicals must be cleaned immediately	Convalt Energy and Contractor	Quality of water. Looking for traces of runoff from the construction site	Regular inspections	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Solid waste management	• Contractors must utilize safe and approved disposal sites • Install dustbins and ensure that any solid waste generated is collected during construction • Solid waste generated on the construction site should be held in temporary disposal sites or containers until collection • Construction site to be kept clean and tidy at all times • Minimize the production of waste that must be treated or eliminated. • Identify and classify the type of waste generated. Even if unlikely, hazardous wastes are generated, proper procedures must be taken regarding their storage, collection, transportation and disposal. • Identify and demarcate disposal areas clearly indicating the specific materials that can be deposited in each. • Control placement of all construction waste (including earth cuts) to approved disposal sites (>300 m from rivers, streams, lakes, or wetlands). • Dispose in authorized areas all of garbage, metals, potential oils, and excess material generated during construction, incorporating recycling systems and the separation of materials.	Contractors	Solid wastes should never be present directly on the site	Regular maintenance	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Fire hazard risk	• Supply adequate and extensive fire safety systems which must include training, firefighting equipment, regular maintenance of all construction related equipment and vehicles • No burning or other fire related activities should be allowed on site.	Convalt Energy and Contractors	Monitor and keep records	Regular maintenance	To be conducted continuously
Electrical hazard risk	• Properly ground all live power lines and deactivate as necessary before performing any installation or maintenance on or close to the subject • Work on all "live" lines must be conducted by properly trained staff • Employees should never be close enough to risk getting electrocuted unless properly geared and properly trained staff must do so. Employees performing this work must be fully insulated and protected from electric shock hazards. • Fit the facility with safety measures such as fencing and anti-climbing solutions to minimize accidental risk • Properly and regularly maintain and check cable status and electrical equipment status by qualified employees • Properly maintain lights and electrical signs • Provide safety and emergency response equipment on site	Consulting Engineer and Contractors	Monitor and keep records	Supply personal protective equipment	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitoring Indicator	Monitoring Means	Time-Frame
Diseases risk	• Educate, guide and counsel local employees of all and any risks of sexually transmittable diseases	Contractor	Monitor and keep records	Regular inspections of employee health and knowledge	To be conducted continuously
Resettlement	• If any resettlement is required, the resettled people must be informed about: • Options and rights regarding the resettlement • Consultations and offered choices of alternatives • Provided compensation for any loss of personal assets as an effect of the project • Support during resettlement until resettlement have reached their prior living standard	Convalt Energy and Contractor	Resettlement in accordance with World Bank standards and policies		To be conducted prior to construction start
Land sites with cultural, religious or heritage significance	• Avoid any significant area at all times	Convalt Energy and Contractor	Preserving of cultural sites		To be conducted prior to construction start

O&M Phase

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitor Indicator	Monitoring Means	Time-Frame
Fire hazard risk	• Ensure that firefighting systems are installed at strategic and extra sensitive areas of the facility • Prohibit smoking and burning of any kind within the project area • Ensure emergency plan in place	Convalt Energy and Contractors	Number of deemed risks of fire	Regular inspections	To be conducted continuously
Noise	• As a solar power plant does not produce any noise while running, no mitigation measures required	Convalt Energy and Contractor	Existing noise	Regular inspections	To be conducted continuously
Electrical hazard risk	• Ensure that only trained and properly equipped employees approach and conduct work on the areas of higher electric shock risk • Ensure that fencing and anti-climbing solutions are applied at all sensitive high risk areas of the site • Ensure that clear warning signs in local languages are installed extensively • Ensure emergency plan in place	Convalt Energy and Contractor	• Proper fencing and anti-climbing solutions • Proper and clear warning signs	Regular maintenance and record keeping	To be conducted continuously
Sanitation and waste management	• Waste bins, regular collection and approved disposal methods shall be utilized for various waste types • Identify extra hazardous waste for specialized disposal • Ensure that waste management complies with best practice • Collect and treat any contaminated water, soil or otherwise	Convalt Energy and Contractor	Waste management systems	Regular inspections	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitor Indicator	Monitoring Means	Time-Frame
Earthbound habitat	• Avoid clearing of vegetation where possible • Clear and dispose of vegetation as needed using environmentally friendly techniques. • No usage of pesticides	Convalt Energy and Contractor	Density of vegetation	Regular inspections	To be conducted continuously
ESMP Efficiency	• Ensure audits of the ESMP	Convalt Energy	Reporting and record keeping of any and all incidents	Regular inspections	To be conducted continuously

Decommissioning Phase

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitor Indicator	Monitoring Means	Time-Frame
Waste Management	• Ensure that all and any waste that is generated during the decommissioning is collected and disposed of safely. (Subject to audit) • Minimize the production of waste that must be treated or eliminated • Identify and classify the type of waste generated. Even if unlikely, hazardous wastes are generated, proper procedures must be taken regarding their storage, collection, transportation and disposal • Identify and demarcate disposal areas clearly indicating the specific materials that can be deposited in each. • Control placement of all construction waste (including earth cuts) to approved disposal sites (>300 m from rivers, streams, lakes, or wetlands). • Dispose in authorized areas all of garbage, metals, potential oils, and excess material generated during construction, incorporating recycling systems and the separation of materials.	Convalt Energy	Reports of improper disposal or complaints	Regular inspections	To be conducted continuously
Noise from vehicles	• Speed management	Convalt Energy	Reports of responsibility lack and complaints	Random inspections	To be conducted continuously
Soil	• Ensure that no great soil erosion occurs by applying binding materials if needed	Convalt Energy and Contractors	Soil situation	Regular inspections	To be conducted continuously
Dust	• Provide mouth and lung protective gear as part of the PPE	Convalt Energy and Consulting Engineer	Status of current proper protective equipment	Regular inspections of PPE	To be conducted continuously

Potential Impact	Proposed Mitigation	Responsibility for Monitoring	Monitor Indicator	Monitoring Means	Time-Frame
Vehicle emissions	• Ensure proper vehicle servicing	Convalt Energy and Consulting Engineer	Follow and enforce service schedules for vehicle	Apply service after set kilometer of drive. Separate for on and off-road vehicles	To be conducted continuously
Physical Hazards	• Ensure that work flow designs comply with the physical tasks undertaken by the employees while maintaining a balance with expected productivity	Contractor and Consulting Engineer	Status and volume of employee complaints	Regular inspections and adaption of workflow design	To be conducted continuously

7.3.1 Specific Environmental Mitigation Measures

Based on the assessment undertaken as part of the ESIA for the Solar Project in Meiktila, a series of mitigation measures have been identified which aim to reduce and / or eliminate the predicted impacts of the project. It is important that these mitigation measures are appropriately applied to the project construction and operation, and this management plan provides a strategic framework for their implementation. In particular, to the Solar Project, the Contractor is required to undertake construction:

- In accordance with the International Finance Corporation and World Bank Environmental, Health and Safety Guidelines which set standards for noise, air quality and water quality which should not be exceeded.
- In accordance with the EU Directive 2005/88/EC, which provides noise standards for construction equipment such as excavators and compactors.
- In accordance with National Laws of the Union of Myanmar

The Contractor will also ensure that all necessary environmental and social mitigation measures as identified in the ESIA, ESMP and detailed site-specific contractor ESMP will be implemented. For this Solar Project in Meiktila, this will include, but not be limited to, the following:

- Provision of lighting where appropriate to maintain safety.
- All potential chemical, oil and fuel storage should be contained in bund or on suitable impermeable surfaces / drip drays etc. Such locations should be positioned away from watercourses (both seasonal and permanent). Potential chemicals are mentioned within this ESIA to ensure full compliance coverage, but there are no chemicals used during construction.
- Control of re-fueling / fuel storage. Re-fueling areas should be located away from any watercourses and managed in accordance to the above point. Spill containment measures should be in place with training for use.
- Works to be undertaken within any watercourse or adjoining land should be planned specifically with regard to reducing downstream contamination of any potential water. This being notably with regard to the condition of machinery used (checks for oil leaks and other liquids). This specific project site does not have any water course running through or nearby.
- Storm water runoff management. Drainage of construction sites should be considered with regard to the potential for surface run-off during Myanmar's wet season to enter the watercourses.

The project should identify any drinking water sources in the proximity of the project and ensure that the risk to damage water quality is managed. Any spill events should be notified to affected users.

The Contractor is required to develop a Traffic Management Plan that will govern all traffic movement during the mobilization, construction and demobilization period in the affected area within and surrounding Meiktila. This will include process/protocol for the management of traffic that will be implemented and publicized to the local communities.

Specific measures to control noise and air pollution during Construction of the Solar Project include:

- Working days in accordance with legal requirements, night working avoided where possible. Construction works should only take place during daylight working hours.

- Works shall be carried out in accordance with the IFC and World Bank Environmental Health and Safety Guidelines, which set ambient noise and air quality standards and shall not cause a breach of these standards. Works shall also be in accordance with the Myanmar Environmental and Conservation Law.
- All equipment should be operated in accordance with the noise standards set out in the EU Directive as of 2015 on the approximation to the noise emissions in the environment by equipment for outdoor use. The Myanmar Environmental Law must also be consulted if any questions arise.
- Consultation with affected communities is an initial mitigation measure which is important to ensure that those likely to be affected by the works are aware of what the works will entail, the duration and likely impacts.
- Maintenance of vehicles in proper working conditions to minimize accident risk.
- Liaison with local community of Meiktila for suitable timings of noisy activities.
- Covering of stockpiled soil during the dry season to prevent dust.
- Spraying of roadways and construction sites with water to dampen and therefore reduce dust if dust becomes an issue.
- Speed controls and traffic management within and surrounding the affected Meiktila area.
- The Contractor shall inform the communities surrounding Meiktila about duration of site works (daily start and finish times).

The potential impacts that could arise during the construction phase of this particular Solar Project, which the Contractor must mitigate and the Contractor is required to develop these mitigation measures and cost them in their site specific ESMP.

Additional environmental priority mitigations for this Solar Project include, but are not limited to:

1. All noise of any activity, construction or otherwise should comply with international standards as well as Myanmar Environmental and Conservation Law.
2. Contained storage should be provided for any and all potential liquid and solid waste prior to safe disposal.
3. If there is anytime any chemicals present, removal from site and transport for recycling or industrial re-uses is prioritized.
4. Install groundwater-monitoring wells on the site periphery as with any other utility scale development. (This is usually not necessary with Solar Power Projects.)
5. Rehabilitate existing fire hydrants and install additional as required.
6. Provide working fire extinguishers in all buildings. Both temporary and permanent structures.
7. Co-ordinate an emergency preparedness plans with the local government of Meiktila.
8. Install a first-aid post on site and train key staff as first-aider.
9. Lock and restrict access to all sensitive areas and mount clear signs.
10. Provide collector system for drainage and waste of the workshop area, canteen area and staff areas.
11. Install septic tanks or connect to municipal/mains sewerage system of Meiktila.
12. Ensure gloves and personal protective equipment (PPE) are issued to staff as appropriate.

13. All employees (including all site managers) exposed to health and safety as well as fire- explosion risks at the Project site should be subject to training and repeated re-training. Use of the established measures (e.g. equipment inspections and checking of all site personnel to use, for example, personal protection equipment) should be constantly monitored on site to ensure full compliance.

7.3.2 Social Mitigation Measures

In order to ensure that communities surrounding the Project site within Meiktila District receive social and economic benefits as a result of project implementation, certain measures should be implemented in order to support the Government of Myanmar to enhance the process of wide electrification of townships and villages in the project region. Facilities such as hospitals and schools will be provided with more stable electric power which will lead to higher efficiency among the communal facilities and therefor the community.

Indirect benefits in the District of Meiktila is expected to emerge as a result of an improved power supply, increasing economic growth and activities as well as aid in created more jobs. The responsibility lies with the Developer to determine what technical option will be suitable for the nearby communities as well as to determine any costs related to implementing these community aids. No cost or other details on implementation are known at this stage but will be identified early during project implementation. It is also important to monitor and evaluate any appropriate mechanisms that the project will include for free before the informed consultation with the nearby and most affected communities.

Performance Standards by the International Finance Corporation is to be utilized during all project activities. The purpose of these standards is to provide further useful information on the development and implementation of key mitigation measures and the management of potential impacts. These guidance documents should form the basis for the detailed site-specific ESMP developed by the Contractor.

Further information and collected data on potential environmental and social aspects can be viewed in the attached Stakeholder Meetings Report.

7.4 Environmental and Social Monitoring

This environmental and social monitoring table contains entities under the Responsibility sections which are currently preliminary and tentative and may be subject to change upon final decision.

The Developer does vow to use only Top Tier Contractors to ensure good practice, high standard and abidance of local and international laws, regulations and standards.

Mitigation Action and Control	Responsibility	Time-frame
Design Impacts		
Pre-construction geotechnical survey of the 850 acres of Land designated for this Solar Power Project in the District of Meiktila	Specialist: Mandalay Pioneer Geotechnical Engineering Service	Design phase
Consider mitigation measures recommended by the specialists with respect to visual aesthetics, flora, fauna, avifauna, water resources, ecology and heritage as detailed within the ESIA report and relevant appendices pertaining to this Solar Power project	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Design review stage
To minimize impacts on avifauna, utilize bird deterrents if necessary within and around the designated project area	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Design phase
Obtain all relevant permits prior to construction in the proposed project area	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Design phase
Carefully plan access roads and minimize the impacted area and prevent unnecessary damages	EPC Contractor: Larsen & Toubro	Design phase
Existing roads must be used as much as possible and be upgraded where needed	EPC: Larsen & Toubro	Design phase
A detailed geotechnical investigation is required for the design phase	Developer: Convalt Energy	Design Phase
Storm water management plan for any hard surfaces (foundations, substations) as part of the final design of the Project	EPC Contractor: Larsen & Toubro	Design phase
Ensure a sustainable final project design	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Design review stage
Submit a final layout to MEPE prior to construction start	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Pre-construction

Mitigation Action and Control	Responsibility	Time-frame
Route, Visual Aesthetics, Loss of Flora, Erosion		
Select routing of equipment that minimizes environmental impacts and enhances benefits	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Design phase
Consider mitigation measures recommended by the specialists with respect to visual aesthetics, flora, fauna, avifauna, water resources, ecology and heritage as detailed within the ESIA report and relevant appendices	EPC Contractor: Larsen & Toubro	Design phase
Plan to use existing access roads but first refurbish or upgrade to ensure safe access	EPC Contractor: Larsen & Toubro	Design phase
Utilize power line towers which are friendly to birds	EPC Contractor: Larsen & Toubro	Design phase
Select the most favorable entrance with the least impact to or within the surrounding area. For example, the entrance to the south side of the site, just north of the Thapyeywa Primary Substation	Developer:Convalt Energy EPC Contractor: Larsen & Toubro	Planning & Design Phase
Storm Water Management		
Any storm water within the site will be handled in an effective manner. Split clean and dirty water streams during storms around the facility, install basins, ditches or dams where needed.	EPC Contractor: Larsen & Toubro	Planning, Design and Operation Phase
Site Establishment		
Working areas and excavation sites secured	EPC Contractor: Larsen & Toubro	Construction
Fence and secure the area where necessary to control access	EPC Contractor: Larsen & Toubro	Construction
Footprints for roads, buildings and cables should be fenced and secured. There should not be any inappropriate disturbances close to the perimeter area without the consent of the Consulting Engineer	EPC Contractor: Larsen & Toubro	Construction
Establish all necessary sanitary facilities for construction employees as well as chemical storage	EPC Contractor: Larsen & Toubro	Construction
Ensure no sanitation facilities are located within 100 meters from a permanent water source such as streams or wetlands	EPC Contractor: Larsen & Toubro	Construction and Operation

Mitigation Action and Control	Responsibility	Time-frame
Dispose of all solid waste collected at an appropriately designated disposal site agreed upon with the local authorities	Contractor (to be chosen)	Construction
Ensure adequate waste collection containers at the project site	EPC Contractor: Larsen & Toubro	Construction
Construction Phase Employment		
Where possible, source high amounts of less skilled work force, which can be sourced, from the surrounding communities. Surrounding communities being Meiktila, Wundwin and Thazi	EPC Contractor: Larsen & Toubro	Prior to and during construction
Implement appropriate training and development of skill programs prior to construction start	EPC Contractor: Larsen & Toubro	Prior to and during construction
Identify as many opportunities as possible for local businesses	EPC Contractor: Larsen & Toubro Developer: Convalt Energy	Prior to and during construction
Ensure to undertake local sub-contractors who are qualified for the work required	EPC Contractor: Larsen & Toubro	Prior to construction
For any employees housed on the project site, develop a Code of Conduct to cover the activities	Developer: Convalt Energy EPC: Larsen & Toubro	Prior to and during construction
Ensure that all construction employees attend training sessions before construction starts informing of the rules and regulations governing activities on the site as set out in the Code of Conduct	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Prior to construction
When the construction phases are completed, ensure that all and any construction employees leave the project site	EPC Contractor: Larsen & Toubro	At construction finalization
Safety, Dust, Noise, Air, Disturbance		
Ensure that open fires on the site is prohibited and make employees aware of consequences of starting fires	EPC Contractor: Larsen & Toubro	During construction
Wet roads and excavation sites in order to mitigate dust emissions when transporting of performing construction work when required during for example, strong winds or extra dry days.	EPC Contractor: Larsen & Toubro	During pre-construction and construction

Mitigation Action and Control	Responsibility	Time-frame
Ensure that all vehicles used are road eligible and well maintained with qualified drivers that have been made aware of safety issues	EPC Contractor: Larsen & Toubro	During pre-construction and construction
Ensure that all drivers obey speed regulations and limits	EPC Contractor: arsen & Toubro	Duration of construction
Ensure that any damages to local road networks and road related paths are repaired before construction is completed	EPC Contractor: Larsen & Toubro	Prior to construction finalization
Ensure that maintenance is performed on all local roads, private and public accesses, which are being used by the Contractor in order to minimize damages. Damages such as potholes must be repaired and storm water management must be maintained	EPC Contractor: Larsen & Toubro	Construction phase
Any roads used by the Contractor, public or private road networks, must always be maintained and cleaned as necessary from litter and gravel or other rubbish	EPC Contractor: Larsen & Toubro	Duration of construction
Ensure that any footprint of the facility and associated infrastructure is minimized	Developer: Convalt Energy EPC Contractor: Larsen & Toubro	Duration of construction
Ensure that any damaged areas are refurbished or repaired before construction completion	EPC Contractor: Larsen & Toubro	Duration of construction
Any vehicle or other road activity must have minimized disturbance to surrounding communities.	EPC Contractor: Larsen & Toubro	Duration of construction
Ensure to minimize airborne dust emissions from vehicles or other related activities as a result of the construction	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that construction materials and equipment are securely fastened on logistics vehicles so that there is no risk of blowing off during strong winds	EPC Contractor: Larsen & Toubro	Duration of the contract
Manage the speed of construction vehicles to follow the local rules and regulations. Consulting Engineer to oversee.	EPC Contractor: Larsen & Toubro	Duration of the contract
During extra windy periods, increase the dust emission control if dust debris is negatively impacting surrounded communities.	EPC Contractor: Larsen & Toubro	Duration of the contract
If deemed necessary by regulatory ministries, re-grow vegetation in disturbed areas.	EPC Contractor: Larsen & Toubro	Construction finalization

Mitigation Action and Control	Responsibility	Time-frame
Ensure that all vehicles and equipment are maintained in to road safe conditions at all times.	EPC Contractor: Larsen & Toubro	Duration of the contract
If any complaints show that current performance is inadequate, the source of the issue shall be identified and current procedures or equipment must be enhanced to ensure further issue development.	EPC Contractor: Larsen & Toubro	Duration of the contract
Vegetation		
Ensure that any clearance of vegetation is minimized as far as possible and when possible, re-growth of any areas possible must commence.	EPC Contractor: Larsen & Toubro	Construction phase
Ensure that any impacts as a result of construction activities are confined within the project perimeter and aligning infrastructure.	EPC Contractor: Larsen & Toubro	Construction phase
Ensure that any unnecessary impacts on surrounding flora are avoided as much as possible. Establish and use clear routes and access roads.	EPC Contractor: Larsen & Toubro	Construction phase
Ensure that once construction is complete in one area, that area is rehabilitated as soon as possible.	EPC Contractor: Larsen & Toubro	Construction phase
Ensure that any sensitive flora, if any have been identified, is avoided during construction.	EPC Contractor: Larsen Toubro Consulting Engineer: To be chosen	Construction phase
Ensure that no trees or other vegetation is removed unnecessarily outside of the designated project site during construction.	EPC Contractor: Larsen & Toubro	Construction phase
Ensure safe parking of all vehicles on flat ground, preferably without any underlying vegetation to avoid any possible contamination from leakage.	EPC Contractor: Larsen & Toubro	Construction phase
Ensure that no vegetation is removed unless authorized by the Consulting Engineer.	EPC Contractor: Larsen Toubro Consulting Engineer: To be chosen	Construction phase

Mitigation Action and Control	Responsibility	Time-frame
Ensure that the Consulting Engineer obtains any permission needed in order to deal with any additional clearing or altering of vegetation.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction phase

Mitigation Action and Control	Responsibility	Time-frame
Drainage and Ecology		
Ensure that any disturbance during construction close to water sources is minimized.	EPC Contractor: Larsen & Toubro	Construction and operational phase
Ensure that any and all possibly disturbed areas within the construction site are rehabilitated immediately.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction and operational phase
Ensure that any and all storm water is controlled.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction and operational phase
Ensure that sufficient permits are required from adequate authorities before altering any water source.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction and operational phase
Ensure that all access roads are planned and constructed in order to minimize any impacts on areas and prevent unnecessary excavations as much as possible	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Prior to and during construction
Ensure that all construction areas that require water such as wetting of excavation areas are wetted in order to perform work with minimized dust emissions when required.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	During construction
Ensure that any removal of vegetation that adds the benefit of soil stability is minimizes as much as possible	EPC Contractor:Larsen & Toubro Consulting Engineer: To be chosen	During construction
Ensure that proper erosion control measures are utilized. Measures such as fences, storm water drainage and sandbags	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Prior to and during construction

Mitigation Action and Control	Responsibility	Time-frame
Ensure that any bridge that travels over natural or existing water drainage routes are refurbished and upgraded as part of Corporate Responsibility.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Prior to and during construction.
Ensure that an adequate soil erosion management plan is implemented and monitored within the facility and along access routes. Apply erosion mitigation measures as necessary in order to prevent risk of potential erosion.	EPC Contractor: Larsen & Toubro	Prior to and during construction
Ensure that any storm water is adequately managed within the project site. Separate clean and dirty water sources around the designated facility. If needed, implement pump systems to aid existing infrastructure in handling the water and prevent erosion.	EPC Contractor: Larsen & Toubro	Prior to and during construction
Heritage		
Monitor any heritage area to ensure that project related activities avoid interference with any heritage or culturally important sites or structures.	Developer: Convalt Energy EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Prior to construction start
Any sites of social or cultural or historical value must be identified and avoided in order to stay protected during project activities.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction phase
All work within the project perimeter must halt if any area of archaeological or paleontological or graves of value is uncovered during construction and adequate institutions and authorities must be informed immediately and come to assess the findings.	Developer: Convalt Energy EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction phase
Visual Impacts		
Ensure that all plans regarding routes and roads around infrastructure that is being uses is environmentally responsive and meet local regulations and requirements.	EPC Contractor: Larsen & Toubro	During construction

Mitigation Action and Control	Responsibility	Time-frame
Ensure that responsible construction measures are prioritized and containing any and all construction related activities within the designated project area. This aids in limiting impacts of natural vegetation in surrounding areas.	EPC Contractor: Larsen & Toubro	During construction
Ensure that access to the construction site is limited and secured around the site and in particularly at the access roads.	EPC Contractor: Larsen & Toubro	During construction and operational phases
Ensure that all areas that have been disturbed as a result of construction activities are rehabilitated to acceptable visual standards.	EPC Contractor: Larsen & Toubro	During construction and operational phase
Maintain the project site. Keep the facility clean and waste free in order to keep a good appearance.	Developer: Convalt Energy	During construction and operational phase
Ensure that all fixed lighting structures are maintained and properly planned when installed in order to reduce negative visual impacts associated with glare and other light pollution.	EPC Contractor: Larsen & Toubro	During construction and operational phase as well as during maintenance
Maintain the facility in the cleanest most visually pleasing manner.	Developer: Convalt Energy	During O&M
Ensure that light fixtures are regularly maintained	Developer: Convalt Energy	During O&M
Ensure that any access to the solar power plant facility is limited as well as limit access to any and all associated infrastructure.	Developer: Convalt Energy	During O&M
Traffic and Logistics		
Ensure that all relevant permits for heavy loads and related logistics are obtained from the relevant local authorities.	EPC Contractor: Larsen & Toubro	Prior to construction start

Mitigation Action and Control	Responsibility	Time-frame
Designated access routes to the proposed project site must be clear to ensure safe passage in and out of the facility and area.	EPC Contractor: Larsen & Toubro	Prior to construction start
Ensure that no unauthorized changes in approved routes of transportation routes are allowed or conducted unless designated routes are closed for uncontrollable reasons.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure the implementation of adequate road management strategies on all roads affected by project activities. All contractors and employees should be bound to obey the set standards and safety procedures.	EPC Contractor: Larsen & Toubro	Prior to and during construction
Ensure that the mitigation of dust emissions is minimized on all roads at all times.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that scheduled arrivals and departures of logistics vehicles are organized to minimize negative impacts on local traffic.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that any and all delays in traffic as a result of construction related activities are kept to a minimum as much as possible and coordinated with local authorities when required.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that designated roads exist for any movement of vehicles on the project site.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that proper road signage or installed and maintained and updated in synergy with the project development phases. All signs must act in accordance with local regulations.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure proper maintenance of any and all vehicles by the Contractor.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that all project-associated vehicles abide by local road network traffic rules and speed limits and that all drivers carry valid drivers license.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that hard road surfaces are kept as narrow as possible.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that all damages to local road networks by construction or logistics vehicles are minimized.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that it is prohibited for logistics vehicles to carry more weight than allowed.	EPC Contractor: Larsen & Toubro	Duration of the contract

Mitigation Action and Control	Responsibility	Time-frame
Ensure that a proper traffic management plan is implemented for all site access roads and related roads to ensure that any and all risks of hazards are minimized and to ensure that negative traffic flow is minimized. The traffic management plan must contain measures to minimize any negative impacts on existing local traffic.	EPC Contractor: Larsen & Toubro	During construction

Mitigation Action and Control	Responsibility	Time-frame
Management of Liquid Hazardous Materials and Substances		
Ensure that "spill kits" are available on the project site for immediate spill and leak cleanup.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that immediate corrective actions are taken if any complaints or potential spillage which risk polluting the environment is identified, including cleaning up the affected surrounded environment as much as possible and implementing further mitigation measures.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that an effective leakage or spillage detection monitoring system is implemented for all possible hazardous substances during transportation, utilization and storage. The monitoring system must include preventive measures to limit the possibility of any potentially hazardous leakage or spillage of chemicals, oils or other liquids.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure the fastest possible remedial actions are taken if fuel is leaked or spilled	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that as much as possible of the used waste on the project site is subject to reusing. Containers and trash bins must be present on the project site for easy collection and storage. Separate metals from wood and general trash for example.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that local regulations and rules are followed regarding waste disposal and ensure that contractors that are hired to collect and dispose of waste are licensed contractors using licensed and authorized disposal sites.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that any toxic substances are stored in appropriate and safe containers in designated areas.	EPC Contractor: Larsen & Toubro	Duration of the contract
Dangerous waste is to be minimized as much as possible and must be transported by licensed and approved waste transport contractors to the licensed and authorized disposal sites.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that all waste is documented and records needs to be kept to detail quantity, category and waste fate. These waste records and documentations must always be available for audit.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Duration of the contract

Mitigation Action and Control	Responsibility	Time-frame
Ensure that all complaints are registered and maintained in order to be minimized and mitigated.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Duration of the contract
Ensure an adequate water quality monitoring system on the project site for any water source within or near the immediate project site perimeter.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that recycling, re-using and proper disposal is integrated into the waste management plan. Ensure that an adequate waste management plan is implemented.	EPC Contractor: Larsen & Toubro	Duration of the contract
Ensure that the area is cleared of any and all potentially contaminating or hazardous materials or wastes upon the finalization of the construction.	EPC Contractor: Larsen & Toubro	Construction finalization
Ensure that all necessary measures are taken to minimize negative footprint on surrounding natural ecology as determined by an ecological specialist. This includes fencing in the project construction area, clear signage around particularly sensitive areas.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Prior to construction start
Ensure that all waste materials, equipment and facilities relating to construction activities are removed from the site.	EPC Contractor: Larsen & Toubro	During construction stages within phases
Ensure that all fences or otherwise of a temporary nature is removed when the construction phase is finalized.	EPC Contractor: Larsen & Toubro	Construction finalization
Ensure that, where it may be required to mitigate and control erosion, adequate drainage and other erosion mitigating measures are taken when necessary.	EPC Contractor: Larsen & Toubro	During construction
Ensure that any hazardous materials are stored in safe and secured areas.	Developer: Convalt Energy	During O&M
Ensure that any and all storage areas are secured.	Developer: Convalt Energy	During O&M
Ensure that all replaced components of the facility during maintenance is appropriately disposed or reused at the authorized disposal site or sold to licensed contractors.	Developer: Convalt Energy	During O&M

Mitigation Action and Control	Responsibility	Time-frame
Ensure the minimization of leakage or spillage of oil, chemicals and other hazardous substances. Trained employees or personnel within designated areas should handle all usage of said substances. Ensure the immediate cleanup of any accidental spillage at all times in accordance with rules and regulations.	Developer: Convalt Energy	During O&M
Appoint a waste management contractor to deal with any and all waste collections and disposals.	Developer: Convalt Energy Waste Management Contractor: To be chosen	During O&M
Ensure that all waste is managed, stored and disposed of according to local authority and rules and regulations within licensed facilities or designated areas.	Developer: Convalt Energy	During O&M
Ensure that all general waste, such as waste from canteen or otherwise is recycled as much as possible and disposed of in accordance with local rules and regulations.	Developer: Convalt Energy	During O&M
Areas that may be Disturbed		
Any natural areas of extra sensitive nature of the facility perimeter should be monitored by the Consulting Engineer and the Contractor to ensure minimized negative impacts.	Developer: Convalt Energy Consulting Engineer: To be chosen	Prior to construction
If determined by the Consulting Engineer, replant indigenous plant species where deemed possible.	EPC Contractor: Larsen & Toubro Consulting Engineer: To be chosen	Construction finalization
Ensure that erosion is controlled along drainage lines and other necessary areas.	Developer: Convalt Energy Consulting Engineer: To be chosen	After rehabilitation efforts begin
Ensure annual inspections of the regrowth of any plants as a result of rehabilitation measures.	Developer: Convalt Energy Consulting Engineer: To be chosen	After rehabilitation efforts begin
Ensure that any and all vehicle traffic is limited and restricted to designated roadways.	Developer: Convalt Energy	During O&M

Mitigation Action and Control	Responsibility	Time-frame
Ensure that the existing local road networks are maintained in order to limit negative impacts on the nature surrounding the roads	Developer: Convalt Energy	During O&M
If deemed necessary, implement unwanted plant monitoring.	Developer: Convalt Energy	During O&M
In order to minimize any possible negative impacts to sensitive habitats around the facility, appoint an environmental manager is during the operational phase.	Developer: Convalt Energy	During O&M
Appoint a specialist to monitor the rehabilitation efforts.	Developer: Convalt Energy Ecological Specialist, E-Guard Environmental Services	Annually post construction finalization
Ensure fire spread preventive measures such as firebreaks and environmentally safe fire extinguishers are applied where deemed most effective.	EPC Contractor: Larsen & Toubro Developer: Convalt Energy	During construction and post construction finalization
Avifauna and Endemic Bird Species		
Ensure that all equipment and installations with potentially hazardous components are fitted with bird repellant or made safe for birds.	EPC Contractor: Larsen & Toubro Developer: Convalt Energy	During construction
Ensure that heights of power lines comply with local rules and regulations and are either made safe for birds or equipped with bird repellents.	EPC Contractor: Larsen & Toubro	During construction
Any incidents with fatalities of birds are to be recorded and future mitigation measures should be implemented to minimize bird fatalities.	Developer: Convalt Energy	During O&M
Control of Fire		
Ensure the provision of well maintained and effective firefighting equipment on the project site.	EPC Contractor: Larsen & Toubro	During construction
Ensure that training in firefighting is provided to selected operations and maintenance staff.	EPC Contractor: Larsen & Toubro Developer: Convalt Energy	During construction and O&M

Mitigation Action and Control	Responsibility	Time-frame
In the event of a fire, ensure the establishment of adequate communication is implemented.	Developer: Convalt Energy	Prior to construction start

Mitigation Action and Control	Responsibility	Time-frame
Employee Accommodations		
Ensure that no employee accommodation is installed outside of the project footprint or zone of influence in order to minimize negative impacts on the environment.	EPC Contractor: Larsen & Toubro	Prior to construction
Ensure that vegetation clearing and land leveling is kept to a minimum outside of the project perimeter in regards to construction employee accommodation.	EPC Contractor: Larsen & Toubro	During construction
Ensure that any and all negative impacts of the surrounding areas as a result of construction employee accommodations are rehabilitated.	EPC Contractor: Larsen & Toubro	Construction finalization

7.5 Emergency/Incident Response Procedures

The Contractor should develop emergency or incident actions during the construction phase as part of the ESMP. Any emergencies or incidents will be under the Operators responsibility during operational phase.

The construction phase should ensure the following, but not be limited to:

- The EPC Contractor should ensure that there is an initial Emergency Response Team (ERT) supported by the Developer;
- External Emergency Response Team (EERT) includes nearby medical service facilities, police stations and so on.

Provided by the Contracted, initial technical, financial and social resources for swift response during construction should always be present.

Figure 28: Roles and responsibilities in emergency / incident

Entity	Responsibilities
The Contractor management team	• Alert the ERT and have continuous communication with EERT. • Identify any emergency site to ensure safe response actions of the ERT. • Provide support and assistance if requested by the EERT, to aid response efforts.
External Emergency Response Team (EERT)	• Provide solutions for any identified incident and provide response.
All Contractor resources.	• To ensure response to any emergency situation, provide and support the people with equipment and tools as well as the funds necessary. • Keep healthy communication and reporting mechanisms with the various EERT to inform of the project process to help ensure fast and adequate responses.

The Contractors senior team should appoint an Emergency Response Team Leader (ERTL) who should lead the ERT and also appoint a deputy to help carry the following responsibilities. First-aid trained teams and the members of security will be the main assets of the ERT. ERT members must be mentally and physically fit for their responsibilities, which should be ensured by the Contractor.

The Construction Manager and Convalt Energy shall meet with response institutions in the surrounding area to discuss and prepare for the construction phase and the discussions should include, but not be limited to the following:

- Construction sites
- Construction time-frame and phasing
- Any construction techniques and equipment that will be used
- Any hazardous materials that will be brought to and stored in the construction premises and details on their applications and handling/management system. Liquids or solids.

- The Contractor's Emergency Management Plan (ESMP)
- Names and contact details of the ERT members
- The main objective of the meeting should be to provide the response institutions knowledge of the following:
- Comments on the sufficiency of the respective Emergency Management Plans
- Provide and exchange assessments of what potential incidences that are anticipated.
- Prepare plans for coordination and collaboration, which should be active during construction.

Before initiating the construction phase, the Contractor will make the following efforts to ensure effective and sufficient emergency response:

- Commission the ERT
- Commission all necessary support equipment and facilities in adequate working condition
- Prepare any arrangements necessary with the EERT
- Provide the ERT with proper training as well as encourage any currently train volunteers from the labor force
- Inform all construction workers of the emergency response procedures as well all facilities which would include evacuation plans, routes, assembly points as well as conduct any training for any anticipated emergency situation

Training events, drills and constant reminders should take place regularly to ensure effective emergency response mechanisms through the entire construction period.

With respect to the points raised above, the EPC Contractor and the Developer has the responsibility to provide emergency response services and to structure and coordinate emergency response procedures for this Solar Power project, ensure that specific emergency responsibilities allocated are organized and undertaken and ensure that employees and contractor third parties are trained and aware of all required emergency procedures. The roles and responsibilities surrounding this Solar Power project for the implementation of the Emergency Response Procedures are presented below:

Figure 29: Responsible Parties and Roles and Responsibilities

Responsible Parties	Roles and Responsibilities
Solar Power Facility General Manager	• Review monthly and annual spill reporting • Review emergency response drill outcomes and work with Health and Safety Manager and Environmental and Social Manager to identify necessary improvements • Appoint an Emergency Response Coordinator tasked with responding to emergencies in order to minimize disparate utilization of resources
Emergency Response Coordinator	• Respond to emergencies so as to minimize disparate utilization of resources
Evacuation Officer	• Ensure they are easily recognizable to their colleagues/visitors and the emergency services by wearing the orange high visibility vest or coat during any evacuation • Responsible for all occupants' safety during evacuation and to ensure the safety for personnel to reenter the building, unless his role is passed onto the Emergency Response Coordinator • Keep an updated list of employees and visitors on site and carry the name list with them during evacuation • Ensure all occupants have evacuated the area where the incident has taken place (including people in rest rooms, meeting rooms, etc.) • To be fully trained in the provision of first aid
Health and Safety Manager	• Distribution of the Emergency Response Plan to all parties with responsibilities in implementing the plan (including contractors) • Review monthly incident report • Review quarterly report of accidents/incidents and reviews of contractor practices • Plan emergency response drills with the Solar Power Facility General Manager and Contractor Managers • Develop Emergency Response Training • Lead any reviews or investigations into reported accidents/incidents • Review all contracts prior to signing and confirm these contain requirements to meet the Developers emergency response standards • Receive all notifications of incidents/accidents and ensure proper response is being followed including reporting and review
Environmental and Social Manager	• Support the Health and Safety Manager as required in emergency response planning and in development of training and management plans to ensure environment concerns are addressed • Provide regular incident and accident reporting
Health & Safety Support Staff	• Schedule monthly inspections and audits and resolve issues identified • Schedule emergency response training sessions for relevant staff • Prepare monthly incident report

Responsible Parties	Roles and Responsibilities
Security Manager	• Provide local management and coordination of security for personnel and operations at the project facility • Deliver security induction briefings for visitors, including international and Burmese employees, contractors and contractors' personnel • Provide briefings and recurring security awareness training for all personnel in security procedures, with specific focus on their job role as per the project security plan • Implement security risk mitigation measures and procedures as per the security plan in order to reduce risk to as low as reasonably practicable • Maintain local security and emergency response and other contingency plans to ensure they remain up-to-date • When requested, assist with investigations on incidents (including interviews, where necessary), writing clear reports to be provided to management. • Provide security support to Ethiopian and expatriate personnel working at remote locations (e.g. drilling teams) and provide field-level security advice and assistance with planning • Be the focal point for security issues in the field and at any camp • Execute community related tasks in consultation with the Solar Power Facility General Manager and ensure that good communication and harmonious relationship with external stakeholders is maintained • Maintain and develop local information network to understand concern from the local community and raise it to site manager for resolution
Project Manager	• Together with the Health & Safety Manager and Environmental and Social Manager is responsible for staffing, planning and day-to-day execution of the management measures described under this ERP during the construction phase of this Solar Power project. • As needed, this individual will develop and propose staff plans and contractual language to ensure that these measures are implemented by the EPC Contractor staff and contractors throughout the construction phase of the Project.
Operations Manager	• Together with the Health & Safety Manager and Environmental and Social Manager is responsible for staffing, planning and day-to-day execution of the management measures described under this ERP during the operational phase of this Project. • As needed, this individual will develop and propose staff plans and contractual language to ensure that these measures are implemented by the Developer staff and contractors throughout the operational phase of the Project.

Responsible Parties	Roles and Responsibilities
Contractors (Construction and Operations)	• Responsible for following the procedures and requirements indicated in construction and operational sections of this document.
All persons	• All persons employed by the Developer or under service contract for the Developer (e.g. contractors, transporters, drivers), who discover or cause an incident are responsible for immediate reporting to his or her supervisor.

7.5.1 Alert Procedures

Traditional and modern means of communicating throughout the site should always be ensured to be in working conditions. This should include any or all of the following:

- Audio Alarms (sirens or other alarm systems)
- Visual Alarms (rotating or blinking light with the proper color)
- Landline telephone and cellphone if possible coverage is available on site
- Walky-talky radio

Anyone who detects an emergency should first do the following:

- Inform other people in the area about the situation and emergency location
- Sound the nearest possible alarm and report the emergency to the ERT immediately.

The ERT should be the persons responsible for communicating with the EERT. If the ERTL is not available, the ERTL Deputy of the senior team shall carry authorization to communicate with the EERT. Any exceptions or changes to this rule should be defined in the Emergency Management Plans. It is important to provide the EERT when alerting with relevant information such as what type of emergency, correct location of the emergency, estimated severity of the emergency, estimated amount of people involved, what time the emergency occurred as details like these will help the EERT prepare appropriate actions.

Close to all communication equipment, the contact details and names of responsible persons as well as institutions should be available and strategically include but not be limited to:

- A section with relevant construction staff, the Contractor senior team, Contractor senior team deputy, first-aid personnel and construction foremen.
- EERT institutions/organizations
- Nearby villages and departments
- Consulting Engineer (CE)

The project site should be well equipped with audible and visual alarms, landline phones, and walky-talky radios for constant stable communication.

7.5.2 Emergency Response Situations

The table below contains suggestions on general procedures that must be refined and in detail.

The main responsibility during construction lies with the EPC Contractor and with the Developer during. The main responsibility during operations lies with the plant management team. Further description of the Emergency Management Plans in the final ESMP is to be delivered by the EPC Contractor.

Figure 30: Evacuation Procedure

Procedure	Remarks
Evacuate as rapidly in groups but avoid panic	Guided by the ERT, all and any staff, sub-contractors, site visitors must move out of the site
Evacuate through designated evacuation routes	The safe evacuation shall have been determined fast by the ERTL/deputy & immediately communicated to ERT members.
Move constantly until it is determined that all and anyone are out of harm's way	At least one restricted area must be established outside the emergency site
Conduct headcount once evacuated	Foremen to do head counts
Report missing persons to EERT immediately	The ERTL/deputy must communicate this information with the EERT
Assist any injured in evacuating and place them in the care of the ERT or EERT medics	The ERT should manage injured persons to ensure proper placement to the EERT is conducted
Unless instructed by the EERT, do not move injured persons that are in need of special care	ERTL/deputy must communicate with EERT to get instructions on situations such as these

Figure 31: Response Procedure during Medical Emergency

Procedure	Remarks
Always administer first aid, no matter the severity of any injury immediately.	First aid should always include: • Safety first • Do not move any victim unless it is expected that the victim will be in more danger when not moved for example, during fire or if EERT are unable to get to the insured's location or instructed by the EERT • First aid should always and only be conducted by properly trained personnel
Immediately communicate to all the EERT emergency medical services or nearest hospital.	• By the ERTL/deputy or authorized on-site emergency communication systems
Lead the EERT to the emergency location	ERTL/deputy ERTL should be responsible to instruct: • ERT member to rapidly meet EERT close to the access road or previously designated strategic location. That person shall hold safety vest, flag or other bright clear color gear to get their immediate attention and quickly assist in leading the EERT to the emergency site. • The ERT should also clear all roads for the EERT
If it is possible, immediately leave the project site and suspend work until further notice following ERT instructions	• This falls under following the evacuation procedures

Figure 32: Response Procedure In Case of Fire

Procedure	Remarks
Immediately alert fire situations	• Immediately call the attention of other people to the location of the fire, sound the nearest alarm and inform the foreman or closest ERT member to contact the fire department • Directly report the fire or other emergency situation to the ERTL/deputy
Halt all construction and operational activities and evacuate the project site	• Apart from the responsible ERT, all workers and other staff, site visitors and other concerned must immediately move out of the project site using the evacuation procedures
The ERT should, if circumstances allow, contain the fire or prevent the fire from spreading	• ERT members that were trained to mitigate fire should immediately assess the situation first before attempting to control the fire spread
Communicate with the closest fire/police institutions and emergency medical services	• The ERTL/deputy shall give information to the EERT such as fire location, cause of fire and estimated severity of the fire as well as give an assessment of possible injured persons close to the fire
Lead the EERT to the fire location of the fire	• The ERTL/deputy ERTL should instruct an ERT member to meet the EERT close to the access road or previously designated strategic location and thereafter lead the EERT to the site of the fire • That ERT person shall hold safety vest, flag or other bright clear color gear to get their immediate attention and quickly assist in leading the EERT to the emergency site. • The ERT should also clear all roads for the EERT
If it is possible, immediately leave the project site and suspend work until further notice following ERT instructions	• This falls under following the evacuation procedures

8 Conclusions

The ESIA findings argue that the development of the solar power plant in the district of Meiktila will produce local short-term and long-term employment and other business opportunities during the construction phase as well as the operational phase of the project. The electrification of nearby communities is expected to support local economic growth in the area as well as aid the efficiency of any medical or other institutional facilities with a more reliable power supply which will represent a significant social benefit for not only the surrounding area but also for the nation, especially where opportunities are currently limited.

The proposed project also represents a significant investment in clean, renewable energy infrastructure, which will represent a positive social benefit for the entire nation.

The conclusion has been made that no World Bank safeguard policies will be triggered concerning natural biodiversity or resettlement of any kind. The construction and operation of a solar power plant with photovoltaic (PV) technology is often seen as the most environmentally friendly way to produce electric power through utility scale developments.

The proposed Solar PV project is thus highly supported by the findings in the ESIA.

8.1 Social Findings

The main statistical results from the surveys conducted show the current conditions of the surrounding communities. There is a clear need of development within the infrastructure in each of the communities surveyed and 100% express the need for additional electrification, drainage and other basic community infrastructure. The main statistical results include:

- On a poverty index by District, Meiktila is ranked as the second poorest district in Myanmar according to the Framework of the Rural Development Group of Myanmar.
- The infrastructure is mostly in poor conditions by international standards but is considered normal by Burmese standards, which leaves room for improvement that may come as an indirect result of the proposed project.
- Regular and stable employment is very low
- The educational standard is considerably lower in the smaller communities
- It was determined that the majority of each community has an approximate 50% lack of community electrification, concluding that half of the citizens of all the surveyed communities lack the ability to connect to a stable electric power supply

The conducted assessment confirms that there will be no displacement or resettlement of any kind, nor any loss of land, assets or impacts on historical or cultural heritage. There is no great variety of ethnic groups as the vast majority of the population in the townships and surrounding districts are of Burmese ethnicity.

Overall, the negative impacts of the project implementation will be highly limited to noise of transportation vehicles and construction vehicles during the initial construction phases of the project, which are highly insignificant as effective mitigation measures can limit these impacts.

There is a high acceptability of the project expressed by the surveyed townships and Focus Group Discussions are scheduled to occur in some time during 2015 to gather initial thoughts on the project and its possible benefits to the surrounding communities. The FGD´s are expected to provide additional acceptability of the proposed project. As affirmed by all other electric power project consultations that have taken place in Myanmar the past 5 years, there is a clear demand for improved power supply on a nationwide basis.

All of the interviewed and surveyed townships accept and welcome the proposed project hoping it will not only bring a more stable source of power but also enhance the services between rural and urban economic systems in terms of provision of additional basic services and economic benefits as well as aid the government's goal of local electrification throughout rural and urban Myanmar.

It is considered that the economic situation and poverty incidence of the poorer communities surveyed is a direct effect of lack to basic health facilities, stable electricity, water and drainage services and good local road networks. The women and children of the poorer communities are particularly vulnerable to the lack of electricity, water supply and access to surrounding markets.

8.2 Environmental Findings

Solar Power Plants are associated with few environmental issues but Health and Safety should always be prioritized. Further details on the Environmental Findings can be found in the attached Biodiversity Study of the site.

Figure 33: Summary of Environmental Issues

Issue	Comment
Health and Safety	• There will be a number of full time staff employed at the site. Equal gender ratio male/female • Health and safety manuals will be present at the Solar Power Plant, both operation and maintenance manuals. • There will be regular safety training conducted and health and safety audits will be regularly conducted. • Staff will be issued with personal protective equipment (PPE) • There will be first aid trained staff present at all times at the site. There will also be a medical clinic installed with basic facilities and staffed on site or in the close proximity with an ambulance to and from the site on standby that the surrounding community can benefit from as well. • The Contractor must submit the EHS-MS plan for approval furthermore design and implement the EHS measures during the operational phase.
Noise	• The Solar Power Plant will not produce any noise what so ever while in operation. Noise will be produces for a limited time during construction from trucks hauling equipment and construction related activities.
Water supply	• The site will be mains water supply. • No chemicals will be used during construction or operation phases. • Water supply for the staff will be provided from installed wells and the water extracted will be treated in a way to make it absolute safe to drink.
Sanitation	• The site will be on mains sewerage. All, if any wastewater and sewerage is will be disposed of in an environmentally responsible way.
Solid waste	• There shall be plans to manage any solid waste that may be produces during constructional phases. The site will not produce any major waste during operations other than waste from canteen and staff.
Flooding	• Rain that may cause flooding at the site is not deemed a significant issue. New, open drains will be installed which will carry away any water from heavy rainfall. • The ESMP should include measures need to be put in place to manage any future potential contamination if any and the performance monitoring requires to be conducted even though the operation of the Solar Power Plant won't produce any contaminated waste.
Monitoring	• Environmental monitoring will take place constantly to measure any possible impacts. As thoroughly stated previously in this document, no noise or air pollution will be produced as a result of site operations. Wells will be installed to monitor groundwater.

Issue	Comment
Liabilities	• Liabilities are expected to be very minimal as all wrapping material and construction waste will be removed from the premises during construction of the project. Based on surveys carried out, there will be no pollution outside the immediate site during operations. Environmental liabilities would thus mainly be removal of waste such as construction material. • Future risk should be managed through the EHS-MS, which would control waste management. Groundwater sampling and periodic monitoring will be scheduled to ensure that there is no persistent pollution

The conclusion can be drawn that the development of the Solar Power Plant will be basically entirely confined to the designed fenced site with very little negative environmental impacts and the implementation of the ESMP is assumed to be of no significance and will act to mitigate any possible negative instances.

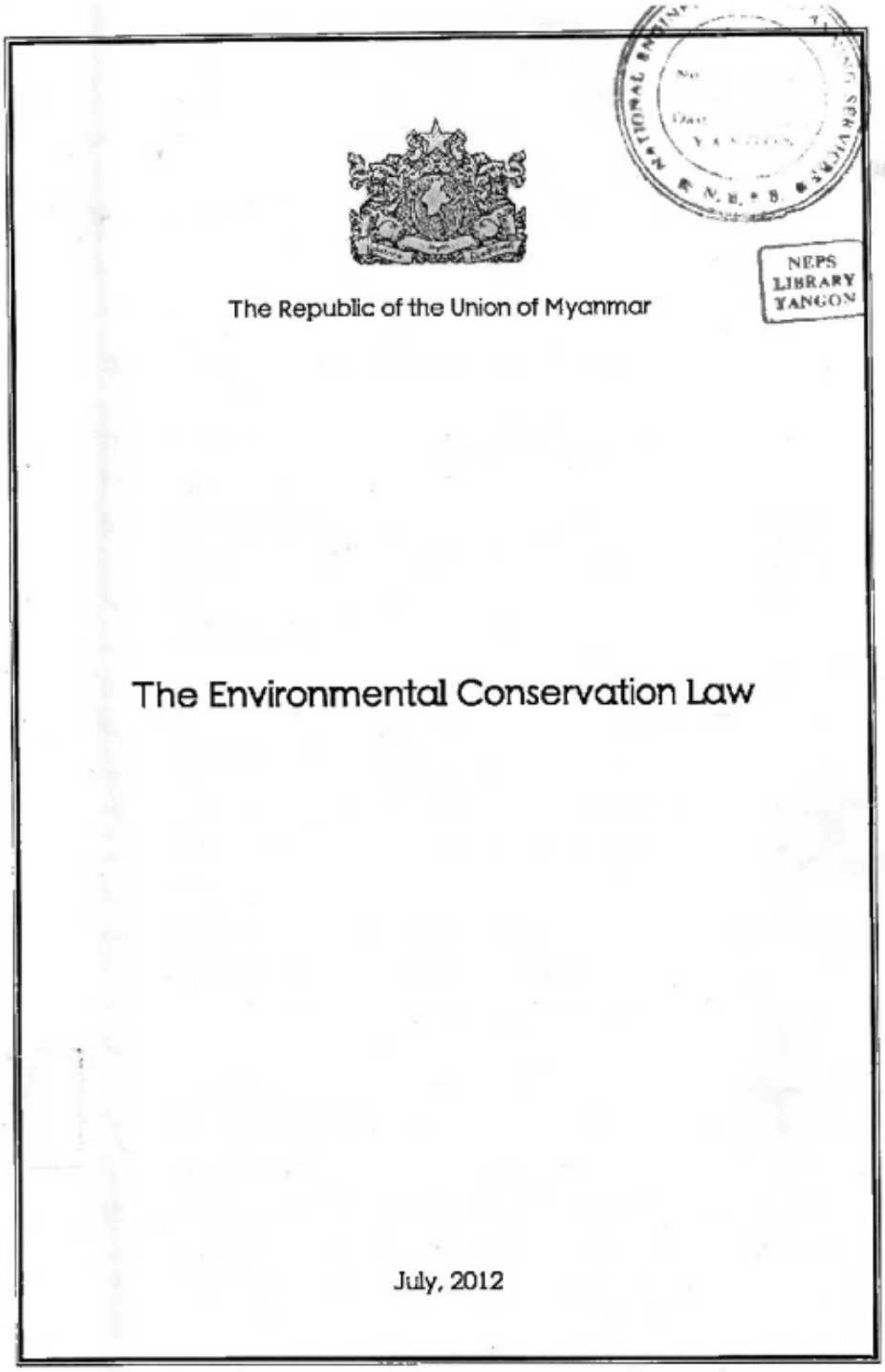
In the operational phase the Project will deliver net environmental benefits as the plant is entirely silent, causes no significant amount of waste other than canteen and staff, and does not intrude on endangered species of mammal or plant of any kind. Further benefit enhancement may take place if an integrated environmental management system is put in place.

The development and implementation of an EHS-MS will be an investment required by the Contractor in terms of training, tools and support. In order to verify the successful implementation of an EHS-MS as well as the ESMP through the construction phase and to further ensure that the environmental performance during the operational phase is accepted by both national and international standards, a qualified and internationally recognized third party should be appointed to conduct environmental audits.

Overall, there are no findings that would imply that the proposed Solar Power Project should not commence.

ANNEX

1. Environmental Law of Myanmar



The Environmental Conservation Law

The Pyidaungsu Hluttaw Law No. 9 / 2012

The 8th Waxing Day of Tagu, 1373 M. E.

(30th March, 2012)

The Pyidaungsu Hluttaw hereby enacts this Law:

Chapter I

Title and Definition

1. This Law shall be called **the Environmental Conservation Law.**
2. The following expressions contained in this Law shall have the meanings given hereunder:
   (a) **Environment** means the physical factors in the human environment, including land, water, atmosphere, climate, sound, odour, taste, the biological factors of various animals and plants and historical, cultural, social and aesthetic factors;
   (b) **Environmental Quality** means the balance of nature including man-made objects and also animals, plants, natural resources for the benefit of sustainability of nature and human beings;
   (c) **Environmental Quality Standard** means the parameters of general quality for enhancement and conservation of environmental quality for environmental situations;
   (d) **Environmental Audit** means periodic, systematically documented and objective evaluation to determine the followings:
      (i) correspond with regulatory requirements on environmental conservation;
      (ii) environmental management system;
      (iii) various possible environmental risks to the buildings, plots and premises.
   (e) **Pollution** means any direct or indirect alteration, effect of the physical, thermal, chemical or biological properties of any part of the environment including land, water and atmosphere by discharging, emitting or depositing environmental hazardous substances, pollutants or wastes so as to affect beneficial use of environment, or to affect public health, safety or welfare, or animals and plants or to contravene any condition, limitation or prohibition contained in the prior permission issued under this Law;
   (f) **Noise Pollution** means the occurrence of sound unit, which causes annoyance, fatigue, loss of hearing or interference with the perception of other sounds;
   (g) **Pollutant** means solid, liquid, or vapour which directly or indirectly alters the quality so as to affect beneficial use of any segment or element of the environment or is hazardous or potentially hazardous to health or causes pollution;
   (h) **Waste** includes solid, liquid, or vapour and also includes anything which is classified as waste in accord with this Law including radioactive substance which is discharged, emitted or deposited in the environment in such volume, constituency or any manner which causes environmental pollution;
   (i) **Hazardous Substance** means a substance or object which may affect health including explosive substance, substance which may be created and used as a biological weapon, substance which may be used as a nuclear weapon, inflammable substance, oxidizing and peroxidizing substance, toxic

substance, pathogenic substance, radioactive substance, genetic transforming substance, corrosive substance, irritating objects, whether chemical or not, which can be harmful to human being, animal, plant, property or environment;

(j) **Beneficial Use** means the use of the environment or any element or segment of the environment after making required protections from the adverse effects of wastes, discharges, emissions and deposits so as to cause public health, safety or welfare;

(k) **Cleaner Production** means the continuous application of multi-strategy on environmental conservation to processes, products and services to improve the use of resource efficiently, minimize waste, polluted water and emissions and conserve the healthy nature and human environment;

(l) **Control Equipment** includes the followings:

(i) any apparatus for collecting waste;

(ii) any automatic device which can be used for more effective operation of any equipment;

(iii) any device for indicating or recording pollution or warning of excessive pollution;

(iv) any other device or facility used for the purpose of limitation of pollution;

(m) **Ecosystem** means the natural system existing living, non-living substances and plants in compatibility and the natural environment, which have been evolving due to such system;

(n) **Owner** means owner, proprietor, operator in charge, lessor or receiver of any building, plots, or vehicle, or heir, trustee or representative of such person;

(o) **Occupier** means any person in occupation or control of any building, plot or any part of it, or any vehicle;

(p) **Environmental Emergency** means the situation, which may affect the safety and health of the public or the environment and ecosystem if natural or man-made disaster or pollution is not taken action immediately;

(q) **Committee** means the Environmental Conservation Committee formed under this Law;

(r) **Ministry** means the Union Ministry assigned by the Union Government to perform the matters of environment;

(s) **Department** means the relevant Department formed under this Law.

Chapter II

Objectives

1. The objectives of this Law are as follows:
   (a) to enable to implement the Myanmar National Environmental Policy;
   (b) to enable to lay down the basic principles and give guidance for systematic integration of the matters of environmental conservation in the sustainable development process;
   (c) to enable to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;
   (d) to reclaim ecosystems as may be possible which are starting to degenerate and disappear;
   (e) to enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;
   (f) to enable to implement for promoting public awareness and cooperation in educational programmes for dissemination of environmental perception;
   (g) to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation;
   (h) to enable to cooperate with Government departments, Government organizations, international organizations, non-government organizations and individuals in matters of environmental conservation.

Chapter III

Formation of the Environmental Conservation Committee

1.
   (a) The Union Government shall form the Environmental Conservation Committee with the Union Minister for the Union Ministry assigned by the Union Government as the Chairman and with suitable members to conserve the environment of the Republic of the Union of Myanmar;
   (b) In forming the Committee, the Vice Chairman, Secretary and Joint Secretary shall be assigned among the members of the Committee;
   (c) The Union Government may re-form the Committee.
2. The Union Government shall stipulate functions and duties of the Committee to enable to implement the objectives contained in this Law.
3. The powers of the Committee are as follows:
   (a) carrying out organizational education and activities relating to environmental conservation;
   (b) suggesting to enable to amend and insert, as may be necessary, the lessons on environmental conservation contained in school lessons after coordinating with the relevant departments;
   (c) accepting donations, grants, materials and technological aids from local and foreign and managing and using such money, materials and technologies as may be necessary in environmental conservation works;

(d) sending suitable suggestions and encouragements relating to environmental conservation to the relevant Government departments and organizations;

(e) asking necessary proposals and suggestions from the relevant Government departments and organizations for conservation and enhancement of environment;

(f) prohibiting the relevant Government departments and organizations if the environmental damages arise or situations for damage arise and, if necessary, asking policy to the Union Government;

(g) laying down and carrying out the Myanmar national environmental policies and other environmental policies for conservation and enhancement of environment with the approval of the Union Government.

Chapter IV

Duties and Powers relating to the Environmental Conservation of the Ministry

1. The duties and powers relating to the environmental conservation of the Ministry are as follows:

(a) implementing the environmental conservation policies;

(b) planning and laying down national or regional work plans relating to environmental management;

(c) laying down, carrying out and monitoring programmes for conservation and enhancement of the environment, and for conservation, control and abatement not to cause environmental pollution;

(d) prescribing environmental quality standards including standards on emissions, effluents, solid wastes, production procedures, processes and products for conservation and enhancement of environmental quality;

(e) submitting proposals to the Committee for economic incentive mechanisms and terms and conditions which may not affect the environment or cause least environmental affect for sustainable development in addition to legal affairs and guidelines relating to environment;

(f) facilitating for the settlement of environmental disputes and, if necessary, forming bodies to negotiate such disputes;

(g) specifying categories and classes of hazardous wastes generated from the production and use of chemicals or other hazardous substances in carrying out industry, agriculture, mineral production, sanitation and other activities;

(h) prescribing categories of hazardous substances that may affect significantly at present or in the long run on the environment;

(i) promoting and carrying out the establishment of necessary factories and stations for the treatment of solid wastes, effluents and emissions which contain toxic and hazardous substances;

(j) prescribing the terms and conditions relating to effluent treatment in industrial estates and other necessary places and buildings and emissions of machines, vehicles and mechanisms;

(k) negotiating, cooperating and implementing in respect of international, regional and bilateral agreements, instruments and programmes relating to matters of environment;

(l) implementing the international, regional and bilateral agreements accepted by Myanmar for environmental conservation and enhancement of environmental quality in accord with the guidance adopted by the Union Government or the Committee

(m) causing to lay down and carry out a system of environmental impact assessment and social impact assessment as to whether or not a project or activity to be undertaken by any Government department, organization or person may cause a significant impact on the environment;

(n) laying down guidance relating to the management, conservation and enhancement of environment for the matters of protection of ozone layer, conservation of biological diversity, conservation of coastal environment, mitigation and adaptation of global warming and climate change, combating desertification and management of non-depleting substances and management of other environmental matters;

(o) managing to cause the polluter to compensate for environmental impact, cause to contribute fund by the organizations which obtain benefit from the natural environmental service system, cause to contribute a part of the benefit from the businesses which explore, trade and use the natural resources in environmental conservation works;

(p) carrying out other functions and duties assigned by the Union Government relating to environmental conservation.

2. The Ministry shall establish an Environmental Management Fund in the Union Budget in accord with the financial regulations and by-laws of the Union for effective implementation of environmental conservation works in addition to the receipt from the Union Consolidated Fund.

Chapter V

Environmental Emergency

1.

(a) If the Committee is aware that an event of environmental emergency has occurred or may occur in the entire Myanmar or any Region or State or any area, it shall immediately report to the Union Government so as to declare the occurrence of such event;

(b) The Committee, Ministry and Department shall carry out necessary measures relating to the environmental emergency.

Chapter VI

Environmental Quality Standards

1. The Ministry may, with the approval of the Union Government and the Committee, stipulate the following environmental quality standards:

(a) suitable surface water quality standards in the usage in rivers, streams, canals, springs, marshes, swamps, lakes, reservoirs and other inland water sources of the public;

(b) water quality standards for coastal and estuarine areas;

(c) underground water quality standards;

(d) atmospheric quality standards;

(e) noise and vibration standards;

(f) emissions standards;

(g) effluent standards;

(h) solid wastes standards;

(i) other environmental quality standards stipulated by the Union Government.

2. The Ministry may, with the approval of the Union Government and the Committee, insert, modify and stipulate the environmental quality standards for the interests of the public in accord with the scientific and technological advances or requirement of work according to time and area.

3. If any environmental quality standard stipulated by any Government department,

Government organization under any existing law is more than the quality standard stipulated by the Ministry, it shall remain in force; however if it is less than such standard, only the standard stipulated by the Ministry shall be in force.

Chapter VII

Environmental Conservation

1. The Ministry shall, under the guidance of the Committee, maintain a comprehensive monitoring system and implement by itself or in co-ordination with relevant Government departments and organizations in the following matters:

   (a) the use of agro-chemicals which cause to impact on the environment significantly;

   (b) transport, storage, use, treatment and disposal of pollutants and hazardous substances in industries;

   (c) disposal of wastes come out from exploration, production and treatment of minerals, industrial mineral raw materials and gems;

   (d) carrying out waste disposal and sanitation works;

   (e) carrying out development and constructions;

   (f) carrying out other necessary matters relating to environmental pollution.

2. A person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards.

3. The owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impracticable, it shall be arranged to dispose the wastes in accord with environmentally sound methods.

4. A person or organization operating business in the industrial estate or business in the special economic zone or category of business stipulated by the Ministry:

   (a) is responsible to carry out by contributing the stipulated cash or kind in the relevant combined scheme for the environmental conservation including the management and treatment of waste;

   (b) shall contribute the stipulated users charges or management fees for the environmental conservation according to the relevant industrial estate, special economic zone and business organization;

   (c) shall comply with the directives issued for environmental conservation according to the relevant industrial estate, special economic zone or business.

Chapter VIII

Management of Urban Environment

1. The Ministry shall, for the management of urban environment, advise as may be necessary to the relevant Government departments and Government organizations, private organizations and individuals in carrying out the following matters in accord with the guidance laid down by the Committee:
   (a) land use planning and management including zoning;
   (b) management of the construction industry in pivotal urban centres;
   (c) management of housing settlements;
   (d) management of wastes;
   (e) pollution control including land, water, air and noise pollution;
   (f) other necessary environmental management.

Chapter IX

Conservation of Natural Resources and Cultural Heritages

1. The relevant Government departments and Government organizations shall, in accord with the guidance of the Union Government and the Committee, carry out the conservation, management, beneficial use, sustainable use and enhancement of regional cooperation of the following environmental natural resources:
   (a) forest resources;
   (b) land resources;
   (c) fresh water resources including underground water;
   (d) mineral resources;
   (e) agricultural resources;
   (f) fisheries resources;
   (g) marine resources;
   (h) natural ecosystems;
   (i) natural areas, wildlife, natural plants and biological diversity;
   (j) other natural resources stipulated by the Union Government.
2. The Ministry shall cooperate with the relevant Government departments and Government organizations in the matters of environmental conservation for perpetual existence of cultural heritage sites and natural heritage sites, cultural monuments and natural areas stipulated under any existing law.
3. The Ministry shall provide necessary technologies to the relevant Government departments and Government organizations in implementing the matters contained in sections 18 and 19.

Chapter X

Prior Permission

1. The Ministry may, with the approval of the Union Government, stipulate the categories of business, work-site or factory, work-shop which may cause impact on the environmental quality that requires to obtain the prior permission.
2. The owner or occupier of the category of business, work- site or factory, workshop stipulated by the Ministry under section 21 shall apply for the prior permission to the Ministry in accord with the stipulations.
3. The Ministry may, after scrutinizing whether or not the application made under section 22 is in conformity with the stipulations, grant or refuse to issue the prior permission by stipulating terms and conditions.
4. The Ministry may, in issuing the prior permission, stipulate terms and conditions relating to environmental conservation. It may conduct inspection whether or not it is performed in conformity with such terms and conditions or inform the relevant Government departments, Government organizations to carry out inspections.
5. The Ministry may, if it is found that a holder of the prior permission fails to comply with any of the terms and conditions relating to environmental conservation contained in the prior permission, pass any of the following administrative penalties:
   (a) causing to comply with in accord with the terms and conditions after warning, causing to sign the bond;
   (b) causing to comply with in accord with the terms and conditions after paying a fine.

Chapter XI

Insurance

1. The holder of the prior permission shall affect insurance according to the category of his business, work-site or factory, workshop for any accident that may cause impact on the environment, in accord with the existing law.
2. The Ministry shall give the remark if it is requested by the Myanmar Insurance on the extent and potential environmental impact in respect of the business, department or organization, which carries out the business to be insured under section 26.

Chapter XII

Prohibitions

1. No one shall, without the prior permission, operate business, work-site or factory, workshop which is required to obtain the prior permission under this Law.
2. No one shall violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under this Law.
3. No one shall, without permission of the Ministry, import, export, produce, store, carry or trade any material which causes impact on the environment prohibited by the Ministry.

Chapter XIII

Offences and Penalties

1. Whoever, without the prior permission, operates business, work-site or factory, workshop which is required to obtain the prior permission under this Law shall, on conviction, be punished with imprisonment for a term not exceeding three years, or with fine from a minimum of one hundred thousand kyats to a maximum of one million kyats, or with both.
2. Whoever violates any prohibition contained in the rules, notifications, orders, directives and procedures issued under this Law shall, on conviction, be punished with imprisonment for a term not exceeding one year, or with fine, or with both.
3. Whoever shall:
   (a) if convicted under section 32, be passed an order to compensate for damage due to such act or omission;
   (b) if ordered under sub-section (a), and fails to pay the compensation to be paid, be recovered in accord with the existing revenue laws.
4. Whoever imports, exports, produces, stores, carries or trades any material prohibited by the Ministry due to its impact on environment shall, on conviction, be punished with imprisonment for a term from a minimum of three years to a maximum of five years, or with fine from a minimum of one hundred thousand kyats to a maximum of two million kyats, or with both. Moreover, he shall incur the expenditure for the treatment and disposal of such material until the process that has no impact on the environment.

Chapter XIV

Miscellaneous

1. In prosecuting an offender under this Law, prior sanction of the Ministry shall be obtained.
2. The Ministry may, with the approval of the Union Government, exempt or relieve any Government department, organization or private business from complying with any provision contained in this Law for the interests of the Union and its people.
3. If any Government department, organization or individual incurs the expenditures for any action due to the declaration of environmental emergency, such expenditures are entitled to
4. The relevant Government department, Government organization authorized to issue license, permit or register for enabling operation of category of business, work-site or factory, workshop which is required

to obtain the prior permission shall issue such license, permit, or register only to the business, work-site or factory, workshop which has obtained the prior permission under this Law.

5.

(a) The Ministry shall, if the person obtained the prior permission who was imposed with administrative penalty under section 25 fails to comply with the terms and conditions, inform the relevant Government department, Government organization authorized to issue license, permit or register for the relevant business, work-site or factory, workshop to enable to take action as may be necessary.

(b) The Government department, Government organization received information under sub-section (a) may, after making necessary inquiries if it is found that any terms and conditions of environmental conservation contained in the prior permission is not complied with, cancel the issued license, permit or register or suspend it for a limited period.

6. The offence contained in section 32 is determined as the cognizable offence.

7. The provisions relating to environmental conservation contained in the laws, rules, orders, directives and procedures issued before the enactment of this Law shall remain in force unless it is contrary to the provisions contained in this Law.

8. In implementing the provisions contained in this Law:

(a) the Ministry may issue necessary rules, regulations and by-laws with the approval of the Union Government;

(b) the Committee and the Ministry may issue necessary notifications, orders, directives and procedures.

I hereby sign under the Constitution of the Republic of the Union of Myanmar.

(Sd.) Thein Sein

President of the Union

Republic of the Union of Myanmar

2. Photographic Record of Proposed Solar Site

Meiktila-Wundwin Highway. Entrance is located to the right hand site on this highway

Site entrance located directly off Meiktila-Wundwin Highway

Dirt road leading from the highway to the northern part of project site

View from the northern part of the site looking north towards Wundwin

View from the northern part of the site looking east

View from the northern part of the site looking west, towards Meiktila-Wundwin Highway

View from the northern part of the site looking south towards Thazi, which is located behind the hills in the background.

South Entrance leading to south edge of site

Road leading up to south edge of site

South edge of site, looking south towards Thapyeywa Primary Sub Station

South edge of site, looking north towards Wundwin

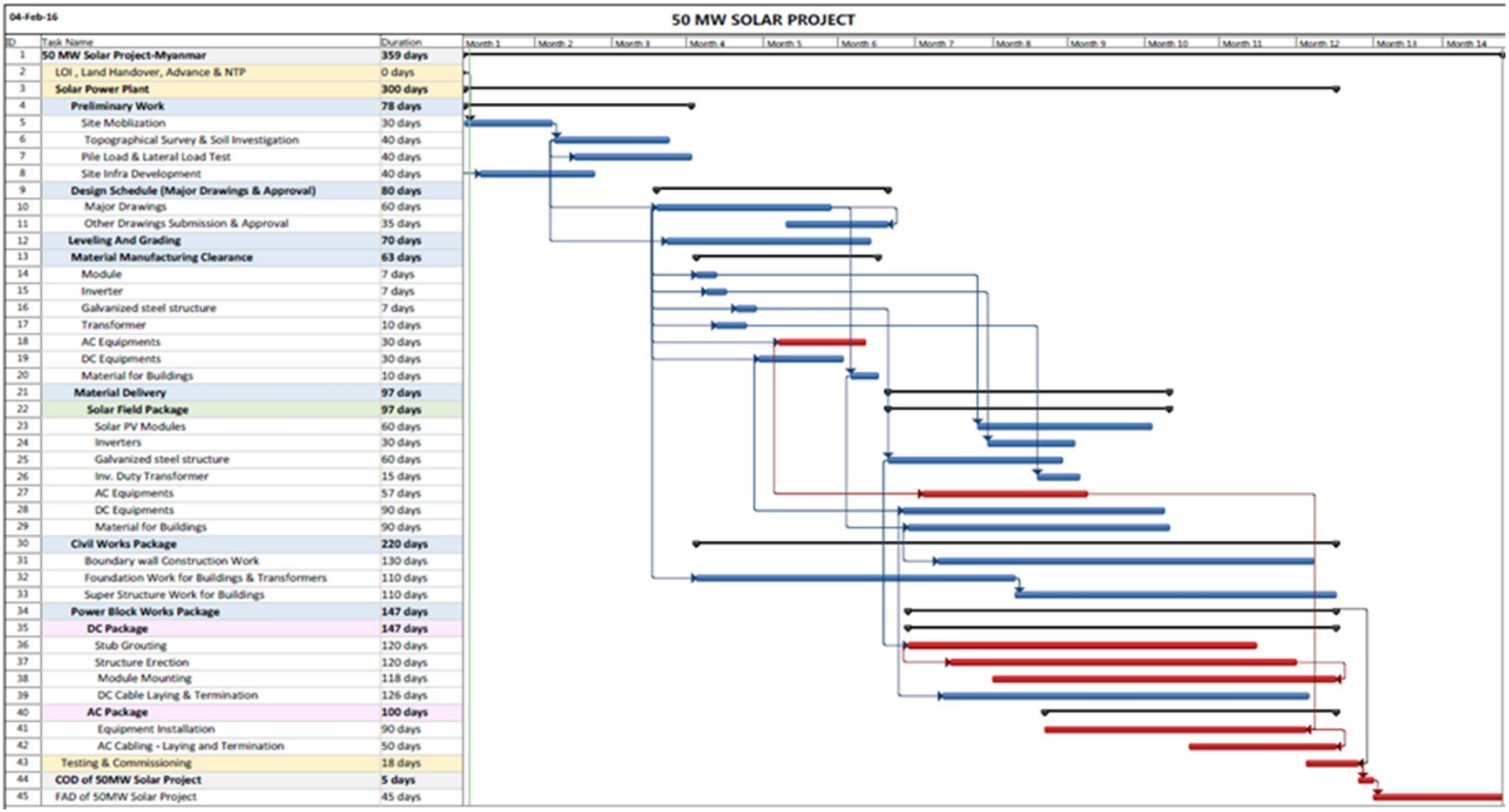
South edge of site, looking west towards Meiktila-Wundwin Highway

South edge of site, looking east

Evidence of garbage being either dumped or burnt on project site.

3. Tentative Construction Schedule

The implementation of the 2x150MW solar PV power plants is expected to be carried out over a period of 30-36 months. The first stage, of 50MW, is expected to be completed within 6-9 months from the start of construction. It is assumed that the required transmission line will be ready by the time the plants are commissioned. The below represents an indicative, generic construction time schedule. The final construction time schedule will be aligned with the selected EPC Provider, ACO/Convalt, Co-Investors and banks prior to Financial Close.



ID	Task Name	Duration
1	**50 MW Solar Project-Myanmar**	**359 days**
2	LOI , Land Handover, Advance & NTP	0 days
3	**Solar Power Plant**	**300 days**
4	**Preliminary Work**	**78 days**
5	Site Moblization	30 days
6	Topographical Survey & Soil Investigation	40 days
7	Pile Load & Lateral Load Test	40 days
8	Site Infra Development	40 days
9	**Design Schedule (Major Drawings & Approval)**	**80 days**
10	Major Drawings	60 days
11	Other Drawings Submission & Approval	35 days
12	**Leveling And Grading**	**70 days**
13	**Material Manufacturing Clearance**	**63 days**
14	Module	7 days
15	Inverter	7 days
16	Galvanized steel structure	7 days
17	Transformer	10 days
18	AC Equipments	30 days
19	DC Equipments	30 days
20	Material for Buildings	10 days
21	**Material Delivery**	**97 days**
22	**Solar Field Package**	**97 days**
23	Solar PV Modules	60 days
24	Inverters	30 days
25	Galvanized steel structure	60 days
26	Inv. Duty Transformer	15 days
27	AC Equipments	57 days
28	DC Equipments	90 days
29	Material for Buildings	90 days
30	**Civil Works Package**	**220 days**
31	Boundary wall Construction Work	130 days
32	Foundation Work for Buildings & Transformers	110 days
33	Super Structure Work for Buildings	110 days
34	**Power Block Works Package**	**147 days**
35	**DC Package**	**147 days**
36	Stub Grouting	120 days
37	Structure Erection	120 days
38	Module Mounting	118 days
39	DC Cable Laying & Termination	126 days
40	**AC Package**	**100 days**
41	Equipment Installation	90 days
42	AC Cabling - Laying and Termination	50 days
43	Testing & Commissioning	18 days
44	**COD of 50MW Solar Project**	**5 days**
45	FAD of 50MW Solar Project	45 days

4. Tentative Solar Plant Layout

5. Technical Description of Plant

6. Wundwin - Tharsi 105 Map

Notarial Translation
(State Emblem)

Land Record 105

THE TRACING SHEET FOR ~~UNCERTIFIED~~ / CERTIFIED COPY OF THE PRESENT YEAR, HOLDING IN THE CURRENT MAP

Court Fee K. 300/-

2015 - 0416157

Region / ~~State~~ - **Mandalay**
District - **Meikhtila**
Township/~~Sub-Township~~ - **Tharsi**
~~Ward~~ / Village-tract - **Wanthar + Wattoe**
Kwin / Block No. & Name - **1626, 1627, 1629, 1630, 1631, 1632, 1633**
Holding No./Plot No. -

MAP

NOTARY PUBLIC AT YANGON
REPUBLIC OF UNION OF MYANMAR
U AYE MAUNG

Holding No.	Name of owner assessee, Grantee/ Lessee.	Possessive right	Kind of Land and Class	Area (acre)	Remark
-	-	Government	(OA) other land	850.00 Acre	as per Township General Administration Department's of Letter No. 5/43-102/Oo 6 (1428) , dated : (1.12.2015)

Subject for copy - To Register at Myanmar Investment Commission (MIC)/ ACO Company (May use only for the said cause)
Applicant Name - **U WIN SHEIN** (Regional Government Secretary)
Application Date - 1.12.2015
Delivery date to applicant - 9.12.2015

(Round Seal of
Township Farmland Administration and
Statistics Department, Tharsi,
Letter No. ....., Date .....)

Office Seal

Verified and confirmed
Signature of Head of Township Land Records Dept;

Sd/x x x, Township Head Officer
Farmland Administration and Statistics Department
Tharsi.

Certify that the above map is copied carefully from the map surveyed for the 2015-16 and that being a supplementary surveyed map.
Signature or Record - Keeper / Surveyor.
Sd/ x x x
Surveyor (4)
Group No. ( ), Township Land Records Dept;
Tharsi
Date : 9.12.2015
Checked and found Correct.
Signature of Assistant Head Officer,
Date : 9.12.2015
Sd/x x x, Assistant Head Officer
Township Land Records Department, Tharsi.

Date :

AUTHENTICATE, true and correct English Translation.

14-12-15

U Aye Maung, B.Com.,B.L.,
Advocate & Notary Public.,
No. 563 (1 st,Floor) Merchant Street,
Yangon, Tel: 386976

NOTARY PUBLIC U AYE MAUNG

14 DEC 2015

Noted as No. ๑๑๑๑๒๒ of 20 ๑๕

AUNG MYIN Desktop Centre *No. 54, Maharbandoola Garden Street, Kyauktada Township, Yangon, Tel : 252205,*

NOTARIAL TRANSLATION

NOTARY PUBLIC AT YANGON * REPUBLIC OF UNION OF MYANMAR * U AYE MAUNG

(Round Seal)

HISTORY OF HOLDING LAND

Land Records 106
District - **Meikhtila,** Township - **Tharsi,** Survey Clerk Group **Wanthar + Wattoe,** Block No. & Name .....

Year	Holding	Name of Assessee (or) Grand Owner (or) Tenant	Possessive Right	Land Class & Rank	Area (Acre)	Taxing Fine (Ks)	Form of transfer	Remarks
1	2	3	4	5	6	7	8	9
2015-16	-	-	Governement	OA Other Land	850.00 acre		as per Township General Administration Department's of Letter No. 5/43-102/Oo 6 (1428) , dated : (1.12.2015)	

Applicant Name - **U WIN SHEIN** (Regional Government Secretary)
Application Date - 1.12.2015
Date of delivery - 9.12.2015
Subject for copy - To Register at Myanmar Investment Commission (MIC)/ ACO Company
(May use only for the said cause)

Sd/x x x, Township Head Officer
Farmland Administration and Statistics Department
Tharsi.

Checke and found correct Signature
of Assistnat Head Officer
Sd/x x x
Assistant Head Officer
Township Land Records Department
Tharsi.

Certify that the above map is copied carefully from the map surveyed for the 2015-2016 and that being a supplementary surveyed map.
Signature or Record - Keeper / Surveyor.
Date : 9.12.2015
Sd/x x x, Survey (4)
Group No. ( ), Township Land Records Department
Tharsi.

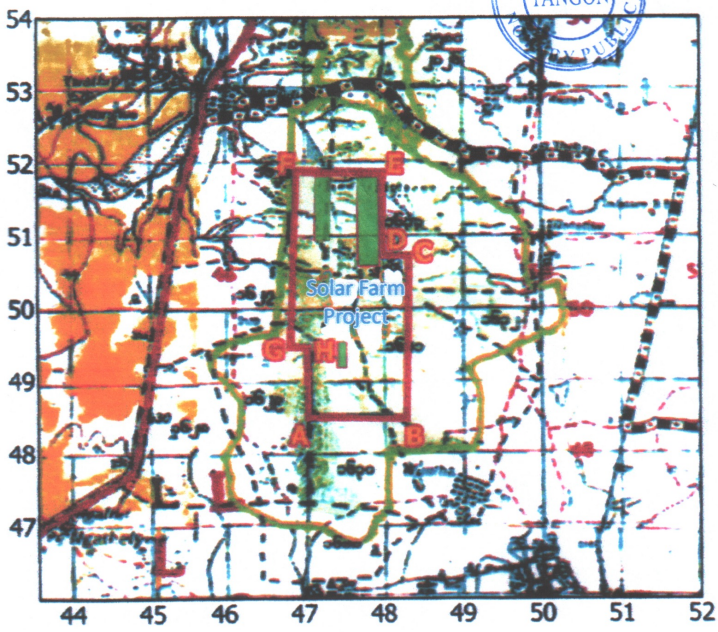
AUTHENTICATED, true and correct English Translation.

14-12-15

U Aye Maung, B.Com.,B.L.,
Advocate & Notary Public.,
No. 563 (1 st,Floor) Merchant Street,
Yangon, Tel: 386976

Noted as No.4476/12 of 2015.

14 DEC 2015



Estimated Map Reference

(1000) Acre

(A) 470485

(B) 483485

(C) 483507

(D) 480507

(E) 480519

(F) 468519

(G) 468495

(H) 470495

U THAN AUNG YANGON NOTARY PUBLIC

Certified True Signature(s) / Document(s)

Applied Land Space – 850 Acre

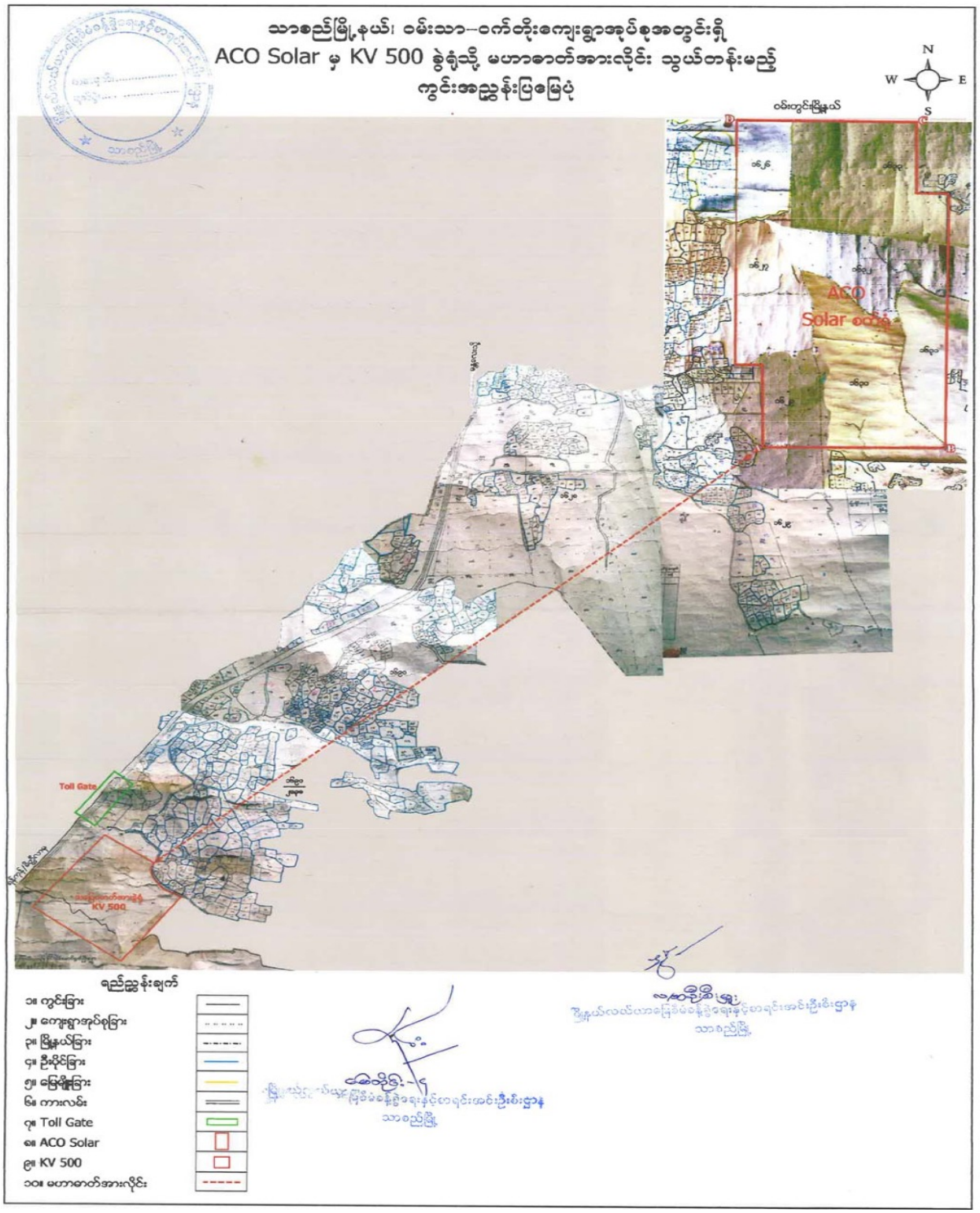
Reserved Forest Plantation Area – 150 Acre

Doc No: 27300/15

28 DEC 2015

U THAN AUNG (B.A.,LL.B)
ADVOCATE & NOTARY PUBLIC
Room No. 203, 2nd Floor, No. 563 MAC Tower
Merchant Street, Kyauktada Township.
Yangon, Myanmar. H.P : 095161364

7. Right of Way



8. Tentative Hardware Vendors

8.1. Inverters

Solar inverters

ABB central inverters
PVS800
100 to 1000 kW

ABB central inverters raise reliability, efficiency and ease of installation to new levels. The inverters are aimed at system integrators and end users who require high performance solar inverters for large photovoltaic (PV) power plants. The inverters are available from 100 up to 1000 kW, and are optimized for cost-efficient multi-megawatt power plants.

World's leading inverter platform
The ABB central inverters have been developed on the basis of decades of experience in the industry and proven technology platform. Unrivalled expertise from the world's market and technology leader in frequency converters is the hallmark of this solar inverter series.

Based on ABB's highly successful platform and the most widely used frequency converters on the market – the inverters are the most efficient and cost-effective way to convert the direct current (DC) generated by solar modules into high-quality and CO_2-free alternating current (AC) that can be fed into the power distribution network.

Solar inverters from ABB
ABB central inverters are ideal for large PV power plants but are also suitable for large-sized power plants installed in commercial or industrial buildings. High efficiency, proven components, compact and modular design and a host of life cycle services ensures ABB central inverters provide a rapid return on investment.

Highlights
- High total performance
- Modular and compact product design
- Extensive DC and AC side protection
- Full grid support functionality
- Fast and easy installation
- Complete range of industrial-type data communication options, including remote monitoring
- Life cycle service and support through ABB's extensive global service network

Power and productivity for a better world™ ABB

Maximum energy and feed-in revenues
ABB central inverters have a high total efficiency level. Optimized and accurate system control and a maximum power point tracking (MPPT) algorithm together with high efficiency power converter design ensure that maximum energy is delivered to the power distribution network from the PV modules. For end users this generates the highest possible revenues from the feed-in tariffs.

Proven ABB components
The inverters comprise proven ABB components with a long track record of performance excellence in demanding applications and harsh environments. Equipped with extensive electrical and mechanical protection, the inverters are engineered to provide a long and reliable service life of at least 20 years.

Compact and modular design
The inverters are designed for fast and easy installation. The industrial design and modular platform provides a wide range of options like remote monitoring, fieldbus connection and modular and flexible DC input cabinet. The integrated DC cabinet saves space and costs as the solar array junction boxes can be connected directly to the inverter DC cabinet fused busbars. The inverters are customized to meet end user needs and are available with short delivery times.

Effective connectivity to power distribution network
ABB's transformerless central inverter series enables system integrators to design the PV power plant using optimum combination of different power rating inverters. Inverters are connected to the medium voltage (MV) power distribution network either centrally or in a distributed manner depending on the plant size and shape and network connection position.

Advanced grid support features
ABB central inverter software includes all the latest grid support and monitoring features including active power limitation, low voltage ride through (LVRT) with current feed-in and reactive power control. Active and reactive power output can be limited by using an external source. Active power can also be limited automatically as a function of grid frequency.

All grid support functions are parameterized allowing easy adjusting for local utility requirements. ABB central inverters are also able to support grid stability even at night by providing reactive power with the DC input disconnected.

ABB central inverters

PVS800

100 to 1000 kW

High total performance

- High efficiency
- Low auxiliary power consumption
- Efficient maximum power point tracking
- Long and reliable service life of at least 20 years

Modular industrial design

- Compact and easy-to-maintain product design
- Fast and easy installation
- Integrated and flexible DC input cabinet

Full grid support functionality

- Reactive power compensation also during the night time
- Active power limitation
- Low voltage ride through with current feed in

Extensive protections

- DC and AC side protection with built-in fuses, surge protection and filters
- Increased reliability and safety with DC and AC side contactors
- Heavy-duty surge protection

Grid code compatibility

- Wide country-specific grid code compliance
- Adjustability to various local utility requirements

Proven technology

- Based on ABB's market-leading technology platform used in frequency converters

Life cycle service and support

- ABB's extensive global service network
- Extended warranties
- Service contracts
- Technical support throughout the service life

Wide communication options

- Complete range of industrial-type data communication options
- Ethernet/Internet protocol
- Remote monitoring

ABB central inverters

PVS800

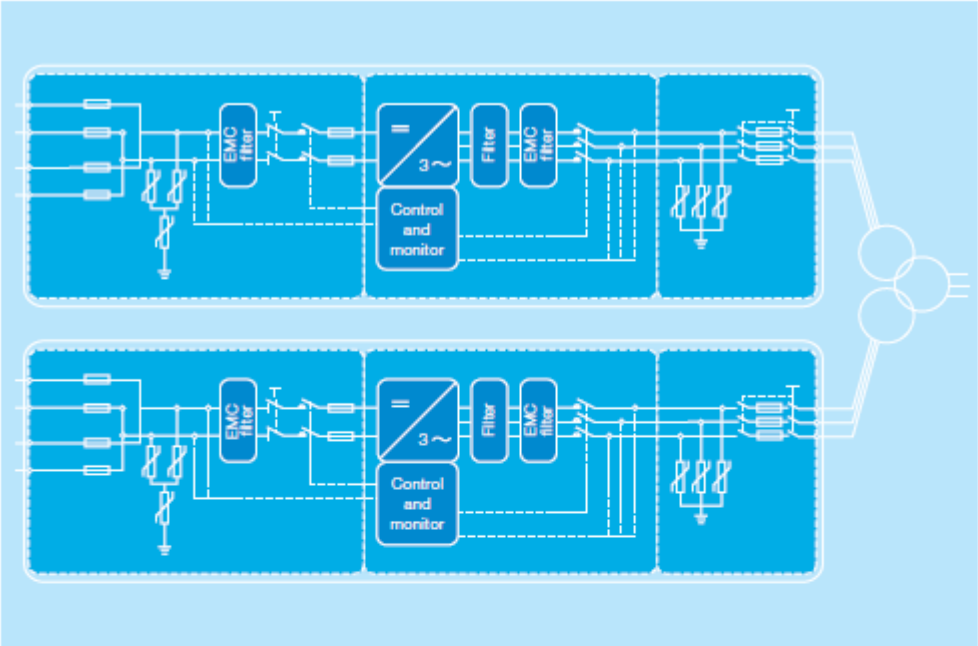
100 to 1000 kW

Technical data and types

Type designation PVS800-57	-0100kW-A 100 kW	-0250kW-A 250 kW	-0315kW-B 315 kW	-0500kW-A 500 kW	-0630kW-B 630 kW	-0875kW-B 875 kW	-1000kW-C 1000 kW
Input (DC)							
Maximum input power (P_{PV_max}) [1]	120 kWp	300 kWp	378 kWp	600 kWp	756 kWp	1050 kWp	1200 kWp
DC voltage range, mpp (U_{dc_mpp})	450 to 825 V	450 to 825 V	525 to 825 V	450 to 825 V	525 to 825 V	525 to 825 V	600 to 850 V
Maximum DC voltage ($U_{max\ DC}$)	1000 V	1000 V	1000 V	1100 V	1100 V	1100 V	1100 V
Maximum DC current ($I_{max\ DC}$)	245 A	600 A	615 A	1145 A	1230 A	1710 A	1710 A
Number of protected DC inputs	1 (+/-) /4 [2]	2, 4, 8 (+/-)	2, 4, 8 (+/-)	4 to 15 (+/-)	4 to 15 (+/-)	8 to 20 (+/-)	8 to 20 (+/-)
Output (AC)							
Nominal power (P_{nom}) [3]	100 kW	250 kW	315 kW	500 kW	630 kW	875 kW	1000 kW
Maximum output power [4]	100 kW	250 kW	345 kW	600 kW	700 kW	1050 kW	1200 kW
Power at cosφ = 0.95 [3]	96 kW	240 kW	300 kW	475 kW	600 kW	830 kW	950 kW
Nominal AC current (I_{nom})	195 A	485 A	520 A	965 A	1040 A	1445 A	1445 A
Nominal output voltage (U_{nom}) [5]	300 V	300 V	350 V	300 V	350 V	350 V	400 V
Output frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Harmonic distortion, current [6]	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%
Distribution network type [7]	TN and IT	TN and IT	TN and IT	TN and IT	TN and IT	TN and IT	TN and IT
Efficiency							
Maximum [8]	98.0%	98.0%	98.6%	98.6%	98.6%	98.7%	98.8%
Euro-eta [9]	97.5%	97.6%	98.3%	98.2%	98.4%	98.5%	98.6%
Power consumption							
Own consumption in operation	310 W	310 W	310 W	490 W	490 W	650 W	650 W
Standby operation consumption	60 W	60 W	60 W	65 W	65 W	65 W	65 W
External auxiliary voltage [5]	230 V, 50 Hz	230 V, 50 Hz	230 V, 50 Hz	230 V, 50 Hz	230 V, 50 Hz	230 V, 50 Hz	230 V, 50 Hz
Dimensions and weight							
Width/Height/Depth, mm (W/H/D)	1030/2130/690	1830/2130/680	1830/2130/680	2630/2130/708	2630/2130/708	3630/2130/708	3630/2130/708
Weight appr. [10]	550	1100	1100	1800	1800	2320	2320

[1] Recommended maximum input power
[2] Optional MCB inputs, 80 A inputs
[3] 100 and 250 kW units at 40 °C. 315 and 630 kW at 45 °C. 500, 875 and 1000 kW at 50 °C.
[4] At 25 °C. See the user manual for details.
[5] +/- 10%
[6] At nominal power
[7] Inverter side must be IT type
[8] Without auxiliary power consumption at min U_{dc}
[9] 115 V, 60 Hz optional
[10] For the smallest number of protected inputs. See the user manual for details.

ABB central inverter design and power network connection

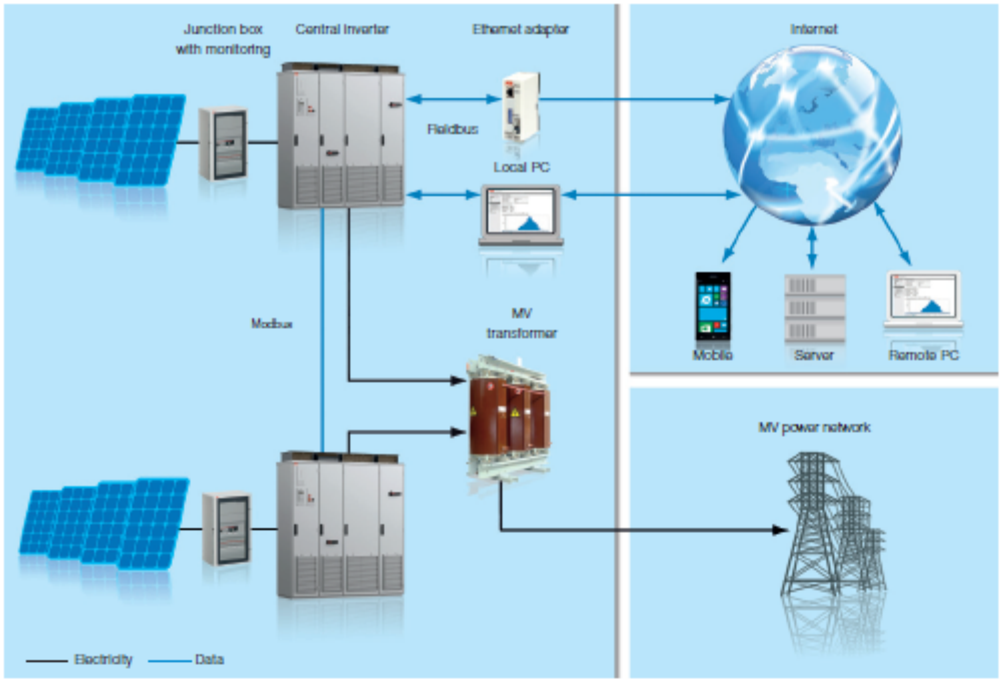


Technical data and types

Type designation PVS800-57	-0100kW-A 100 kW	-0250kW-A 250 kW	-0315kW-B 315 kW	-0500kW-A 500 kW	-0630kW-B 630 kW	-0875kW-B 875 kW	-1000kW-C 1000 kW
Environmental limits							
Degree of protection	IP42	IP42	IP42	IP42	IP42	IP42	IP42
Ambient temp. range (nom. ratings) [11]	-15 to +40 °C	-15 to +40 °C	-15 to +45 °C	-15 to +50 °C	-15 to +45 °C	-15 to +50 °C	-15 to +50 °C
Maximum ambient temperature [12]	+50 °C	+50 °C	+55 °C	+55 °C	+55 °C	+55 °C	+55 °C
Relative humidity, not condensing	15 to 95%	15 to 95%	15 to 95%	15 to 95%	15 to 95%	15 to 95%	15 to 95%
Maximum altitude (above sea level) [13]	2000 m [16]	2000 m [16]	2000 m [16]	4000 m	4000 m	4000 m	4000 m
Maximum noise level	75 dBA	75 dBA [18]	75 dBA [18]	75 dBA [18]	75 dBA [18]	75 dBA [18]	75 dBA [18]
Maximum air flow of the inverter section	1300 m³/h	2500 m³/h	2500 m³/h	5000 m³/h	5000 m³/h	7950 m³/h	7950 m³/h
Protection							
Ground fault monitoring [18]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grid monitoring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Anti-islanding	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DC reverse polarity	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AC and DC short circuit and over current	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AC and DC over voltage and temperature	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User interface and communications							
Local user interface	ABB local control panel						
Analog inputs/outputs	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Digital inputs/relay outputs	3/1	3/1	3/1	3/1	3/1	3/1	3/1
Fieldbus connectivity	Modbus, PROFIBUS, EtherNet						
Product compliance							
Safety and EMC	CE conformity according to LV and EMC directives						
Certifications and approvals [17]	VDE, CEI, UNE, RD, EDF, P.O. 12.3, BDEW, GOST, AS, ZA						
Grid support and grid functions	Reactive power compensation [*], Power reduction, LVRT, HVRT, Anti-islanding						

[11] Frosting is not allowed. May need optional cabinet heating.
[12] Power derating after 40 °C/45 °C/50 °C
[13] Power derating above 1000 m
[16] With option 2000 to 4000 m
[18] At partial power typically < 70 dBA
[18] Optional
[17] More detailed information, please contact ABB
[*] Also during the night

Data communication principle for ABB central inverters



3AUA0000057380 REV L EN 4.9.2014 #17257

Options

- Integrated and flexible DC input extension cabinets
- Cabinet heating
- I/O extensions
- DC grounding (negative and positive)
- Fieldbus and Ethernet connections
- Current measurement to each DC input
- Warranty extensions
- Solar inverter care contracts

Accessories

- Solar array junction boxes with string monitoring
- Remote monitoring solutions

Support and service

ABB supports its customers with a dedicated service network in more than 60 countries and provides a complete range of life cycle services from installation and commissioning to preventative maintenance, spare parts, repairs and recycling.

For more information please contact your local ABB representative or visit:

www.abb.com/solarinverters
www.abb.com

Power and productivity for a better world™

8.2. Panels

8.2.1 Canadian Solar

MAX POWER
CS6X-310|315|320P

High quality and reliability in all Canadian Solar modules is ensured by 14 years' experience in module manufacturing, well-engineered module design, stringent BOM quality testing, an automated manufacturing process and 100% EL testing.

KEY FEATURES

- Excellent module efficiency up to 16.68%
- Outstanding low irradiance performance: 96.0%
- +5Wp — Positive power tolerance up to 5 W
- No.1 PTC — High PTC rating up to 91.97%
- IP67 — IP67 junction box for long-term weather endurance
- Heavy snow load up to 5400 Pa wind load up to 2400 Pa
- Salt mist, ammonia and blowing sand resistance, apply to seaside, farm and desert environments

25 years — insurance-backed warranty
non-cancelable, immediate warranty insurance
linear power output warranty

10 years — product warranty on materials and workmanship

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001:2008 / Quality management system
ISO/TS 16949:2009 / The automotive industry quality management system
ISO 14001:2004 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730: VDE / MCS / CE / SII / CEC AU / CQC / INMETRO
UL 1703 / IEC 61215 performance: CEC listed (US)
UL 1703: CSA / IEC 61701 ED2: VDE / IEC 62716: VDE / IEC 60068-2-68: SGS
PV CYCLE (EU) / UNI 9177 Reaction to Fire: Class 1

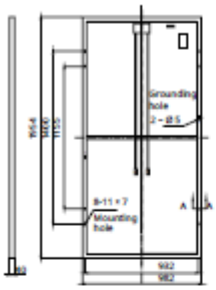
* As there are different certification requirements in different markets, please contact your local Canadian Solar sales representative for the specific certificates applicable to the products in the region in which the products are to be used.

CANADIAN SOLAR INC. is committed to providing high quality solar products, solar system solutions and services to customers around the world. As a leading manufacturer of solar modules and PV project developer with about 10 GW of premium quality modules deployed around the world since 2001, Canadian Solar Inc. (NASDAQ: CSIQ) is one of the most bankable solar companies worldwide.

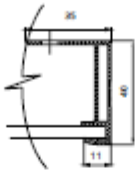
CANADIAN SOLAR INC.
545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

MODULE / ENGINEERING DRAWING (mm)

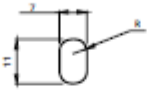
Rear View



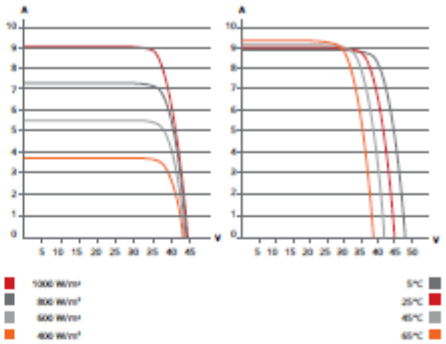
Frame Cross Section A-A



Mounting Hole



CS6X-310P / I-V CURVES



ELECTRICAL DATA / STC*

Electrical Data CS6X	310P	315P	320P
Nominal Max. Power (Pmax)	310 W	315 W	320 W
Opt. Operating Voltage (Vmp)	36.4 V	36.6 V	36.8 V
Opt. Operating Current (Imp)	8.52 A	8.61 A	8.69 A
Open Circuit Voltage (Voc)	44.9 V	45.1 V	45.3 V
Short Circuit Current (Isc)	9.08 A	9.18 A	9.26 A
Module Efficiency	16.16%	16.42%	16.68%
Operating Temperature	-40°C ~ +85°C		
Max. System Voltage	1000 V (IEC) or 1000 V (UL)		
Module Fire Performance	TYPE 1 (UL 1703) or CLASS C (IEC 61730)		
Max. Series Fuse Rating	15 A		
Application Classification	Class A		
Power Tolerance	0 ~ + 5 W		

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

ELECTRICAL DATA / NOCT*

Electrical Data CS6X	310P	315P	320P
Nominal Max. Power (Pmax)	225 W	228 W	232 W
Opt. Operating Voltage (Vmp)	33.2 V	33.4 V	33.6 V
Opt. Operating Current (Imp)	6.77 A	6.84 A	6.91 A
Open Circuit Voltage (Voc)	41.3 V	41.5 V	41.6 V
Short Circuit Current (Isc)	7.36 A	7.44 A	7.50 A

* Under Nominal Operating Cell Temperature (NOCT), irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

PERFORMANCE AT LOW IRRADIANCE

Industry leading performance at low irradiation, average 96.0% relative efficiency from an irradiance of 1000 W/m² to 200 W/m² (AM 1.5, 25°C).

The specification and key features described in this datasheet may deviate slightly and are not guaranteed. Due to on-going innovation, research and product enhancement, Canadian Solar Inc. reserves the right to make any adjustment to the information described herein at any time without notice. Please always obtain the most recent version of the datasheet which shall be duly incorporated into the binding contract made by the parties governing all transactions related to the purchase and sale of the products described herein.

Caution: For professional use only. The installation and handling of PV modules requires professional skills and should only be performed by qualified professionals. Please read the safety and installation instructions before using the modules.

MODULE / MECHANICAL DATA

Specification	Data
Cell Type	Poly-crystalline, 6 inch
Cell Arrangement	72 (6×12)
Dimensions	1954×982×40 mm (76.9×38.7×1.57 in)
Weight	22 kg (48.5 lbs)
Front Cover	3.2 mm tempered glass
Frame Material	Anodized aluminium alloy
J-Box	IP67, 3 diodes
Cable	4 mm² (IEC) or 4 mm² & 12 AWG 1000V (UL), 1150 mm (45.3 in)
Connectors	Friends PV2a (IEC), Friends PV2b (IEC / UL)
Standard Packaging	26 pieces, 620 kg (1366.9 lbs) (quantity & weight per pallet)
Module Pieces per Container	624 pieces (40' HQ)

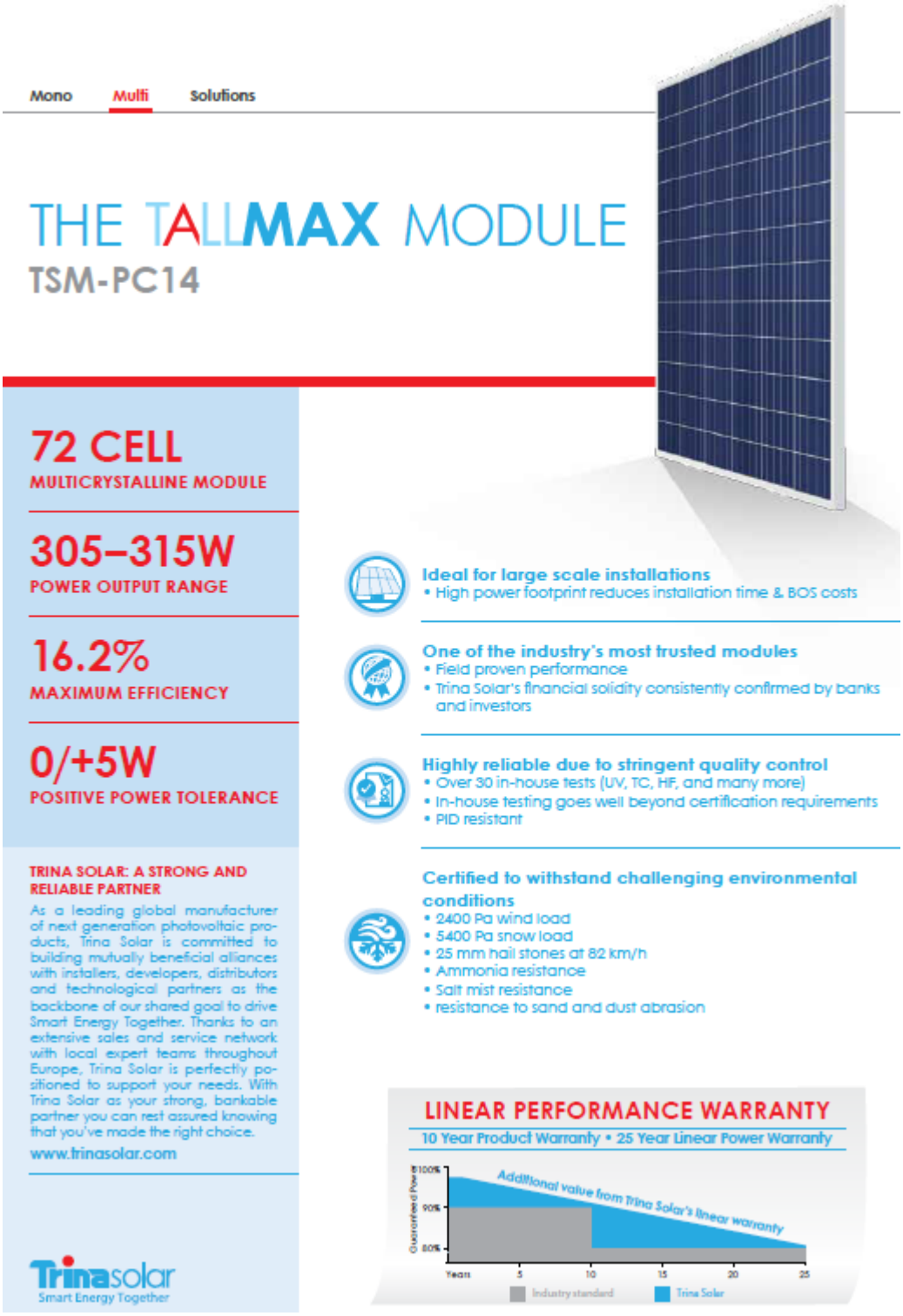
TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.41% / °C
Temperature Coefficient (Voc)	-0.31% / °C
Temperature Coefficient (Isc)	0.053% / °C
Nominal Operating Cell Temperature	45±2°C

PARTNER SECTION

Scan this QR-code to discover solar projects built with this module

8.2.2 Trina Solar

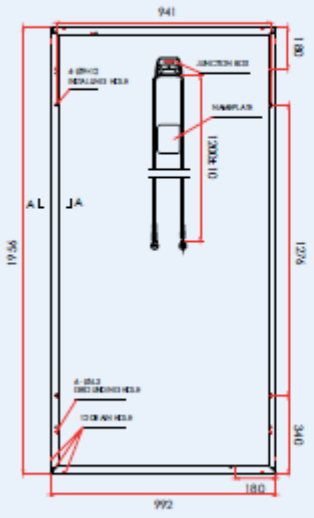


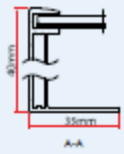
THE TALLMAX MODULE

TSM-PC14

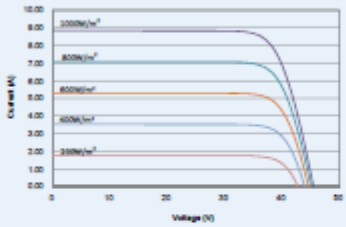
DIMENSIONS OF PV MODULE TSM-PC14

(unit:mm)





I-V CURVES OF PV MODULE TSM-310 PC14



ELECTRICAL DATA @ STC	TSM-305 PC14	TSM-310 PC14	TSM-315 PC14
Peak Power Watts-P_{MAX} (Wp)	305	310	315
Power Output Tolerance-P_{MAX} (W)	0/+5	0/+5	0/+5
Maximum Power Voltage-V_{MP} (V)	36.6	37.0	37.1
Maximum Power Current-I_{MP} (A)	8.33	8.38	8.51
Open Circuit Voltage-Voc (V)	45.5	45.5	45.6
Short Circuit Current-Isc (A)	8.81	8.85	9.00
Module Efficiency η_m (%)	15.7	16.0	16.2

STC: Irradiance 1000 W/m², Cell Temperature 25°C, Air Mass AM1.5 according to EN 60904-3.
Average efficiency reduction of 4.5% at 200 W/m2 according to EN 60904-1.

ELECTRICAL DATA @ NOCT	TSM-305 PC14	TSM-310 PC14	TSM-315 PC14
Maximum Power-P_{MAX} (Wp)	227	231	235
Maximum Power Voltage-V_{MP} (V)	34.0	34.3	34.3
Maximum Power Current-I_{MP} (A)	6.68	6.72	6.83
Open Circuit Voltage-Uoc (V)	42.2	42.2	42.3
Short Circuit Current-Isc (A)	7.11	7.15	7.27

NOCT: Irradiance at 800 W/m², Ambient Temperature 20°C, Wind Speed 1 m/s.

MECHANICAL DATA	
Solar cells	Multicrystalline 156 × 156 mm
Cell orientation	72 cells (6 × 12)
Module dimensions	1956 x 992 x 40 mm
Weight	22.5 kg
Glass	High Transparency, Anti-Reflective, AR Coated and Heat Tempered Solar Glass - 3.2 mm
Backsheet	White
Frame	Silver Anodized Aluminium Alloy
J-Box	IP65 or IP67 rated
Cables	Photovoltaic Technology cable 4.0 mm², 1200 mm
Connector	MC4 Compatible

TEMPERATURE RATINGS	
Nominal Operating Cell Temperature (NOCT)	45°C (±2°K)
Temperature Coefficient of P_{MAX}	- 0.41%/K
Temperature Coefficient of Voc	- 0.32%/K
Temperature Coefficient of Isc	0.05%/K

MAXIMUM RATINGS	
Operational Temperature	-40~+85°C
Maximum System Voltage	1000 V DC (IEC)
Max Series Fuse Rating	15 A
Mechanical Load	5400 Pa
Wind Load	2400 Pa

WARRANTY
10 year workmanship warranty
25 year linear performance warranty

(Please refer to product warranty for details)

PACKAGING CONFIGURATION	
Modules per box:	26 pieces
Modules per 40' container:	572 pieces

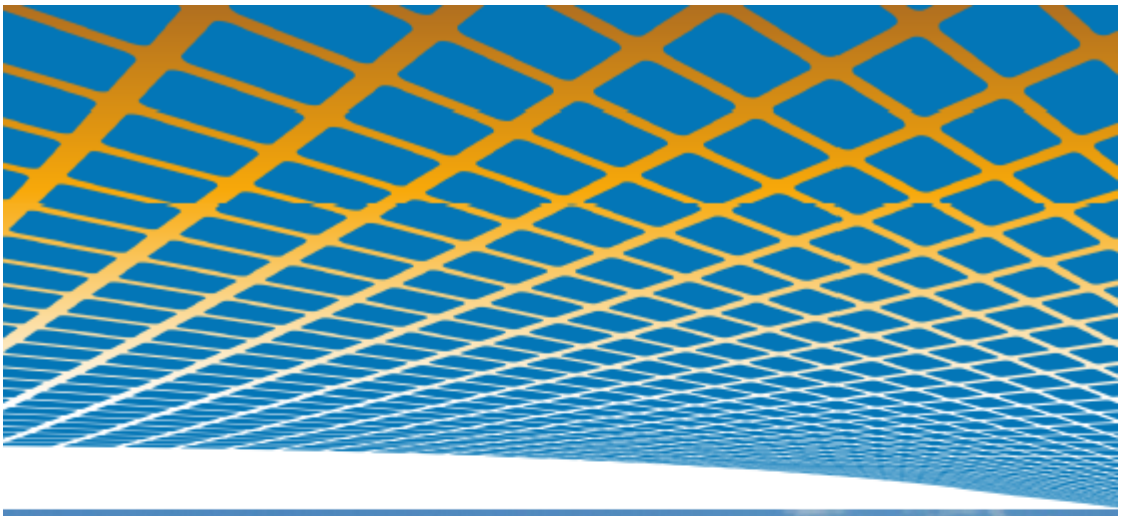
CERTIFICATION

IEC61215/EN61215
IEC61730/EN61730
IEC 62716 PID 1917/05.11
IEC 61701
DIN EN 60068-2-68 LC2
MCS SIRE PV0183

TSM_EN-2015_B

Trinasolar
Smart Energy Together

8.3. Racking



SOLAR STRUCTURE OT 2V12

OPTIMUM TRACKER

1

Product sheet OT 2V12 – 1 – 25/06/2015

OPTIMUM TRACKER

Solar Structure OT 2V12

Technical data

General specifications	
Module type	60 cells
String length	24
Module configuration	2V12
Dimensions	L x l x H : 12,2m x 3,1m x 2,2m
Max slope	20%
Material	
Supporting structure	High-strenght galvanized steel
Foundation type	Driven pile, galvanized steel
Additional Information	
Module grounding	Self-drilling screw
Safety and Warranty	
Snow and wind resistance	Project-specific
Product lifetime	50 years
Standards	CE marking
Structure dimensioning	Eurocodes 0/1/3

2

Product sheet OT 2V12 – 1 – 25/06/2015

8.4. Transformers

Appendix 2

ABB

Technical Specification - Item 10

Characteristic		
Product name		Liquid-Filled Groundmount Transformer; 3PH, 2400 kVA, HV 33000D , LV 400y x 400y
Country of origin		Turkey
Rated power	[kVA]	2400
Insulation Liquid		Mineral Oil
High voltage	[V]	33000
High voltage tappings (DETC)		+2 -2 2.5%
Low voltage at no load	[V]	400(400)
High voltage insulation level	[kV]	LI 170 / AC 70 / Um 36
Low voltage insulation level	[kV]	LI 40 / AC 10 / Um 3.6
Frequency	[Hz]	50
Number of phases		3
Vector group		Dy11d0
Ambient temperature max./monthly/annual average	°C	40 / / 20
Max. average temperature rise (Oil/Winding)	[C/C]	60 / 65
Surface treatment		Painted, RAL 7033
Altitude (a.s.l.)	[m]	<1000
Location		Indoor/Outdoor

Performance values		
Standards		IEC 60076
Impedance	[%]	6(+-10%)
No load losses	[W]	3600(+15%)
Load losses at 75 °C	[W]	27000(+15%)

Preliminary dimensions and weight		
Length	[mm]	2250
Width	[mm]	1500
Height	[mm]	2250
Roller distance (c/c)	[mm]	1070 x 1070
Oil Weight	[kg]	1275
Total weight	[kg]	6000

Type of design	
Tank construction	Corrugated Walls, Hermetically sealed
Cooling	ONAN
High voltage winding conductor material	Al
Low voltage winding conductor material	Al

Standard Features/Accessories - Item 10

Off-Load Tap Changer
DIN type HV and LV bushings
Pressure Relief Relay (One contact)

RIS Integrated Safety Detector

ABB ELEKTRİK SANAYİ A.Ş.

Yukarı Dudullu, Organize Sanayi Bölgesi
2. Cadde No:16 34776 Umraniye-Istanbul-TURKEY
Fax: +90.216.365 29 21
Phone:+90.216.528 22 00

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9. Record of Consultations and CSR Budget

9.1. Solar Power Plant in the Region of Mandalay, Myanmar

Stakeholder Meeting / Community Meeting

Meiktila

Date: April 3rd, 2015

Time: 14:30 – 17:00

Venue: Wun Thar Village Monastery, Thar Si, Meiktila District, Mandalay Region

Meeting Purpose: Present the ESIA and discuss potential direct and indirect concerns and benefits of the proposed project

Total No of attendees: 62

No of male attendees: 51

No of female attendees: 11

Facilitator: Arbutus Consultants Pvt. Ltd.

Project Proponents Present: Wins Tunnitisupawong, Seng Taungbau , Aung Thiha Kyaw Htin, Htet Myat Htoo

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9.1.1. Background Information

Convalt Energy, a directly owned company of the United States based investment firm ACO Investment Group (ACO), is proposing a 360 MW Solar Power Generating Facilities as an independent power producer and operator in the Mandalay Division of Myanmar. The Power Generated from PV Solar Farms will provide substantial benefits to Myanmar and holds the potential to provide further benefits for the country if strengthened and extended. The Benefits include: a more reliable power supply, lower electricity costs to consumers and reduced environmental impacts.

The project location is south of the Wundwin Township north of the Thazi Township in the Meiktila District. The proposed location is two (2) miles, east of Meiktila-Mandalay Highway and three (3) miles from the Thapyaywa Primary Power Station. For the installation of the 180MW Solar PV power plant, about 750 acres of land will be utilized. A land area of (1,000) acres is available within the Meiktila District.

There are three communities surrounding the proposed project location: Meiktila Township, Wundwin Township and Thazi Township.

The township of Meiktila is fairly sizeable with a total of 301,242 citizens inhabiting 57,090 households and the township is located on the banks of Lake Meiktila.

The township of Wundwin is located north of the project site with a total of 228,431 citizens inhabiting 51,578 households.

The township of Thazi is located south of the project site with a total of 191,695 citizens in 39,363 households.

All three communities are led by either municipal officials or village chief/representatives.

These communities are considered secondary impact areas, as they are not in the direct perimeter of the project location in the context of this Environmental and Social Impact Assessment. There communities will not be directly affected by any land acquisition nor involuntary resettlement nor lose any agriculturally productive land.

9.1.2. Purpose

The purpose of the Meeting is to maintain a transparent relationship with the stakeholders and the community, to help provide clarifications on the project, identify and discuss any additional direct or indirect benefits or concerns that may surface as a result of the project development as well as consider any recommendations to mitigate potential negative impacts. The following agenda was followed throughout the meeting:

1) Scope of the Project
2) Environmental Impact Assessment
3) Social Impact Assessment
4) Corporate & Social Responsibility with additional time for discussion and debate

9.1.3. Results of Meeting

1) Project Awareness

The attendees of the meeting were very appreciative of the time taken by the study team to inform about the project and open a transparent dialogue. It was the study teams impression that all of the attendees were aware of the project to some extent. There were no negative responses towards the proposed project overall.

2) Perceived Benefits and Impacts

(i) Positive Impacts

Stabilized Electric Power Supply and Electrification to Nearby Villages.

Irregular power supply with multiple power failures is prominent in the region and the attendees express their concerns of constantly experiencing power fluctuation. With some villages, such as the village of Kanpat located near the Thapyaywa substation not currently even having any power supply at all. A stabilized power supply is highlighted as very important by the attendees for their everyday work, children's learning opportunities, household work as well for the possibility to increase economic development through new and existing businesses.

Water Supply

Attendees from the nearby villages expressed their need for a steady water supply to help aid the water shortage during the dry season, which runs from October through to May. There is only an approximate 30% chance to hit an underground water reservoir if attempted by themselves. The villages are currently paying approximately 100 kyats for 10 gallons of water through traders.

If the villages were supplied with strategically located centralized water tanks, the containers could be refilled at the same time as the project site's water tanks are refilled.

Road Network

Concerns were raised regarding the construction of the road leading up to the project site from the Meiktila – Mandalay Highway. Some of the attendees do not wish for the existing dirt road to be completely blocked of while developing the new road to the project site for obvious emergency and safety reasons. The same villagers also wish for a new road to be developed to the Wun Thar Village, which is one mile east from the project site as part of the project development.

The main concern that the villagers expressed was regarding the current dirt road, that goes through the middle of project site connecting Shawpin Village and Dahattaw Village. As it was cleared and developed by the villagers themselves they would want that particular road relocated as part of the project implementation along the project site perimeter in order to continue commuting between the villages.

Located on the routes to the project site there is a bridge on the Hanza-Wun Thar road that needs to be refurbished as part of project development. From conversation with the local leaders, they advised that a regional donor will be refurbishing this bridge. The picture of the bridge can be seen below.

Photos of bridge on Hanza-Wun Thar Road.

Villagers also express additional concerns on specific road areas. These areas are prone to heavy flooding during the rainy season that needs to be developed and modified to better handle the monsoon season.

Waste Dispensary

Villagers requested that the developer and contractor responsibly manage any and all waste produced by the project development in order to mitigate any pollution of soil and water sources as well as air pollution.

Employment

Villagers would like to see fair and transparent employment of local work force, which is based on the individual skill of varying qualifications and not based on any relationship that the developer may have with any potential employee.

Employment opportunities should aim to be fair on gender, considering both female and male employees and maintaining a stable gender ratio throughout.

Electricity

One of the villages near the Thapyaywa substation does not have access to electricity, they are strongly requesting the developer to negotiate with the government or have a direct supply of electricity from the proposed project. The name of the village is Kanpat.

Education

One of the local head monks at the meeting strongly expressed the need for educational facilities to be developed in one or more of the villages fitted with Basic Educational material and libraries for their children and young adults.

Health

There is a significant need for medical infrastructure in the region that can be improved upon. Meeting attendees strongly request basic medical clinics and pharmacies fitted with basic medical supplies, such as adequate nutritional supplements for their children.

Opportunities of Economic Development

It is the belief of both project proponents and the participating meeting attendees that the proposed project will bring more economic development locally. The additional input of electricity will contribute to growing commerce opportunities within the villages, which progressively lead towards increased businesses and employment opportunities.

During the construction and operations of the proposed project it is perceived that short to long-term local employment will be generated. Many of the meeting attendees would like to be considered for work for labor during the construction phase of the project.

(ii) Negative Impacts

Overall, there are no perceived negative impacts of significant concerns expressed. There are certain impacts identified in the Environmental and Social Impact Assessment such as noise pollution and dust emissions, which are considered to be less significant and can mostly be mitigated. The project will not be affecting vegetation such as trees or agricultural land. There will be no resettlements or displacement of households, no reduced livelihood production or intrusion on sites with cultural or heritage value.

Overall, the results of assessments showed the following perceived impacts:

Assessment of Project Impacts

Impacts – Direct or Indirect	**Response Result**
Loss of vegetation or trees	No significant impact
Forest or otherwise protected areas	No impact
Noise and dust pollution	Less to No impact – Can be fully mitigated
Loss of land or important structures	No impact
Displacement of business/households	No impact
Historical and culturally important sites	No impact
Loss livelihood or productive land	No impact

9.1.4. Other Concerns

The immediate concern of the attending villagers is the ability to be given connection to the power supply via either direct connection to the proposed project or via negotiation with the government. Villagers expressed hope for additional power supply to the main communities, Meiktila Township, Wundwin Township and Tharzi Township as well nearby small villages, which are currently not energized. Many of the attending do not have a supply of electricity today.

The main reason for not being connected to a stable power source today is.

- They cannot afford the current connection fee. As this region contains many of Myanmar's poorest communities the current connection fee issue is no surprise. For many households, the monthly tariff is not affordable.
- No available connection line or substation nearby the villages

Overall, the attendees fully support the proposed project.

Below is a summary of what the developer of the project should consider when developing the proposed project in the proposed area.

Power Supply

As there are villages with no connection, the project needs to consider the needs of the villages to get connected and electrified and supplied with water as well as local road network needs.

Environmental Impacts

Consider environmental impacts such as pollution and emissions carefully. Pollution of any kind, including noise is to be minimized

Cost of Connecting and Tariff

Assistance from the government to establish a transmission line to provide electrification coverage and review tariff and connection fees.

Employment

Consider fair and transparent employment schemes based on skill from the local villages surrounding the project.

9.1.5. Other issues

The project should aim to provide livelihood training and employ local labor. There is a significant will among the communities to learn new labor and agricultural skills to increase income and grow business in order to cover electricity connection fees.

9.1.6. Study Team Response

There was a clear appreciation by the meeting attendees that we had taken the time to develop this meeting and to provide them with a transparent communication on the solar project and how this project can and will effect the livelihoods of the stakeholders.

Prior to this stakeholder meeting, the stakeholders had simply a very basic (if any) understanding of the upcoming project. From these meetings the stakeholders were able to not only gained a better understanding of what a Solar Farm is, but also the pros and cons of having a Solar Farm near them. From the topics raised during this meeting, we were able to better cater our Corporate Social Responsibility (CSR) budgets and programs to the local stakeholders' specific needs.

The meeting ended at 17:00 PM

9.2. Record Documentation of Meeting Attendees

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CONVALT ENERGY ACO INVESTMENT GROUP

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CONVALT ENERGY ACO INVESTMENT GROUP

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CONVALT ENERGY ACO INVESTMENT GROUP

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9.3. Photographic documentation of Meeting

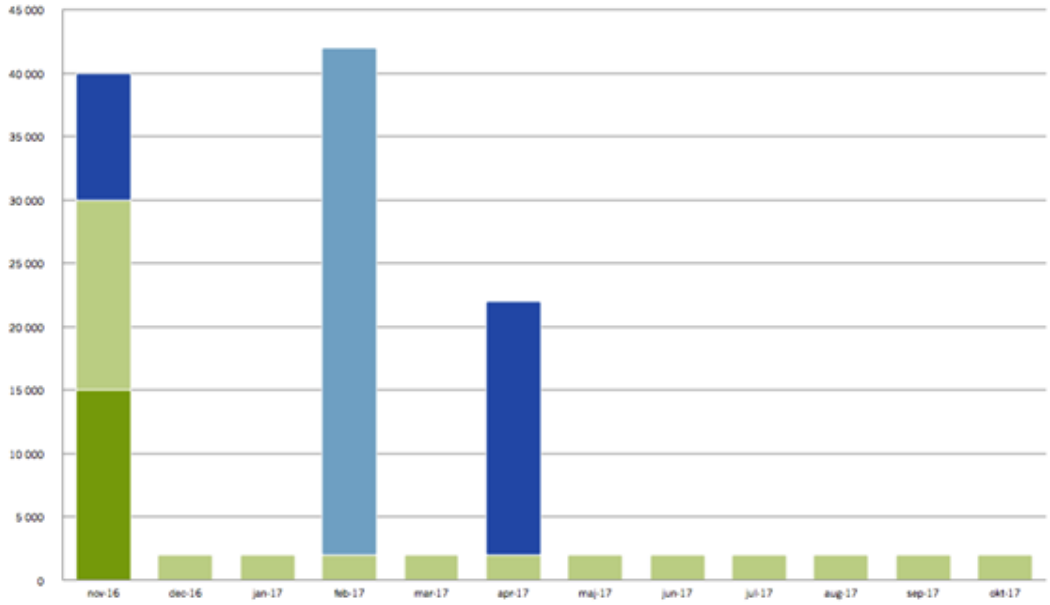
Proposed CSR Budget, Meiktila

Meiktila Proposed CSR Budget — Fiscal Year Begins: nov-16

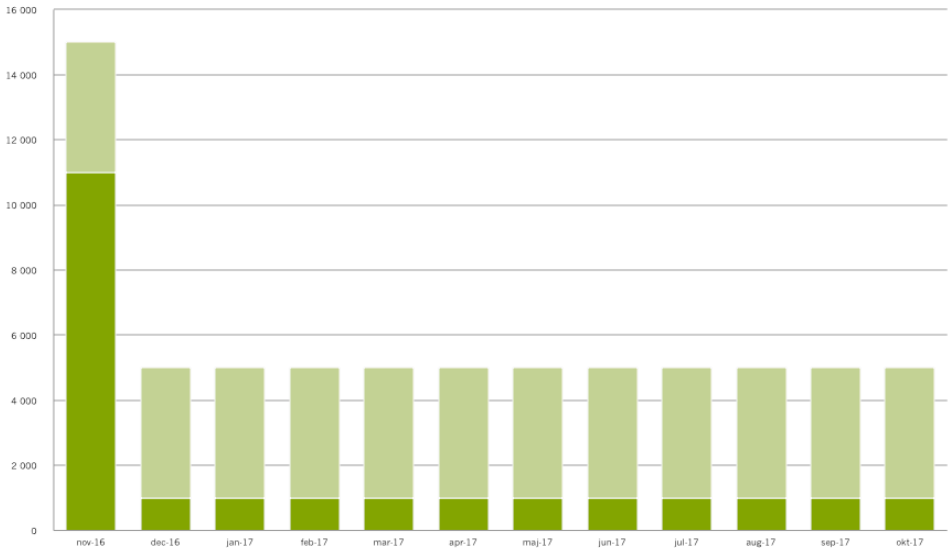
Convalt Energy (Myanmar)

	nov-16	dec-16	jan-17	feb-17	mar-17	apr-17	maj-17	jun-17	jul-17	aug-17	sep-17	okt-17	Monthly Average	Total	Overview
Budget Total	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	25 000	304 000	
Infrastructure															
Provide a New Road in lieu of Current Road thru Project Site*	15 000												15 000	15 000	
Provide Reliable Source of Water*	15 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	3 083	37 000	
Build a new road from the main road to Village*				40 000									40 000	40 000	
Upgrading Road/Bridge Infrastructure from Yangon-Mandalay Highway	10 000					20 000							15 000	30 000	
Infrastructure Total	**40 000**	**2 000**	**2 000**	**42 000**	**2 000**	**22 000**	**2 000**	**2 000**	**2 000**	**2 000**	**2 000**	**2 000**	**10 167**	**122 000**	
Healthcare															
Clinics with Medication*	11 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 833	22 000	
Childhood Malnutrition	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	48 000	
														0	
Healthcare Total	**15 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 000**	**5 833**	**70 000**	
Education															
Development of Local High School*														0	
Technical Apprenticeship Program	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	60 000	
Children's Library	31 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	3 500	42 000	
Computers for children's Library	10 000												10 000	10 000	
														0	
Education Total	**46 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**6 000**	**9 333**	**112 000**	

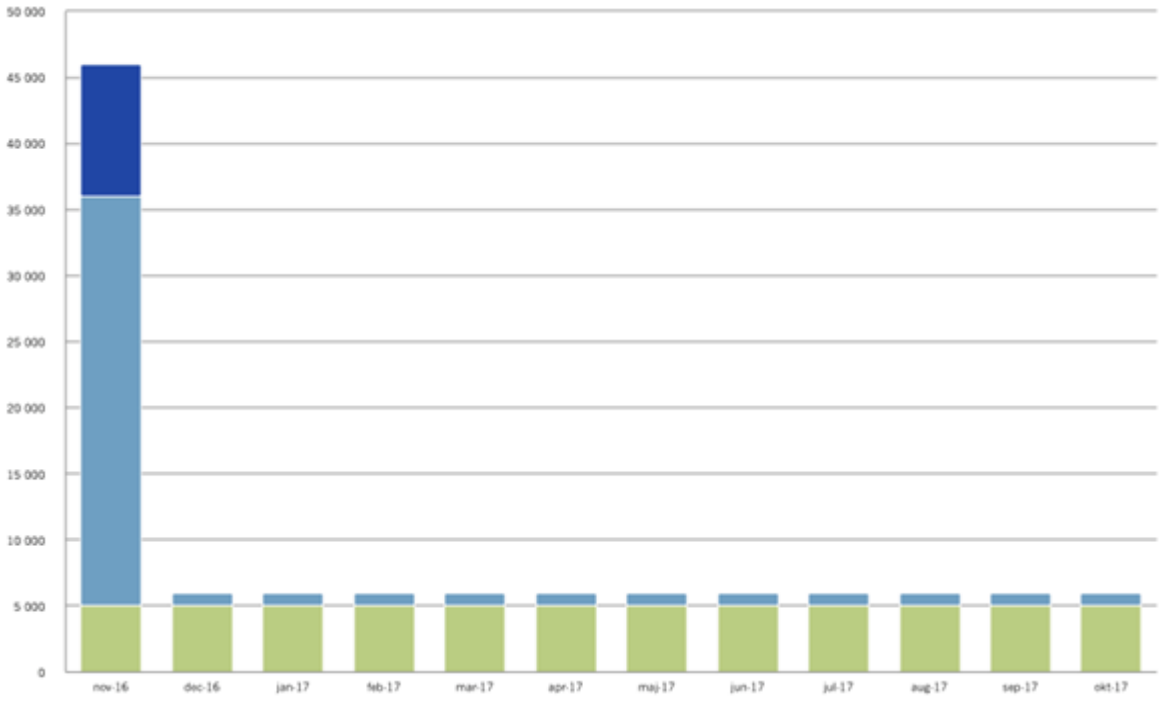
- Provide a New Road in lieu of Current Road through Project Site*
- Provide Reliable Source of Water*
- Provide a Road from the Main Road to Village*
- Upgrading Road/Bridge from Yangon



- Clinics with Medication*
- Childhood Malnutrition Support*



- Development of Local High School*
- Technical Apprenticeship Program*
- Children's Library*
- Computers for Children's Library*



Construction Schedule

During the pre-construction phase, much of the work schedule will done primarily during the working hours of 7 am to 5 pm. During the construction phase, due to the time schedule requirements for the completion of these projects, we will potentially be working 24 hours to adhere to the requirements.

10. Biodiversity Study of Meiktila Site

The Environmental Impact Assessment of Biological Environment from ACO Solar Power Plant Project at Wet Toe/ Wunthar Village Tract, Tharsi Township, Meiktila District in Mandalay Region

SUMMARY

This report is a review of the Environmental Impact Assessment (EIA) including Environmental Management Plan (EMP) and Biodiversity Management Plan (BMP) of Solar Power Plant Project near Wet Toe/ Wunthar Village Tract, Tharsi Township, Meiktila District in Mandalay Region. Fauna and flora are carried out in and around Solar Power Plant Project near Wet Toe/ Wunthar Village Tract. The survey was carried out in cold season (February 12nd – 15th, 2016). The proposed project site is located that near Wet Toe/ Wunthar Village Tract, Tharsi Township, Meiktila District in Mandalay Region. This Environmental Impact Assessment (EIA) report identifies potential environmental impacts associated with the proposed of the Solar Power Plant project in the dry zone area. The base line study and specimen collection of terrestrial **fauna**, especially as major groups are vertebrate (mammals, birds, reptiles, lizards and amphibians, especially visual observation for the animals) and invertebrate (butterflies, dragon flies, damselflies and many kinds of insect visually during survey). According to the survey results, surrounding of the study site, about 23 species of Avian Fauna belonging to 8 order and 21 families were recorded with different population abundance and different categorize bird species as insectivores, omnivores and carnivorous. During survey period, three reptilian species was recorded at the study site. Biodiversity survey group are observed that there are about 6 species of Butterfly as well as male and female belonging to 8 families in surrounding of the project area. The survey team investigated that the surrounding of the project, about 3 species of Dragonfly and Damselfly belonging to two families (Libellulidae and Lestidae) were recorded with few number of population. **As flora**, the baseline study and specimen collection of flora was carried out in and around the project site area. The project was conducted for the assessment of the diversity of local natural flora groups such as trees, small trees, shrubs, herbs and climbers to predict the impacts and biotic ecology. The identification of the possible impact of the project recommended mitigation measures for negative impacts identified. Plant Species diversity: A total of 35species represent 32genera of 22families were listed in the project site area. The survey team investigated that four types of impacts as well as negative and positive impacts, dust emitted during crushing, soil eroded, loss of habitats, soil erosion by removal of ground cover, income and working opportunities for native people were observed in this project. According to the **index value** of the negative impact assessment (**2**), the category was as moderate level. The Solar Power Plant Project would have some impacts (positive and negative) on the surrounding environment in both direct and indirect ways, as there will be direct and indirect interactions between project activities and the environment. The result of building of Project can make the working opportunities of people from the village around the project areas can be developed. The family income can be improved concerning with the project during the construction period. Because of the improvement of family income, the business, health and social affairs will be developed by the advantages of the project.

METHODOLOGY OF THE STUDY

1. Methods of Impact Evaluation

Method of impact evaluation included six steps- (1) identification, potential impacts, (2) preparation of description of Environmental Impact Assessment (EIA) condition, (3) procurement of relevant standards, criteria, or guideline, (4) impact prediction for without-project and with-project condition, (5) assessment of impact significance and (6) identification and incorporation of mitigation measures in design. The basic impact area associated with predicting and assessing impacts on socioeconomic environment. The impacts on environmental condition will be analyzed statistically and evaluated according to standard references of WHO and related organization.

2. Result of Baseline Survey

2.1 Survey Item

Survey items for fauna and flora survey are as follows;

1. Biodiversity and Ecosystem

2.2 Survey Area

The proposed project site is located that near Wet Toe/ Wunthar Village Tract, Tharsi Township, Meiktila District in Mandalay Region. Specimen collection of fauna and flora is carried out in and around the project sites and are also investigated that between 100 meter and 300 meter from the project area.

2.3 Survey Period

Flora and fauna survey was conducted cold season. The survey duration is as shown in Table.

Table 1. Survey Periods for Fauna and Flora Survey

Season	Period
Cold season	February 12nd - 15th, 2016

3. Field Survey Method (Fauna & Flora)

3.1 Field observation

(1) Fauna collection

Primary data collection through direct observation, interview, individual/target group consultation such as- common resident faunas (mammals, birds, reptiles, amphibians, various kinds of insect include butterfly, dragonfly and damselfly etc.) and floras (existing terrestrial flora data such as tree and small tree, shrub, herb and climber and bamboo) in the project area; biological resources (listing of plantation and presence of wild animals).

For the secondary data collection, the team will review the following materials: project reports, research, concept notes, documents, monitoring reports, baseline data, reports shared to relevant organizations, field reports & data, specific information & data, and any other materials during the desk review. All collected specimens were scaled photographed, morphometric characters were recorded and preserved in suitable containers with appropriate concentration of formalin for taxonomical identification and further study. The butterfly and dragonfly were photographed soon after the collection and measurements were also taken to the Department of Zoology, University of Yangon for key characteristics. The identified species were translated to scientific name with assistance of the senior researcher at Department of Zoology, University of Yangon.

As the flora survey, the species identification was carried out by using key to the families of flowering plants and appropriate literature and confirmed by matching with herbarium specimens of Department of Botany, University of Yangon. Diversity of plant species were presented in tabulated forms. Representative checklists of the terrestrial and aquatic species, plant collection was also carried out by visual observation along the project area.

(2)Point count method, Line transects, Capture and Mark

Surveys and Investigations will be conducted for Environmental Impact Assessment (EIA). The aids for field surveys are relevant topographic map, compass, and basic filed survey equipments including the Global Positioning System (GPS) to assess the spatial location (latitude and longitude) of each survey point, digital camera, binoculars and referenced books. Whenever necessary, not only depending on the kind of animal, sign and tracks of live animal but also depending on the study site and project are assessed using the point count method, line transects, capture and mark. Having interviewed with fishermen of nearly study site, the information of some fauna and flora are gathered and identified. After wards, collected specimens will be measured and preserved and txonomically identified within survey area by using field guide and photographic records were made as a complete species list.

(3) Natural and Physical Environment Anlysis

As far as it is concerning about Habitat Evaluation System (HES), Environmental Impact Assessment (EIA) technically exmained few habitat types. Biodiversity survey group observed within short period to collect the data of fauna. Our term identified as to observe their fur and feathers, dens, nests, trails and burrows for not seen face to face species. Biodiversity group investigated base on the conditions of survey areas to use scans and spot observation method.

The survey team learnt that the fudamental assumption underlying HES is that the persence or absence, abundance, and diversity of animal polulation in habitat or community are determined by basic biotic and abiotic factors that can be readily quantified. The carrying capacity of a habitat for a given species or groups of spcies is coorelated with basic chemical, physical, and biotic characteristics of the habitats.

(4) Topography:

Topographical data of land cover and vegetation will be obtained through field survey and pictured with the help of GPS and related equipments and software. Some of these data will be collected visually from field survey.

(5) Biological Condition:

Fauna and flora occuring in the vicinity of around the study site and near Wet Toe/ Wunthar Village Tract will be visually surveyed and recorded with the help of scaled photographs. They will be identified taxonomically using appropriate references result.

(6) Terrestrial Fauna Survey

The base line study and specimen collection of terrestrial fauna, especially as major groups of vertebrate and invertebrate are observed. They are carried out in and around Solar Power Plant Project near Wet Toe/ Wunthar Village Tract. Habitat preferences, relative abundances and diversity assessment were examined. Diversity of fauna species were presented in tabulated forms. Possible impacts (negative and positive impacts) were investigated and mitigation measures were proposed. Collected specimens were checked with the IUCN Redlist and CITE appendices.

(7) Terrestrial Vegetation Survey

During the site visit, the different biodiversity features, habitat and landscape units present at the site were identified. Walk-through-surveys were conducted across the site and all plant species observed were recorded. Searches for listed and rare and dominance plant species at the site were conducted and the location of all listed plant species observed was recorded using a GPS. Photographs and samples were taken of all unknown species for later identification. Species that were of ecological value were also recorded during this period. In order to obtain essential ecological data for predicting of species composition around the study site, plant species and vegetation types present were recorded and also photographs were taken. The species identification was carried out by using key to the families of flowering plants and appropriate literature and confirmed by matching with herbarium specimens of Department of Botany, University of Yangon. Diversity of plant species were presented in tabulated forms.

(8) Interviewing and literature survey

Having interviewed with local people, the information of some fauna and flora are gathered and identified. The Biodiversity team visited the residents in and around the survey area and interviewed the animals existing in and around the area. Also, the past situation of flora and fauna, and the change on biodiversity and ecosystem in the area was interviewed.

(9) Impact Assessment on the Fauna and Flora of the project area

The impacts of fauna and flora on the Solar Power Plant Project were assessed by the index matrix based on three criteria, Extend (area), Duration and Magnitude of the impacts. The direct and indirect environmental impacts associated with the development of all components of the proposed Wet Toe/Wunthar Solar Power Plant. Issues were assessed in terms of the following criteria:

Extend (Area)

If the impact is only in small part of the project area, the index value is 1

If the impact is only in all part of the project area, the index value is 2

If the impact extends over out of the project area, the index value is 3

Duration

If the impact is only in limited time of the project duration, index value is 1

If the impact covers the limited time of the project duration, index value is 2

If the impact is over shoot the project duration, index value is 3

Magnitude

If the impact is only in small magnitude, the index value is 1

If the impact is only in moderate magnitude, the index value is 2

If the impact is only in large magnitude, the index value is 3

Category of Impacts

If Averge index value is 1, the category of the impact is low

Averge index value is 2, the category of the impact is medium

Averge index value is 3, the category of the impact is high.

PURPOSES OF THE STUDY

Fauna

- To record and identify vertebrate (mammals, birds, reptiles, lizards and amphibians) and invertebrate (butterflies, dragonflies, damselflies and many kinds of insects visually during survey) as well as terrestrial resources species with their spatial distribution according to survey around Wet Toe/ Wunthar Village Tract, Tharsi Township, Meiktila District in Mandalay Region.
- To investigate the potential positive and negative impacts of fauna while the construction period and operation period of this project area and throughout the sea near the survey area.

Flora

- To collect, identify and inventory the plant species in the project area.
- To analyse the habitat relationship of flora and identify the impact in the area.
- To detect and analyse the effects of the project on the immediate and neighboring environment such as vegetation and ecosystem.

Results

Classification of Terrestrial Fauna and Flora

1. Fauna

1.1. Vertebrate

1.1.1 Mammals

In and around Solar Power Plant Project, Grey squirrel (*Callosciurus pygerythrus*) is also recorded few numbers of population on the trees of survey area. Other mammal such as Rabbit, *Lepius cuniculus* species are also observed in this survey abundancely.

1.1.2. Birds

According to the survey results, surrounding of the Solar Power Plant Project site, about 23 species of Avian Fauna belonging to 8 order and 21 families were recorded with different population abundance (Table-2). During the study period some bird species were seen in all kinds of habitat showing their capability of wide distribution. Not only bird species but also the nests near the study site are found with various habitat types.

The most commonly observed all year round resident birds include, beneficial insectivorous species like Plain Prinia (*Prinia inornata*), Asian Palm Swift (*Cypsiurus balasinensis*), Plain Martin (*Riparia paludicola*), Common Iora (*Aegithina tiphia*), Grey-breasted prinia (*Prinia hodgsonii*), Black Drongo (*Dicrurus macrocercus*), Pied Bushchat (*Saxicola caprata*), Blue-Throated Bee-Eater (*Merops viridis*), Dusky Warbler (*Phylloscopus fuscatus*), Puff-throated babbler or spotted babbler (*Pellorneum ruficeps*), White-throated babbler (*Turdoides gularis*), Lesser cuckooshrike (*Coracina fimbriata*) as the insectivorous group are identified in this survey.

Plain-Backed Sparrow (*Passer flaveolus*), Common Myna (*Acridotheres tristis*), Spotted Dove (*Streptopelia chinensis*), Red Collared Dove (*Streptopelia Tranquebarica*), Red Vented Bulbul (*Pycnonotus cafer*), Streak-eared Bulbul *(Pycnonotus blanfordi*), are also recorded as omnivores and common resident birds.

The carnivorous species are recorded in bird survey by Burmese Shrike (*Lanius collurioides*), Indian Roller (*Coracias benghalensis*), Black Kite (*Milvus migrans*) and Oriental Honey Buzzard (*Pernis ptilorthyncus*). But, these are found a few numbers of species in these surveys.

Table 2. Bird species recorded during the survey period in Solar Power Plant Project

Sr.	Order / Family	Scientific Name	Common Name	IUCN RedList Status
I.	**Columbiformes**			
1	Columbidae	Streptopellia chinensis	Spotted Dove	LC
2	Columbidae	Streptopelia Tranquebarica	Red Collared Dove	LC
II	**Passeriformes**			
3	Irenidae	Irena puella	Asian Fairy Bluebird	LC
4	Laniidae	Lanius collurioides	Burmese Shrike	LC
5	Corvidae	Dicrurus macrocercus	Black Drongo	LC
6	Corvidae	Aegithina tiphia	Common Iora	LC
7	Muscicapidae	Saxicola caprata	Pied Bushchat	LC
8	Sturnidae	Stumus burmannicus	Vinous Breasted Starling	LC
9	Sturnidae	Acridotheres tristis	Common Myna	LC
10	Pycnonotidae	Pycnonotus cafer	Red-Vented Bulbul	LC
11	Pycnonotidae	Pycnonotus blanfordi	Streak Eared Bulbul	LC
12	Cisticolidae	Prinia hodgsonii	Grey Breasted Prina	LC
13	Aegithinidae	Aegithina tiphia	Common Iora	LC
14	Passeridae	Motacilla alba	White Wagtail	LC
15	Passeridae	Anthus rufulus	Paddy field Pipit	LC
16	Sylviidae	Turdoides gularis	White Throated Babbler	LC
17	Passeridae	Anthus richardi	Richard's Pipit	LC
18	Passeridae	Passer flaveolus	Plain-Backed Sparrow	LC
19	Hirundinidae	Riparia paludicola	Plain Martin	LC
20	Phyllocsopidae	Phylloscopus fuscatus	Dusky Warbler	LC
21	Pellorneidae	Pellorneum ruficeps	Puff-throated babbler	LC
22	Campephagidae	Coracina fimbriata	Lesser cuckooshrike	LC
III	**Apodiformes**			
23	Apodidae	Cypsiurus balasiensis	Asian Palm Swift	LC
IV	**Coraciiformes**			
24	Meropidae	Merops viridis	Blue-Throated Bee-Eater	LC
25	Coraciidae	Coracias benghalensis	Indian Roller	LC
V	**Accipitriformes**			
26	Accipitridae	Milvus migrans	Black Kite	LC
27	Accipitridae	Circus melanoleucos	Pied Harrier	LC
28	Accipitridae	Pernis ptilorthyncus	Oriental Honey Buzzard	LC

LC- Least Concern, No. of species – 28, No. of Order – 5, No. of Family – 19

According to the survey results, the following different categorize of bird species are followed:

Table 3. Different categorize of bird species from Solar Power Plant Project in Mandalay Region

Sr.	Types of bird species	Number of Species
1.	Insectivorous species	15
2.	Omnivores species	9
3.	Carnivorous species	4
	Total	**28**

Some Bird species in project area

Black Drongo *Dicrurus macrocercus*

Pied Bushchat *Saxicola caprata*

Red Collared Dove *Streptopelia Tranquebarica*

Spotted Dove *Streptopelia chinensis*

Plain-Backed Sparrow *Passer flaveolus*

Dusky Warbler *Phylloscopus fuscatus*

Puff-throated babbler *Pellorneum ruficeps*

Plain Prinia *Prinia inornata*

Red Vented Bulbul *Pycnonotus cafer*

Blue-Throated Bee-Eater *Merops viridis*

Pied Harrier *Circus melanoleucos*

Indian Roller *Coracias benghalensis*

Lesser cuckooshrike *Coracina fimbriata*

Burmese Shrike *Lanius collurioides*

Asian Fairy Bluebird *Irena puella*

White-throated babbler *Turdoides gularis*

1.1.3. Reptilian species

During survey period, three reptilian species was recorded at the study site. These are Easteen Russell's viper *Daboia siamensis*, Indian Green Pit Viper / Common Green Pit Viper *Trimeresurus gramineus* rarely come to abundant in this project area according to interview records. According to interview records, there were caught accidentally some snakes both poisonous and non-poisonous snakes in this area according to report by the native villagers. One lizard spcies is recorded as Oriental Garden Lizard (*Calotes versicolor*) (Table.4).

Table 4. Reptilian species recorded during the survey period in Solar Power Plant Project

Sr.	Order/Family	Scientific Name	Common Name	IUCN RedList Status	Type of evidence
Reptilian					
I	**Squamata**				
1	Viperidae	Daboia russelii siamensis	Eastern Russell's viper	LC	Interviewed
2	Colubridae	Trimeresurus gramineus	Indian Green Pit Viper / Common Green Pit Viper	LC	Interviewed
3	Agamidae	Caltoes versicolor	Oriental Garden Lizard	LC	Observed
LC- Least Concern, No. of species – 3, No. of Family – 3					

2. Invertebrate

Invertebrates are abundantly found in the nearby Solar Power Plant Project at Wet Toe/ Wunthar Village Tract, Tharsi Township, Meiktila District. In Solar Power Plant Project Survey, different kinds of invertebrates such as few number of population of butterflies and dragonfly species recorded. Other insect such as Wasp, Grasshoppers, Red ant and Ant species are also observed in the vicinity of the study site.

2.1. Butterfly

Flowering plants are also sources of food for the adult butterfly species as they ecological specialization of butterflies by cross-pollinating the plants. Butterflies are important as one of the external agents of the Entomophily. These insects visit one flower after another gathering pollen and nector certainly have an important role in play of the process of pollination.

The relationship between butterfly and plants plays an important role in an ecosystem. Flowering plants need butterfly species for pollination and the butterflies require suitable plant species to serve as their host plants to complete their life cycle.

Biodiversity survey group are observed that there are about 6 species of Butterfly as well as male and female belonging to 4 families in surrounding of the project area (Table.5).

Table 5. Butterfly species recorded during the survey period in Project Area

Sr.	Order/Family	Scientific Name	Common Name	Abundance status
	Lepidoptera			
1	Pieridae	Ixias pyrene	Yellow Orange Tip	Common
2	Pieridae	Catopsilia crocale	Common Emigrant	Common
3	Pieridae	Catopsilia pomona	Common Emigrant	Abundance
4	Danaidae	Danaus chrysippus	Plain Tiger	Abundance
5	Satyridae	Ypthima philomela	Baby Fivering	Common
6	Lycaenidae	Castalius rosimon	Common Pierrot	Common

No. of species – 6, No. of Order – 1, No. of Family – 4

2.2. Dragonfly

Dragonflies are valuable as indicators of aquatic and terrestrial ecosystem health and also play a vital role as prey and predator to maintain the balance of tropic levels of food chain. The prey of the adults consists mostly of the harmful insects of crops, orchards and forests and thus has a regulatory impact on the agro-forestry.

Their aquatic larvae constitute a natural biological control over mosquito larvae and thus help to control several epidemic diseases like malaria, dengue, filaria etc. Adult odonates feed on mosquitoes, black flies and other blood-sucking flies and act as an important bio-control agent of these harmful insects. Odonates were thus increasingly recognized due to the direct role of predators in ecosystem and their value in indicators of water quality.

According to the survey results, surrounding of the site of Solar Power Plant Project, the survey team investigated that the surrounding of the project, about 3 species of Dragonfly and Damselfly belonging to two families (Libellulidae and Lestidae) were recorded with different population abundance (Table.7).

Table 7. Dragonfly and Damselfly species recorded during the survey period in Paung Stone Crushing Project

Sr.	Order/Family	Species	Common Name	Abundance status
Dragonfly				
I	**Odonata**			
1	Libellulidae	Celithemis amanda	Amanda's pennant	Common
2	Libellulidae	Potamarcha congener	Common Chaser	Common
Damselfly				
II	Odonata			
3	Lestidae	Sympecma fusca	Brown Emerald Damselfly	Common

No. of species – 3, No. of Order – 1, No. of Family – 2

Species Diversity of Terrestrial Fauna from Solar Power Plant Project

According to survey record, especially some of these data collected visually from field survey within short period to collect the data of fauna. So, these areas are assessed as a high diversity of terrestrial fauna representing different groups such as vertebrate (mammals, birds, reptilian) and invertebrate (butterfly, dragonfly and damselfly). There are total of 44 fauna species recorded in and around the Solar Power Plant Project Area. The list of fauna is mentioned as follows:

Table 8. Species Occurrence of Terrestrial Fauna from Solar Power Plant Project

Sr.	Vertebrate				Invertebrate			
	Bird		Reptilian		Butterfly		Dragonfly/Damselfly	
	No. family	No. species	No. family	No. species	No. family	No. species	No. family	No. species
	19	28	5	7	4	6	1+1	3

Overview of Flora

The project area very rare plant growth habits were observed namely, herbs, shrubs, trees, small tree, and climbers. The vegetation community at the site is described as dry deciduous forest type. Approximately 75% - 80% ofthe site was covered by shrub and herb. The remaining 10% - 15% of the site was covered by small tree and climber. The canopywas open and the undergrowth was dominated by *Boscia variabilis , Aerva javanica, Pavonia zeylanica*and so on. There is a tree near the project site range from 2-3 m in height with diameter at breast height (dbh) of mostly 5-20 cm. Flora of the area is mainly represented by shrub species include *Aechmanthera tomentosa, Euphorbia geniculata* and *Waltheria indica* are widely common. Total of 35 plant species represent 32 genera of 22 families were observed during the assessment. The some species are either invasive or native.

Classification of Flora

The vegetation on the proposed site mainly comprises of dominant **Trees and Small trees**, *Albizia lebbek* (L.) Benth., *Borassus flabellifer* L., *Delonix regia* (Bojer ex Hook.) Raf.,*Eucalyptus albens* Benth., *Grewia hirsute* Vahl, *Lannea coromandelica* (Houtt.) Merr., *Mangifera indica* L., *Streblus asper* Lour., *Tectona hamiltoniana* Wall., *Acacia catechu* Willd., *Bauhinia acuminata* L., *Carissa carandas* L., *Cassia glauca* Lam., *Euphorbia lacei* Craib, *Prosopis juliflora* DC., *Rhus paniculata* Wall.

Shrub

Like, Agave americana L., Aechmanthera tomentosaNees, Balanites aegyptiaca (L.) Delile, Boscia variabilis Collett & Hemsl., Cassia auriculata L., Chromolaena odorata (L.) R.M. King & H. Robinson, Euphorbia geniculata Ortega, Jatropha gossypifolia L., Lantana aculeata L., Waltheria indica L.

Herb

like**,** Aerva javanica Juss., Celosia argentea L., Launaea nudicaulis L., Ludwigia octovalvis (Jacq.) Raven, Pavonia zeylanica, Pentanema indicum (L.) Ling,

Climber,

Abrus precatorius L., Hiptage benghalensis (L.) Kurz, Ziziphus glabra Roxb.

Flora

A total of 35 species were recorded at the Solar Power Plant project site area, Wet Toe/Wunthar Village tract, Tharsi township, Meiktila District.

Sr.	Scientific Name	Family	Common Name	Habit	IUCN Status
	TREE				
1	Albizia lebbek (L.) Benth.	Mimosaceae	Anya-koko	T	Nil
2	Borassus flabellifer L.	Arecaceae	Htan	T	Nil
3	Delonix regia (Bojer ex Hook.) Raf.	Caesalpiniaceae	Seinban	T	Nil
4	Eucalyptus albens Benth.	Myrtaceae	Eu-ca-lit	T	Nil
5	Grewia hirsute Vahl	Tiliaceae	Tayaw	T	Nil
6	Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Nabe	T	Nil
7	Mangifera indica L.	Anacardiaceae	Thayet	T	Nil
8	Streblus asper Lour.	Moraceae	Okhne	T	Nil
9	Tectona hamiltoniana Wall.	Verbenaceae	Dahat	T	Nil
	SMALL TREE				
10	Acacia catechu Willd.	Mimosaceae	Sha	ST	Nil
11	Bauhinia acuminata L.	Caesalpiniaceae	Swe-daw	ST	Nil
12	Carissa carandas L.	Apocynaceae	Khan	ST	Nil
13	Cassia glauca Lam.	Caesalpiniaceae	Pyiban-nyo	ST	Nil
14	Euphorbia lacei Craib	Euphobiaceae	Tazaung-pyathat	ST	Nil
15	Prosopis juliflora DC.	Mimosaceae	Gandasein	ST	Nil
16	Rhus paniculata Wall.	Anacardiaceae	Khaung-bin	ST	Nil
	SHRUB				
17	Agave americana L.	Agavaceae	Nanat-gyi	S	Nil
18	Aechmanthera tomentosa Nees	Acanthaceae	Not known	S	Nil
19	Balanites aegyptiaca (L.) Delile	Balanitaceae	Thit-palwe	S	Nil
20	Boscia variabilis Collett & Hemsl.	Capparaceae	Thamon	S	Nil
21	Cassia auriculata L.	Caesalpiniaceae	Peik-thingat	S	Nil
22	Chromolaena odorata (L.) R.M. King & H. Robinson	Asteraceae	Bizat	S	Nil
23	Euphorbia geniculata Ortega	Euphobiaceae	Not known	S	Nil
24	Jatropha gossypifolia L.	Euphobiaceae	Taw-kanako	S	Nil
25	Lantana aculeata L.	Verbenaceae	Seinnaban	S	Nil
26	Waltheria indica L.	Sterculiaceae	Bauk-hpyu	S	Nil
	HERB				
27	Aerva javanica Juss.	Amaranthaceae	On-hnye	H	Nil
28	Celosia argentea L.	Amaranthaceae	Kyet-mauk	H	Nil

Sr.	Scientific Name	Family	Common Name	Habit	IUCN Status
29	Launaea nudicaulis L.	Asteraceae	Not known	H	Nil
30	Ludwigia octovalvis (Jacq.) Raven	Onagraceae	Lay-nyin-gyi	H	Nil
31	Pavonia zeylanica L.	Malvaceae	Not known	H	Nil
32	Pentanema indicum (L.) Ling	Asteraceae	Not known	H	Nil
	CLIMBER				
33	Abrus precatorius L.	Fabaceae	Ywe-nwe	CL	Nil
34	Hiptage benghalensis (L.) Kurz	Malpighiaceae	Bein-nwe	CL	Nil
35	Ziziphus glabra Roxb.	Rhamnaceae	Paungbet	CL	Nil

Some Flora species in project area

Abrus precatorius L.

Acacia catechu Willd.

Aechmanthera tomentosa Nees

Aerva javanica Juss

Agave americana L.

Albizia lebbek (L.) Benth

Balanites aegyptiaca (L.) Delile

Bauhinia acuminata L.

Borassus flabellifer L.

Boscia variabilis Hemsl

Carissa carandas L.

Cassia auriculata L.

Cassia glauca Lam

Chromolaena odorata (L.) R.M. King & H. Robinson

Delonix regia (Bojer ex Hook.) Raf

Eucalyptus albens Benth.

Euphorbia geniculata Ortega

Euphorbia lacei Craib

Grewia laevigata Vahl

Hiptage benghalensis (L.) Kurz

Jatropha gossypifolia L.

Lannea coromandelica (Houtt.) Merr.

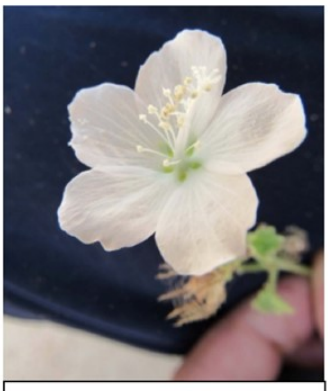
Lantana aculeata L.

Launaea nudicaulis L.

Ludwigia octovalvis (Jacq.) Raven

Mangifera indica L.

Morinda tinctoria Roxb



Pavonia zeylanica L.

Pentanema indicum (L.) Ling

Prosopis juliflora DC.

Rhus paniculata Wall

Streblus asper Lour

Tectona hamiltoniana Wall

Ziziphus glabra Roxb.

Waltheria indica L.

Ecological Profile

The vegetation within the study area consists of a low and open mixed shrubland withoccasional scattered trees and bush clumps. Arid shrubland occurs on extensive,relatively flat plains. Shrubland is a low shrub occurring on flat gravel plains with dominant species including shrubs, herbs and climber. There are no known endemics within this vegetation type. There are no considered to be a threatened vegetation type. Within the proposed development area itself, the vegetation is however fairly homogenous and it was not possible to different plant communities within this area.

POTENTIAL IMPACTS ON FAUNA AND FLORA

Potential Noise Impact

In Construction period

1) The animals can run away by the noise of construction machines and equipments.
2) The habitats of fauna can be moved being shocked because of human impacts by labours of the factory during construction period.

Potential Loss of Habitats Impact

I**n Construction period**, many species of fauna depend on comprises of grass and small patches of bamboo and other shrub and herb in these study area as their habitats. The vegetation also supports good shelter for many wildlife species. Some places in the construction area are likely to be lost due to direct and indirect construction activities for resident animals.

Potential Impacts on Vegetation (Vegetation Clearing) and Mitigations Measure

The main consequences of impacts on flora and fauna during construction phase and operation are:

1) Clearing of existing vegetation which may leads to loss of habitat.
2) The understory and canopy formations that describe the vegetation structure are the vital attraction and refuge for the diverse faunal species. This makes the area have local ecological importance for resident and visiting species.
3) The construction of infrastructure, facilities, and amenities for the solar power plant should observe minimal and selective removal of the existing vegetation covers.

Potential Impacts on Ecology

Vegetation clearing

One of the important potential indirect impacts of a solar power development relates to the clearing of natural vegetation. Clearing of vegetation could result in the potential loss of vegetative screening, which would result in the opening of views. Importantly in a visual contrast context the clearing of vegetation could result in the exposure of soils which could contrast with the colour of surrounding natural vegetation as well as potentially creating significant changes in form, line, colour, and texture for viewers close to the solar field. The vegetation removal could result in windblown dust which could constitute an indirect visual impact.

Impacts on vegetation may be both direct and indirect, with direct impacts occurringmostly during the construction phase, and indirect impacts during the operational phase.Clearing activities during the construction phase will lead to direct loss of vegetationwhich will in turn lead to localised or more extensive reduction in the overall extent of vegetation. Plant species are especially vulnerable to infrastructure development because theycannot move out of the path of the construction activities. They are also affected byoverall loss of habitat.

None of the other protected tree speciesthat have the potential to occur on site were found.The health of the ecosystem may also be affected through the establishment and spreadof alien invasive species due to disturbance activities in the construction phase.

Identification of Potential Impacts of the projectthe significance on ecology during the construction and operation phases

1) **Impacts on indigenous natural vegetation**

Direct permanent loss of vegetation will occur at the footprint of the solar fields; storage and treatment reservoirs; internal access roads; and administrative offices and storage areas. The most widespread vegetation type on site is arid shrub lands which are classified as Least Threatened. The locality of the solar and ancillary infrastructure is in an area near to the boundary of these vegetation types and contains floristic elements. It is insignificant compared to the overall extent of arid shrubland area. Impactsare therefore relevant only at a local scale and will be scored relative to the study area.

Timeline – Construction

2) **Impacts of the establishment and spread of alien invasive species**

The impact of alien invasive spread will be long-term unless alien plants are controlled. The impact will occur at the site of the proposed facility, but could spread into neighbouring areas.

Timeline-Construction/Operation

3) **Increased erosion risk as a result of soil disturbance and loss of vegetation cover**

The site has a low susceptibility to erosion, primarily due to the very dry climate. However,exceptional heavy rainfall can occur and therefore soil erosion concerns will be greatest alongdrainage lines where run-off is concentrated potentially high. Areaswhere loose, unconsolidated sandy soils of low plasticity occuralso tend to be more susceptible to erosion following heavy downpours, and this includes most ofthe proposed site. In addition to this, areas where vegetation is limited or has been disturbed ordamaged due to construction activity will be more susceptible to erosion following heavydownpours.

Timeline - Construction/Operation

Priority Mitigations measures that may be necessary in addition listed below should be considered.

(a) Ensure there is selective clearing of the vegetation this allows future re-growth and regeneration. This will ensure minimal disruption of wild fauna's natural movement, territoriality, and other ecological processes.

(b) The sites will be landscaped after construction, using plant species available locally. This will include establishment of flower gardens and grass lawns to improve the visual quality of the site.

(c) Indigenous and native species should be used for re-vegetation for trees and shrubs; a native tussocks grass commonly growing at the site can be very used in checking soil erosion especially on loose soil dumps or bare slopes created during construction.

Impacts Classification

The impacts are classified base on the biodiversity their range varies in space and time. The intensity of theses impacts is classified according to the following criteria:

1) Loss of indigenous vegetation
2) Alien invasive species
3) Reduction of the diversity of species
4) Loss of habitats

1) Potential Impacts (Fauna and Flora)

Evaluation and analysis of the projects' impacts

The assessment of the different impacts as identifiedon the biophysical environment are evaluated and analyzed by the index matrix based on three criteria, Extend, duration and magnitude of the impact.

	Source	Potential impact to Environment	Extent			Duration			Magnitude			Recommended Measures
			Low	Medium	Height	Low	Medium	Height	Low	Medium	Height	
1	**Fauna & Flora**	1.1 Impacts on indigenous natural vegetation	B					B		B		Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the construction site.
		1.2. Impacts of the establishment and spread of alien invasive species		B		B				B		Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove.Establish an ongoing monitoring programme to detect and quantify any aliens that may become established.
		1.3 Increased erosion risk as a result of soil disturbance and loss of vegetation cover	B				B			B		Any extensive cleared areas that are no longer or not required for construction activities should be re-seeded with locally-sourced seed of suitable species. Bare areas can also be packed with brush removed from other parts of the site to encourage natural vegetation regeneration and limit erosion.

A: Height impact is expected. **B**: Medium impact is expected. **C**: Extent of impact is unknown (Low impact, but survey and analysis shall be done) No mark: Few impacts are expected.

Source: JICA SurveyTeam

Impact assessments on the fauna and flora of the project area

Conclusively, the following impacts were presented with the Extend (area), duration and magnitude.

Impact index value and categories in Solar Power Plant project

No.	Impacts	Extend (area)	Duration	Magnitute	Total	Average	Category
	Fauna / Flora						
1	Loss of indigenous vegetation	2	3	2	7	2	Medium
2	Alien invasive species	2	1	2	5	1.5	Medium
3	Soil erosion by removal of ground cover	1	2	2	5	1.5	Medium
4	Loss of habitats	2	3	2	7	2	Medium
	Total	**7**	**9**	**8**	**24**	**2**	**Medium**

CURRENT ENVIRONMENTAL ASPECTS

According to the recorded data, plenty of birds, some species of butterflies and some species of insects between 100 Meter and 500 Meter surrounding the project area are discovered because of there are little food sources by mainly comprises of grass and Alien invasive species and other shrub and herb in these study area.

IUCN and CITES Appendices

In study sites were recorded no fauna species under the IUCN RedList and CITES appendices were recorded in this project area at the survey time. According to BirdLife International (2012 & 2013), Least Concern (LC) mean without include threatened species, the taxon is not in a threatened category.

Forecast Result

1) **Changes of vegetation**

The main composition of vegetation in the project area was non-productive area. By the construction work, the natural vegetation in the project area would disappear and replaced with non-native vegetation. From the beginning of planning phase, land use design of project development made consideration to in and around natural environment. Hence, it is judged the change of vegetation before and after project development would not cause any significant impact on the surrounding area.

2) **Loss of terrestrial species and/or their habitats**

As described above section of species which need to conserve and were not identified in the project area. Among habitats, some terrestrial fauna species little far from project surrounding area can continue to live in the existing habitat. On the others hands other species of habitat and local cultivations would be affected by the construction work, although important species would not be included these affected species.

Mitigation Measures

Following measures are required for the exiting fauna and flora species:

- The natural vegetation at the site for the treatment works is considered of local conservation value. These efforts should be made to retain as much as is feasible during the construction stage.
- At the beginning of construction works, the exact site area should be marked and then the remainder of the shrub cordoned off for the duration of construction.
- The tree plantations should be left during operation phase. It will become natural habitat for some fauna species.
- The fauna can be moved away because of the increase in noise speed. So, during the operation periods should be controlled the noisy volume in this area.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions and Recommendations

It is concluded that;

The Solar Power Plant Project would have some impacts (positive and negative) on the surrounding environment in both direct and indirect ways, as there will be direct and indirect interactions between project activities and the environment.

The serious negative impacts can't be occurred association with the Solar Power Plant Project on terrestrial faunas around the survey area. These areas have suitable condition of site, population and species diversity of fauna. This condition will be faced a few percentage of impacts as terrestrial animals because to use the solar power plant project is large space to compare with relative animal's habitats. They can move away during operation periods project. But, they have to move to construct the habitats to other places of near the study sites.

From an ecological perspective, the site is a favorable location for the development of a solar energy facility. There is sufficient space available at the site to accommodate the development within areas which are not sensitive locally or from a regional perspective.The developmental footprint will not affect any botanical "no go" habitats or areas.As there are no obvious concentrations of rare species or any especially threatenedhabitats or vegetation types on site, there are no areas of regionally high or veryhigh ecological sensitivity demarcated within the project development footprint.

It is recommended that;

The result of building of Project can make the working opportunities of people from the village around the project areas can be developed. The family income can be improved concerning with the project during the construction period. Because of the improvement of family income, the business, health and social affairs will be developed by the advantages of the project. Loss of habitat for some fauna and flora species and biodiversity reduction due to vegetation clearing neighboring the project site are recorded. Different mitigation measures for these negative impacts have been proposed to reduce to the minimum their effects on the biophysical environment.

Nowadays it is widely accepted that the active Solar Energy Systems (photovoltaics, solar thermal, solar power) provide significant environmental benefits in comparison to the conventional energysources, contributing to the sustainability of the human activities.

Solar energy facilities operate by converting solar energy into a useful form (ie. electricity). The use of solar energy for electricity generation is a non-consumptive useof a natural resource and consumes no fuel for continuing operation. Solar powerproduces an insignificant quantity of greenhouse gases over its lifecycle as compared toconventional coal-fired power stations. The operational phase of a solar facility does notproduce any other type of airpollution, as do fossil fuel power generation technologies.The climate change challenge needs to include a shift in the way that energy is generated and consumed.Renewable energy is considered a 'clean source of energy' with thepotential to contribute greatly to a more ecologically, socially and economicallysustainable future. The challenge now is ensuring solar energy projects are able to meet all economic, social, and environmental sustainability criteria.

The overall impacts of the proposed project have been assessed as being of low or medium significance. The proposed project is therefore considered to be acceptable in terms of potential impacts on flora it is recommended that it should be permitted to go ahead.

With regards to environmental aspect, it may be concluded that this Project Construction is assumed to be better than that of our survey environs. As the assumption, by the advantages of the project, it may be support for the developed country. Thus, the present study agreed with that statement.

Photographic Record of observations and the Study Team





Study Site

Biodiversity Survey Team

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11. Developers Corporate Social Responsibility

The Developer´s (Convalt Energy) Corporate Social Responsibility

1.6.1 Corporate Social Responsibility ("CSR") is a function that acts as a self-regulatory mechanism whereby the business at hand monitors *3.4.10 Snapshot – Generation and Distribution* and ensures its active compliance and good practice within the local law, ethical standards and national or international development standards. The goal is for the CSR to lead to positive impacts for its employees, their families as well as that of the local community and society when doing any kind of business.

Myanmar does not have a deep awareness of CSR. Many local companies (and some international firms) still equate CSR with in-kind donations or charitable contributions. Myanmar is a deeply religious country with the majority of its residence practicing the Buddhist religion, which holds that one may increase one's standing in the cycle of reincarnation by "making merit" through acts of charity. As a result, most Burmese business owners, including so-called "cronies", often donate money, build schools, hospitals, low-rent apartments or even pay above the market wage as a result of their Buddhist faith.

Private companies owned by foreign nationals from China, South Korea, Japan or other ASEAN countries may practice some form of CSR, but such practices are largely absent in the Myanmar market. Several U.S. companies, such as ACO Investment Group and Convalt Energy are actively incorporating CSR as an integral part of their entry (or pre-entry) strategy for Myanmar.

The Government of Myanmar does not have in place corporate governance, accounting, or executive compensation standards. Nonetheless, since 2011, Burmese civil society organizations have become more vocal in protesting against companies or government sponsored projects that they view as violating social standards

The Firm

Convalt´s business is energy and as the availability of energy is crucial to the development of a country, so is the trust of the people. Trust and responsibility represent two core firm values; we continually aim to be a trusted and responsible business partner.

The core of a successful future within the energy sector is achieved only through partnerships and working closely with our stakeholders and taking their interests into account.

As part of the energy sector, our business impacts the society, the environment and economy both directly and indirectly through the project development itself and the permanent job opportunities that may be created.

As a professional developer, service provider and employer, Convalt aims to make a sustainable commitment to its CSR practice. Convalt Energy will adopt operating principles under this policy, which will provide guidance on:

- Community & Social objectives
- Environmental sustainability
- Ethical Issues and Solutions
- Employee commitment and business relationships

Environmental sustainability

Convalt Energy´s believes that by encouraging sustainability and assisting clients and partners to implement sustainable strategies that reduce overall cost and generate overall value, we will thrive as a firm. We believe that our firm will continuously become more sustainable and grow through encouraging others.

The responsibility towards our clients and affected communities are thoroughly recognized by Convalt Energy. Through the advice we provide and strategies we develop alongside partners and clients, we all move towards a better and more sustainable future. We always strive to set an example.

Our goal is to:

- Work alongside our clients and partners to promote and develop a sustainable high standard business.
- Ensure continuous sustainability performance and improvements for our firm and clients through a proven strategy that continuously evolves to adapt to an ever-changing future.
- Ensure that our clients, employees and partners affected by this policy always have a complete understanding of sustainability and climate change impacts as this is a key element in the energy business and the society.
- Promise to be a promoter of sustainability in the energy sector by being thoroughly engaged with our equipment suppliers and partners to promote high standard values toward a sustainable and clean society and aid in any way reasonably possible within each directly affected community.

Responsibility towards the community

Convalt Energy is committed to understanding any impact that we make on the community through all of our developments.

Our goal is to:

- Commit to the U.N. Global Compact principles regarding strategies, policies and procedures, and establishing a culture of integrity, where Convalt Energy is not only upholding its basic responsibilities to people and planet, but also setting the stage for long-term success.
- Continuously aid and encourage all clients and partners who have a notable drive in charitable services.
- Continue to offer our knowledge and time at no cost for any community that we do business in, including non-profit organizations.

- Thoroughly review our suppliers to ensure sustainable continuous partnerships.

Ethics

The goal of Convalt Energy is to maintain and adhere to the highest ethical standards and integrity. Convalt Energy will always comply with ethical guidelines in addition to local regulations, laws and standards.

Our firm follows and promotes global standards and values of respect, integrity, trust and collaboration.

All employees are held to the standard set by the parent company, ACO Investment Group.

Convalt Energy provides annually a mandatory compliance meeting for all employees. The meeting communicates to all employees, the proper steps disclosing malpractice or wrongdoing internally and how to deal with concerns without fear of retaliation. Victimization of a whistle-blower will not be tolerated at Convalt Energy. Convalt Energy shall also seek to protect the identity of the individual who raised the concern.

Convalt Energy has established means of reporting wrongdoing. Convalt Energy employees, are required to identify and report to government authorities any suspicious accounts or transactions that may be related to possible violations of law, including money laundering, terrorist financing, insider trading and insider abuse, fraud and misappropriation of funds, among others.

Convalt Energy procedures are monitored by the Compliance Officer and annually reviewed by the board directors. Convalt Energy also has an open door policy where each level of employee can approach any member of the firm's executives. Employees are encouraged to discuss internal issues of concern within the firm, emphasizing that employee feedback is welcome. Convalt Energy believes that, internal reporting is vital to the health of the organization. Furthermore, there are discussions held within the annual compliance meeting on reaching out to external options, such as hotlines.

Convalt Energy also offers financial incentives through a reward system, again, employing the concept that there should be no fear of retaliation. Convalt Energy promotes open and effective channels of communication.

Convalt Energy strives to create an atmosphere where employees are encouraged and can feel safe raising any concerns. Convalt Energy, as a growing firm pursues an ethical and legal culture where its biggest strengths are created and preserved by its employees

Our goal is to:

- Follow high standards of behavior; this is considered a must at all times by our employees and partners.
- Provide a platform through which employees can easily report incidents or concerns which may arise regarding unsafe, unethical or dishonest behavior in the workplace or community.
- Firmly adhere to a zero tolerance approach to any form of unwanted behavior, harassment or conduct that may be found intimidating, upsetting, offensive or humiliating to both the community as a whole or a single individual's dignity. Within our organization, any such negative behavior is firmly described as unacceptable.

People

Working together is considered to be the foundation of Convalt Energy. Business partners, clients, employees, suppliers within our organization must adhere to Convalt Energy´s integrity standard of conduct. Convalt Energy always aims to treat all stakeholders with dignity and outmost respect where any issue is to be resolved collectively.

Our goal is to:

- Continuously evolve within the company to establish long relationships. As people and the society is the fundamental piece of our business, we encourage continuous personal evolvement within our firm, relationships with clients and partners, which we will continue to strive for.
- Always respect employees and encourage personal development not only within the firm but also within each project developed.
- Be diverse within the workforce regarding both gender and ethnicity. Equality and diversity is considered healthy by Convalt Energy.

Policies

The policies that help to underpin and support our Corporate Social Responsibility Policy are:

- Sustainability strategy
- Diversity policy
- Equal employment opportunities policy
- Flexible working policy
- Anti-harassment policy
- Maternity, paternity, adoption & parental leave
- Good international best practice adherence