Client

**Myanmar Central Power**

Project

# 50 MW Gas Engine Power Plant in Hlawga, Myanmar

Document

## Environmental GAP Analysis

Project number

**2756**

June 2014

# Imprint

**Client**
Myanmar Central Power
Address

**Contractor**
AF-Consult Switzerland Ltd
Täfernstrasse 26
5405 Baden/Dättwil

## Document Information

| | |
|---|---|
| **Project** | 50 MW Gas Engine Power Plant in Hlawga, Myanmar |
| **Document** | Environmental GAP Analysis |
| **Project number** | 2756 |
| **Department** | TK |
| **Document path** | Dokument3 |

## First Edition

| | Date | Initials | Signature |
|---|---|---|---|
| **Created** | June 2014 | RAL | |
| **Verified** | | | |
| **Released** | | | |

## Revision List

| Nr. | Page(s) | Date | Revision Note | Created by (Initials/Signature) | Verified by (Initials/Signature) |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

## Distributor

# Contents

© Copyright AF-Consult Switzerland Ltd

# 1 Introduction

The Department of Electric Power (DEP)/ Ministry of Electrical Power (MOEP) are responsible for thermal power generation plants in Myanmar. Due to seasonal reasons with the hydro power plants and technical problems with existing thermal generation plants, the electricity shortages have worsened in Myanmar. In particular, the insufficient electricity supply in Yangon often causes big problems for residences and industries.

The Republic of the Union of Myanmar initiated to carry out urgently three new 50 MW class generation plants in order to counteract power shortage and to stabilize the voltage of the national power grid and to improve power supply to Yangon.

DEP/MOEP and Zeya & Associates (Z&A) in October 2012 signed a Memorandum of Understanding (MOU) to develop one of these projects and to install a new 50 MW Gas Generation Power Plant in on Hlawga site in Yangon. It was decided to base this plant on gas engines because with this alternative the shortest implementation times can be realised.

Zeya & Associates Co., Ltd has developed the Hlawga Gas Engine Power Plant with a generation capacity of about 50 MW in two phases:

- ca. 25 MW operated with 100 % gas as first phase,
- ca. 25 MW operated with 100 % gas as second phase.

The site of the gas engines plant is near to Yangon, in the direct vicinity of the existing GT plant on Hlawga site. The company **Myanmar Central Power** (MCP) has been founded to own the plant (***Attachment A-1***).

The first phase (25 MW) of the plant is in commercial operation since July 2013. The contract for the second phase has been signed, start of commercial operation is expected end of April 2015.

Whereas the first phase of the project comprise 26 engines, each with a generation capacity of 1 MW, the second phase will use three big engines, each with about 9 MW generation capacity. Contractor for the gas engine generators will be Rolls Royce with engines manufactured by Bergen in Norway.

Z&A is now under the discussion with GIEK (Garantiinstituttet for Eksportkreditt, Oslo), the Norwegian Funds for the debt financing for Hlawga Power Plant Phase 2 with Rolls Royce/Bergen Engines. As a part of their due diligence GIEK requires an **Environmental Gap Analysis** Report for the Hlawga Power Plant.

AF-Consult Switzerland was awarded by Z&A to prepare this Environmental Gap Analysis Report.

# 2 Brief Description of the Project

The project site is located in the north of Yangon in Mingaladon Township, neighboring the south part of the Hlawga Lake. Hlawga Lake itself is part of the Hlawga National Park and serves as one of the drinking water reservoirs for Yangon. The figure below show the site location and the situation with Phase 1 of TPP.

*Figure 1: Site Location*


*Figure 2: Phase 1 of Gas Engines TPP*


The two main buildings of Phase 1 (see picture above) comprise each 13 gas engines, supplied by Dresser Rand Guascor, see photo below.

*Figure 3: Gas engines of Phase 1*


Phase 2 of the Gas Engine Thermal Power Plant will be erected in the south of Phase I.

Main Data of Phase 1:

| | |
|---|---|
| Number of gas engines | 26 |
| Type | SFGM 560 |
| Efficiency (gross) | 39.6% |
| Net plant electrical output, ca. | 25 MW |
| Guaranteed NOx emission | 500 mg/Nm$^3$ (dry, 5% $O_2$) |

As in Phase 2 three big engines (supplied by Rolls-Royce) will be used the space demand will be lower than for Phase 1. The layout of Phase 2 is shown on ***Attachment A2***.

Main Data of Phase 2:

| | |
|---|---|
| Number of gas engines | 3 |
| Type | B35:40V20AG2 |
| Efficiency (gross) | 44.7% |

| | |
|---|---|
| Net plant electrical output, ca. | 27 MW |
| Guaranteed NOx emission | 500 mg/$Nm^3$ (dry, 5% $O_2$) |

Due to the different type and size of the gas engines, the power generation efficiency of Phase 2 is higher than in Phase 1. A power generation capacity of 27 MW is expected for Phase 2.

# 3 Analysis

## 3.1 Preparation of the Report

GIEK generally follows IFC (International Finance Corporation) guidelines, i.e.

- IFC's Performance Standards on Social & Environmental Sustainability
- IFC's Environmental, Health and Safety Guidelines for Thermal Power Plants

have to be considered as benchmark for projects funded by GIEK.

End of May 2013, Zeya & Associates awarded AF-Consult Switzerland with the preparation of the Environmental Gap Analysis Report for the 50 MWel Gas Engine Power Plant Project in Hlawga.

This report in hand has been prepared within AF-Consult's Thermal Energy Plants Department, headed by

- Mr. Markus Schneider.

Project Manager for the execution of the environmental gap analysis and responsible for the preparation of the report was

- Dr. Ludwig Raible

who is Head of Environmental Engineering Group within AF-Consult Switzerland's "Thermal Energy Plants" Department.

He was in the home office supported by

- Mr. Jürgen Lobpreis

as environmental engineer.

A visit to Yangon and Hlawga (site) was undertaken 08.-20.06. 2014 by AF-Consult's expert in order

- to visit the site,
- to interview Z&A and MCP management,
- to review documents,
- to collect data and available information and
- to prepare the report.

In the beginning of this mission a meeting with Z&A and a short site visit were arranged under participation of two representatives of GIEK:

- Ms. Sigrid Brynestad (Environmental Expert)
- Mr. Alexander Berg (Country & Power Market Analyst)

The gap analysis will include for each of the relevant criteria

- a brief description of the main objectives and requirements,

- the descrtiption of the actual situation, and
- the identification of the main gaps.

Based on this analysis, an approach and actions to close the gaps shall be proposed.

Finally, a summary and conclusion will be given, using a tabular compilation of the main findings and the proposed actions to close gaps (Summary and Action Plan).

## 3.2 General Remarks

The Performance Standards (PS) on Social & Environmental Sustainability comprise the following:

Performance Standard 1: Social and Environmental Assessment and Management Systems
Performance Standard 2: Labor and Working Conditions
Performance Standard 3: Pollution Prevention and Abatement
Performance Standard 4: Community Health, Safety and Security
Performance Standard 5: Land Acquisition and Involuntary Resettlement
Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
Performance Standard 7: Indigenous Peoples
Performance Standard 8: Cultural Heritage

Due to the nature and size of the project and to specific boundary conditions, some of the PS are not applicable in the Hlawga Gas Engines TPP project.

- PS 5 is not applicable, as no land acquisition and resettlement was needed. The land is owned by MOEP and is leased at a low rate to MCP.
- PS 7 is not applicable, as no indigenous people are affected.
- PS 8 is not applicable, as no cultural heritage was found on site and surroundings.

PS3 mainly deals with issues which are covered also in IFC's EHS Guidelines for TPP and which have been addressed already in the EIA Report (January 2013). The analysis of these two criteria shall therefore be combined in one section of the report.

With respect to the site, it is worth to mention that the land for the gas engines plant is not a "new" site. The site was covered with buildings till some years ago as can be seen on the Google Earth picture of 2006. No big trees had to be cut down in course of the site preparation for the new gas engines power plant (see chapter 3.7, PS 6).

## 3.3 Performance Standard 1 – Environmental and Social Assessment and Management Systems

### 3.3.1 Main Objectives and Requirements

The objectives of PS 1 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 communitie, and the environment
- To ensure that affected communities are appropriately engaged on issues that could potentially affect them
- To promote improved social and environment performance of companies through the effective use of management systems.

The client shall establish and maintain a Social and Environmental Management System appropriate to the nature and scale of the project and commensurate with the level of social and environmental risks and impacts. The Management System shall incorporate the following elements: (i) Social and Environmental Assessment; (ii) management program ; (iii) organizational capacity; (iv) training; (v) community engagement; (vi) monitoring; and (vii) reporting.

### 3.3.2 Actual Situation

#### 3.3.2.1 Environmental and Social Assessment

According PS 1 the client should conduct an environmental and social assessment of the project. For the 50 MW Hlawga Gas Engines Power Plant an Environmental Impact Assessment (EIA) Report has been prepared by AF-Consult Switzerland in January 2013 and has been submitted by Z&A to the responsible authorities.

Not all information were available in desirable scope and depth (e. g. ambient air quality baseline conditions) to prepare an EIA in the full scope and depth as defined in the World Bank guidelines for EIA. Therefore, the EIA could not cover all tasks of a full scope EIA according international standard (e. g. preparation of dispersion calculations). The EIA Report focused on environmental issues, whereby the social assessment was not yet covered in the same depth.

The EIA Report provided a brief description of the gas engine power plant, considering also the existing gas turbine combined cycle power plant in the neighbourhood. All relevant environmental issues and impacts of the new gas engines power plant have been identified and described. Conclusions with respect to mitigation measures and environmental management have been given.

The impacts have been divided into impacts during construction phase and impacts during operation phase. The potential negative environmental impacts were assessed using a scale from "negligible" over "slight" and "intermediate" to "high".

As can be seen from the summarising assessment below, by far most of the investigated individual environmental impacts have been assessed as "slight". Consequently, for the new 50 MW Gas Engines Project the expected overall environmental impact is relative low and the project is acceptable from environmental point of view.

In order to improve environmental awareness and to coordinate environmental issues and activities and to properly assess environmental impacts of the Hlawga Gas Engine Power Plant, the installation of an Environmental Management Plan (EMP) has been recommended in the EIA Report.

*Figure : Summarised Impacts according EIA Report*

**Summarising Assessment of Environmental Impacts**

| Impact | positiv | negligible | slight | inter-mediate | high | Remark |
|---|---|---|---|---|---|---|
| **Impacts During Construction Phase** | | | | | | |
| Land clearing & land used | | | | | | existing site; no resettlement |
| Air pollution | | | | | | mainly dust |
| Water pollution | | | | | | sanitary water |
| Noise | | | | | | constr. equipm. temporary |
| | | | | | | |
| **Impacts During Operation Phase** | | | | | | |
| Land used | | | | | | existing site; no additional impact |
| Particulate emission | | | | | | negligible due to gas firing |
| CO emission | | | | | | no emission standard |
| SO2 emission | | | | | | negligible due to gas firing |
| NOx emission | | | | | | below WB emission standard |
| Impact on ambient air | | | | | | expected relative low |
| Noise | | | | | | standards can be met |
| Water consumption | | | | | | very low water consumption |
| Impact by waste & wastewaters | | | | | | standards will be met |
| Impact on climate (CO2) | | | | | | determined by fuel and efficiency |
| Impact on Flora & Fauna | | | | | | no rich flora and fauna around site |
| Socio-economic | | | | | | industr. developm, new employments |
| | | | | | | |

*Conclusion: Environmental assessment has been executed; the present analysis will also pay attention to the social aspects.*

### 3.3.2.2 Permit

The project has passed the local permit procedure. The permit to operate the 50 MW Hlawga Gas Engines Power Plant was issued 09. September 2013 to the operating company Myanmar Central Power (MCP). The *Permit No. MaNaTha-934/2013* was issued by Myanmar Investment Committee (MIC) and includes all relevant and necessary approvals from Ministries, including Ministry for Environmental Conservation and Forestry. ***Attachment A3*** shows a notarial translation of this permit.

*Conclusion: No gap; no action needed.*

### 3.3.2.3 Management Program

The company Z&A has implemented a management system and is certified according ISO 9001 (***Attachment A4***). The Client confirmed the intention to implement this system also for the plant operation company. The final organisation and management system will also reflect the Environmental Management Plan (EMP) as recommended in the EIA Report.

*Conclusion: Management system shall be implemented also for plant operation company.*

#### 3.3.2.4 Organisation

The organisation of the gas engines power plant for Phase 1 (in operation) and Phase 2 (planned) is shown on ***Attachment 5*** and ***Attachment 6***.

The organisation Phase 1 comprises besides plant management teams for

- Operation
- Maintenance
- Store and Support
- Security.

The organisation of Phase 2 is still preliminary (shall first cover implementation phase and can later be modified for operation phase).

The organisational structure as of today does not yet include the position of an *Environmental Engineer* as proposed in the EIA Report. Z&A and MCP management informed that the search for this position has already commenced but is not easy to find a skilled and experienced candidate. Goal is to cast this position before Phase 2 of the plant passes to commissioning and operation.

One Environmental Engineer should be enough for both parts of the plant. As described in the EIA, he shall take the responsibility for the environmental related issues, such as stack emission monitoring, noise monitoring, internal waste management, oil storage etc. and internal and external reporting. The organisational structure should be modified in order the integrate this position and responsibilities.

*Conclusion: Position of Environmental Engineer shall be installed before operation of whole plant.*

#### 3.3.2.5 Training

PS 1 requires to train employees and persons with responsibility for environmental and social issues so that they have the necessary knowledge and skills to perform their tasks. No concrete plan and program have been established to date. Operation company shall commence to prepare and plan such a training program. The training program should commence towards the end of the construction period (Phase 2) and should be completed in the first few months of whole plant operation.

*Conclusion: Training to be prepared and executed.*

#### 3.3.2.6 Community Engagement

Hlawga site is an area where since many years power generation units are in operation. The risks imposed to local communities by the new gas engines plant operation or adverse effects are assessed almost negligible and on-going consultation with them seems not necessary. But Z&A proposed in future to disclose relevant information on the project and plant operation. Such disclosure could include general operational information, information on environmental performance of the plant or relevant incidents. A possibility to disclose those information would be to publish it on the company's website.

*Conclusion*: *No gap.*

#### 3.3.2.7 Monitoring and Reporting

All relevant information and data with respect to the plant's performance and environmental aspects will be collected and stored for preparation as necessary. After the whole plant will be in commercial operation (latest after warranty phase), a regular reporting procedure will be installed.

It is recommended to prepare Annual Environmental or EHS Reports with relevant information, comprising e.g.:

- Operation time
- Annual generation
- Gas consumption
- $CO_2$ emission
- NOx emission
- Noise measurements
- Consumables consumption
- Incidents
- Accidents
- Special issues.

*Conclusion:* *Reporting to be established on regular basis after whole plant is in commercial operation.*

### 3.3.3 Identified Gaps

Summarising the Analysis with respect to PS 1, the following gaps or open issues have been identified:

- Management System shall be implemented for operation company
- Position of Environmental Engineer shall be installed and casted
- Training to be planned and executed
- Reporting on regular basis to be implemented.

## 3.4 Performance Standard 2: Labor and Working Conditions

### 3.4.1 Main Objectives and Requirements

Objectives of PS 2 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 labor and employment laws
- To protect the workforce by addressing child labor and forced labor
- To promote safe and healthy working conditions, and to protect and promote the health of workers.

### 3.4.2 Actual Situation

The regulations with respect to labor and working conditions are under the reponsibility of the *Ministry of Labour, Employment and Social Security* of the Republic of the Union of Myanmar.

http://www.mol.gov.mm/en/

A brief overview on key provisions of the Labor and Employment Regulatory Framework in Myanmar has been published in *T-AB (Thai-American Business), Vol. 5, 2013* (***Attachment 7***).

Z&A's rules and regulations concerning labor and employment (***Attachement A8***) cover the following issues:

- General Rules
- Employment
- Staff Grade & Designation
- Working Rules
- Retirement, Dismissal & Disciplinary Punishment
- Salary, Allowances and Loan
- Holidays & Leave
- Health Control and Sanitation

These company regulations comply with the national regulations. Payed salaries are higher than required minimum and several other conditions are better than required in the national regulations (e.g. with respect to health care).

Z&A Management confirmed

- not to apply child labor or forced labor, and
- with respect to the implementation of Phase 2 of the Hlawga Gas Engines Project, to make sure that those rules and regulations will also be followed by subcontractors during construction of the plant.

*Conclusion: The project will be implemented in compliance with the applicable regulations with respect to labor and working conditions.*

### 3.4.3 Identified Gaps

No gaps identified.

## 3.5 Performance Standards 3: Pollution Prevention and Abatement and EHS Guidelines for TPP

### 3.5.1 Main Objectives and Requirements

The operation of a fossil-fired thermal power plant may cause different negative environmental impacts comprising:

- Influence on the air quality by the emission of gaseous pollutants and dust into the air
- Emission of carbon dioxide ($CO_2$), i. e. contribution to the so-called greenhouse effect
- Water consumption and wastewater production
- Solid waste and residues production
- Noise.

The general objective of PS 3 is "Pollution Prevention and Abatement", i.e.

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities
- To promote the reduction of emissions that contribute to climate change.

During the design, construction, operation and decommissioning of the project the client shall consider ambient conditions and apply pollution prevention and control technologies and practices that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective.

As described in the EIA Report, the emission standards which shall apply for this project are standards recommended by the World Bank Group and published by IFC (International Finance Corporation) in the document *EHS Guidelines for Thermal Power Plants*. This document, among others, provides guidelines and standards covering effluents and emissions of different kinds of thermal power plants (TPP), including reciprocating engines (RE) plants.

For Reciprocating Engines (REs) fired with natural gas, emissions of particulates and $SO_2$ are not relevant, only nitrogen oxides (NOx) are of importance.

**Applicable Emission Standards:**

IFC's EHS Guidelines for gas-fired Reciprocating Engines define the following emission standard:

NOx emission standard: **200 mg/Nm$^3$** (dry, at **15%** reference oxygen)

The EHS Guidelines standard for RE is defined for a reference oxygen content of 15% in the dry flue gas. For RE facilities mostly a value of 5% reference oxygen is in use. To have a direct comparison, we have re-calculated the standard also for 5% reference oxygen:

NOx emission standard: **533mg/Nm$^3$** (dry, at **5%** reference oxygen).

**Applicable Noise Standards:**

Noise impacts should not exceed the levels presented below or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

*Table 1: Noise Level Guidelines for Far Field Noise*

| World Bank: EHS Guidelines for Thermal Power Plants (2008)<br>Maximum Allowable Noise Pressure Levels at Receptors in dB(A) | | |
|---|---|---|
| **Receptor** | **daytime 07.00-22.00 hrs** | **nighttime 22.00-07.00 hrs** |
| Residential, institutional, educational areas | 55 | 45 |
| Industrial and commercial areas | 70 | 70 |

*Table 2: Noise Level Guidelines for Near Field Noise*

| World Bank: EHS Guidelines for Thermal Power Plants (2008)<br>Maximum Allowable Noise Pressure Levels | |
|---|---|
| **Location** | **LAeq in dB(A)** |
| Control Room | 55 |
| 1 m from any equipment in 1.5 m height | 85 |

### 3.5.2 Actual Situation

#### 3.5.2.1 Greenhouse Gas CO2

Carbon dioxide ($CO_2$) is besides water the main combustion product of all fossil fuels. The amount of $CO_2$ generated during combustion is defined by the composition of the fuel, i.e. the carbon content of the fuel.

Combustion calculations have been performed for the natural gas used in the Hlawga gas engines power plant (Yadana gas type). The specific $CO_2$ value of the Yadana gas is 1.504 kg/Nm3 gas. That means, the complete combustion of 1 normal cubic meter of fuel gas produces 1.5 kg of carbon dioxide. The $CO_2$ emission mass flow is proportional to the amount of combusted gas, as shown below for different units:

1.504 kg $CO_2$ / $Nm^3$ gas (related to gas volume)

210 kg $CO_2$ / MWh gas (related to gas heat input).

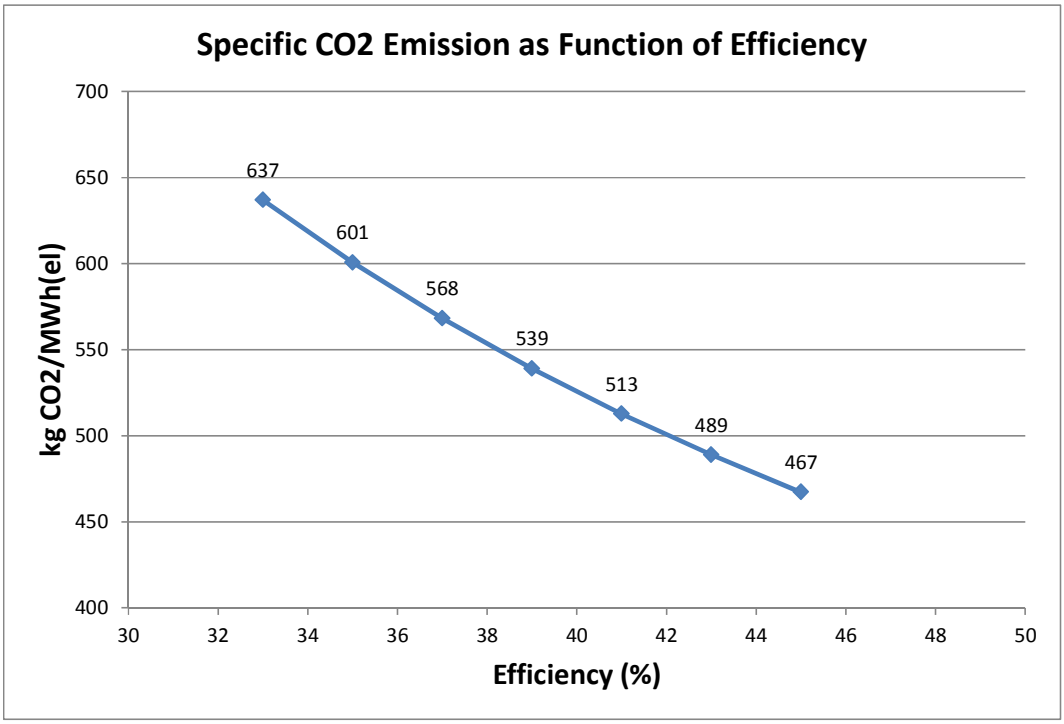
The specific carbon dioxide emission of natural gas is lower than for oil or coal as fuel. For a given fuel, the $CO_2$ emission can be lowered only by increasing the efficiency of the power plant.

In the figure below the specific $CO_2$ emission, related to power generation, is shown as function of the power plant efficiency. For example, with 37% efficiency the specific carbon dioxide emission is 568

kg/$MWh_{el}$ and with 45% efficiency only 467 kg/$MWh_{el}$. As mentioned, the efficiency of Phase 2 will be higher than for Phase 1.

If 41% efficiency is assumed as an average for the whole Hlawga gas engines power plant (50 MW), the plant will produce 25.6 t $CO_2$ per hour.

*Figure 5: Carbon Dioxide Emission and Efficienncy*




Such specific carbon dioxide emission values can be used to calculate the annual $CO_2$ mass flow from the gas consumption or the generated power.

*<u>Conclusion:</u> With respect to the objective to minimise greenhouse gas emission, it can be stated that Hlawga Gas Engines TPP fulfills this requirement,because of using natural gas as fuel (low specific $CO_2$ values) and applying state of the art technology (high efficiency).*

### 3.5.2.2 Emmissions into the Air

#### 3.5.2.2.1 Emission Values

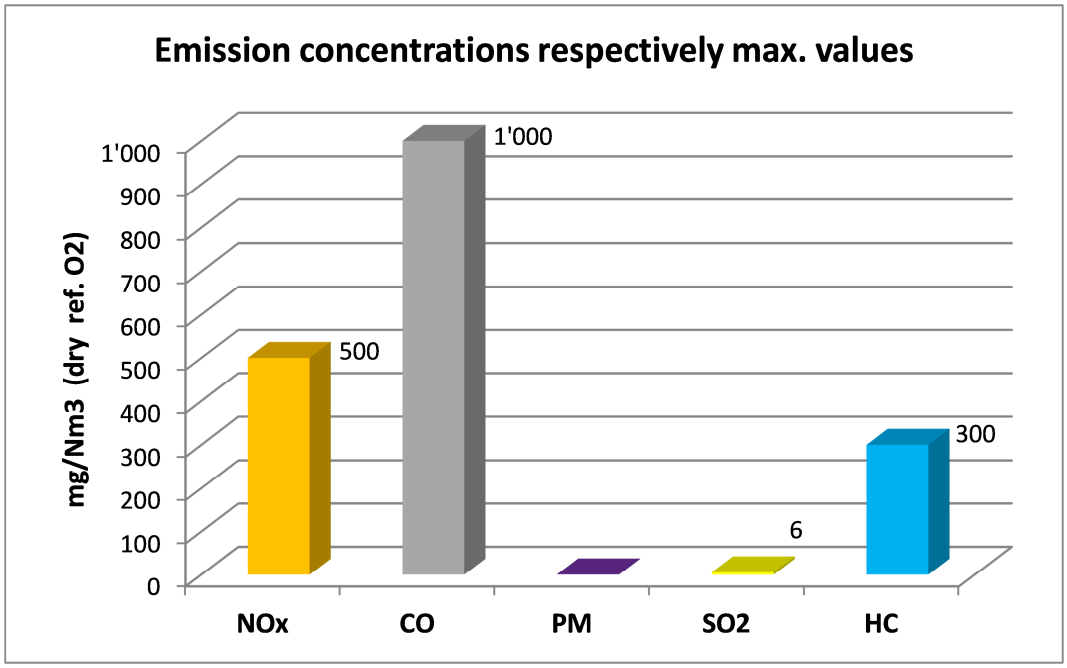
As natural gas is exclusively used as fuel, NOx is the only relevant emission into the air which has to considered. The emissions of $SO_2$ and dust are very low or negligible. As mentioned, the EHS Guidelines NOx emission standard for gas-fired RE plants is 200 mg/$Nm^3$ (dry, 15% oxygen), which is equivalent to 533 mg/$Nm^3$ (dry, at 5% oxygen).

It can be expected that the NOx concentration will not exceed 500 mg/$Nm^3$, related to dry flue gas at 5% reference oxygen content. This value has been guaranteed by the engines suppliers of both phases. Hence,

the NOx emission concentration would still have a margin to the emission standard (533 mg/Nm$^3$ @ 5% O2).

The CO emission is guaranteed to be below 1000 respectively 750 mg/Nm3 (Guascor / Rolls-Royce) and hydrocarbons (HC) below 300 / 225 mg/Nm$^3$ (Guascor / Rolls-Royce). The sulfur dioxide concentration has been calculated from the sulfur component in the fuel gas and will be not more than 5.6 mg/Nm$^3$. A summary of the emission concentrations, respectively the expected maximum values (Phase 1) is shown in the diagram below.

*Figure 6: Emission Concentrations*




As mentioned above, for gas engines as well as for gas turbines, the NOx emissions are the most important gaseous pollution and only the NOx emissions are covered by emission standards according the WB EHS guidelines. If supplier's emission guarantee value (500 mg/Nm3 @ 5% O2) is kept, the RE plant will also fulfill the IFC's EHS guidelines (533 mg/Nm3 @ 5% O2).

*Conclusion: According emission analyses so far, emission standards are fulfilled.*

#### 3.5.2.2.2 Emission Measurements

Phase 1 of the plant is still in the warranty phase. Since commissioning, repeatedly emission measurements have been executed by the supplier Guascor. These measurements take place all 3000 operating hours and are part of the service and maintenance program. The main findings aresummarised in a "Service Report" which includes also the measured NOx and CO emission values. An example of such Service Report is attached (Attachment 1). According the interview with the Plant Director, generally the NOx emission values to date are below the emission standard.

At a later date, after the warranty period, the execution of the emission measurements will be taken over by the plant operator. MCP as operator of the plant has already purchased a complete set of a mobile

industrial flue gas analyser (Testo 340, from the German company Testo AG). Insofar, the basic technical pre-conditions for a regular emission monitoring during future plant operation are given. Emission measurements have been recommended in the EIA as part of the Environmtal Management Plan.

*Conclusion: Future emission measurements by operation company. Analyser equipment available, special instruction or training recommended.*

#### 3.5.2.2.3 Reporting

Reporting on the emission measurements and monitoring to authorities is not yet established. All previous and future emission measuring reports shall be collected and stored and could be used as base for a regular reporting to authorities or information to community from a date when such procedure will become relevant.

*Conclusion: Environmental reporting to be established and cooperation with authority concerning appropriate procedure.*

### 3.5.2.3 Water and Wastewater

The RE power generation uses an air cooling system. Hence, the power generation process in the new plant does not need any process water or cooling water on a continuous basis. The gas engines have an internal cooling system operated with a coolant which is com-posed of water and several additives. This coolant has to be replaced in regular intervals (approximately yearly). For this purpose clean water isneeded from time to time to prepare the new coolant.

Summarising, the overall water demand of the new gas engines plant is therefore low and concentrates mainly on service water and potable water. Consequently, the usage of water resources for the new gas engines generation plant is very low compared e.g. with steam turbine based generation technologies.

There is no wastewater in classical meaning which would have to be drained to the lake (concerning used coolant see below). There is a network of rainwater from different parts of the plant which is finally directed to the lake. All rainwater and water from areas with potential oil spills is guided to separators before it is connected to the rainwater network. The water to be drained to the lake does not carry hazardous substances.

The sewage from existing toilets and showers is directed to a septic tank. It is a primary treatment unit of domestic sewage, inside is performed the separation and physical-chemical transformation of solid matter contained in those water. It is cleaned periodically by local operators (YCDC).

*Conclusion: According requirements.*

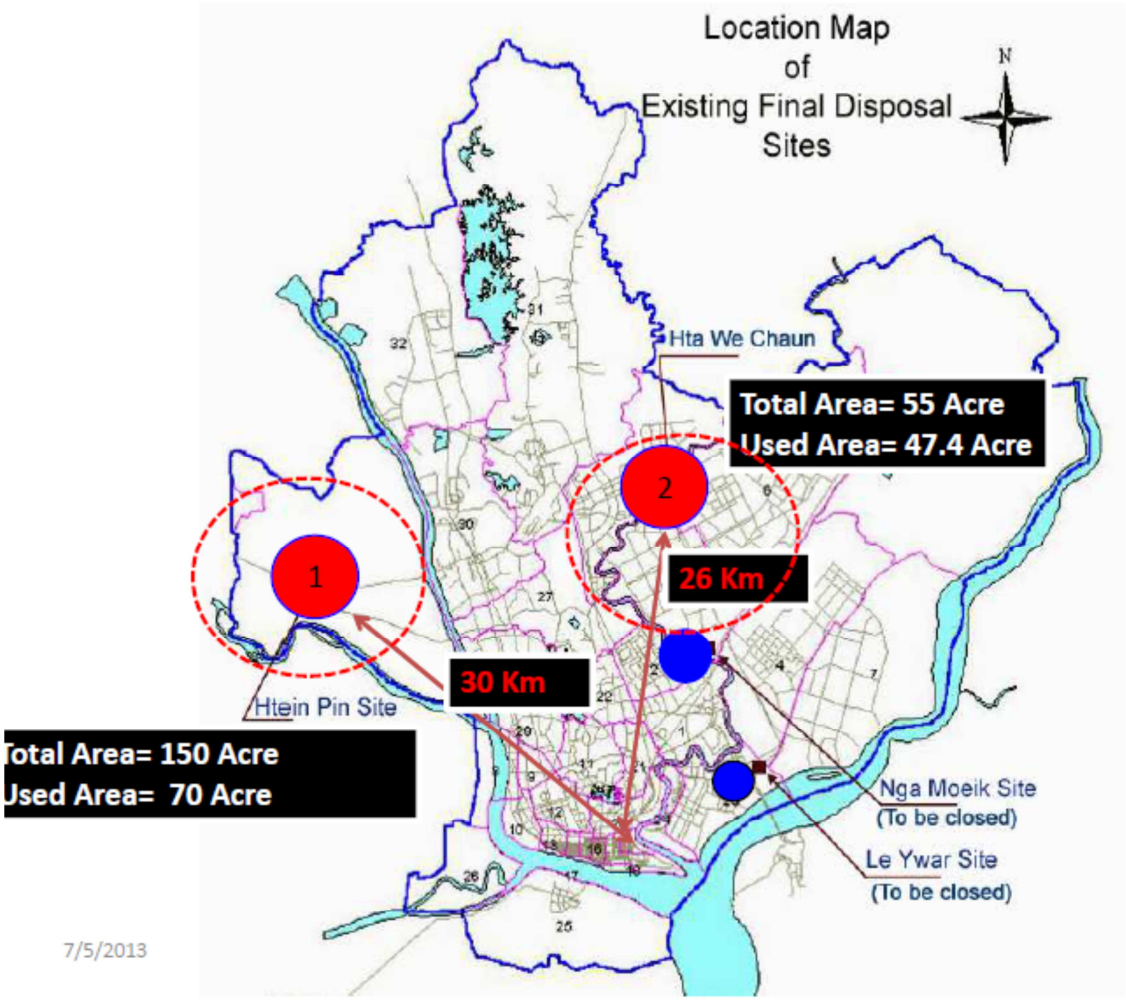
### 3.5.2.4 Waste

Domestic solid waste and similar industrial waste in the plant is collected in containers. The collection and disposal of this waste is executed by YCDC (Yangon City Development Comitee). YCDC is responsible for the whole waste management system of Yangon. If certain tasks in connection with waste management shall be contracted to private companies or persons, YCDC is the responsible authority to issue necessary approvals or to grant licence. Waste collection in Yangon as practiced by YCDC can be categorized into three types:

- Bell ringing system (in this system, collection vehicles pass through streets with bell ringing sound so that people can come out to dispose municipal waste)
- Collection at a street dumps, and
- Limited collection of market wastes and other wastes.

Collection service of 6 Townships at CBD (Central Business District) area is contracted to 6 private companies. The collected solid wastes are hauled into waste dumping sites. In Yangon area mainly two waste disposal sites are in operation where the municipal waste is dumped: *Htein Pin* site and *Htawe Chaun* site. About 800 tons per day are disposed to Htein Pin site and 600 tons per day to Htawe Chaun site. Both are located in Yangon area and its surroundings of the city.

*Figure 7: Waste Disposal Sites in Yangon*




The intention of YCDC is to construct next each dump site a municipal solid waste incineration plant (MSWIP). In 2013 requests for tender for these projects have been issued. Zeya & Associates, together with a partner, offered for the MSWIP project at waste dump site Htawe Chaun and recently was awarded with this project.

*Figure 8: Waste Collection and Disposal at Hlawga Plant by YCDC*


Special or hazardous waste like used engine oil or oily waste from oil separators are collected and disposed of by licensed company or person in accordance with the local regulations. For this purpose MCD has an agreement with U Thet Naing who takes over this category of wastes (***Attachment A9***). U Thet Naing himself owns the business licence for this task from Yangon Regional Government/YCDC (***Attachment A10***).

*Conclusion: according requirements.*

#### 3.5.2.5 Used Coolant

For the cooling of the engines a closed cooling system is used. Only for filling fresh water is needed, and only when the coolant has to be changed from time to time (approximately once per year and engine) used coolant occurs which shall not be drained of to the lake like the surface waters. The amounts of used coolant are low (some cubic meters per year) and up to now a transportation to final disposal was not yet needed.

To date the used coolant is collected and stored in fiber glass tanks until transportation to furthrt treatment or final disposal. The operation company and YCDC are currently investigating the possibilities in order to find the appropriate way of disposal.

*Conclusion: Final disposal under investigation.*

#### 3.5.2.6 Chemicals and Oil Storage

Adjacent to the warehouse there is a storage area for chemicals and oil barrels. Apparently this storage area does not provide enough space. Outside the fence, on the east side of the plant, a further provisional storage area has been arranged where barrels of engine oil and coolant are stored on the ground. This area does not provide a concrete floor, nor a coating, only a plastic sheet on the natural floor has been placed. This solution shall not be sustained and has to be replaced in the near future.

Z&A informed about the plan to construct a new storage area for engine oil, used oil and cooling additive. This area shall be erected according relevant requirements. It shall provide a concrete floor in form of a catch basin with oil-resistant coating. MCP should start planning in time in order to have the new storage area ready when the whole plant is in commercial operation.

*Conclusion: Provisional storage area to be replaced by new one according requirements.*

#### 3.5.2.7 Noise

Only indicative noise measurements on site have been executed so far. The fulfillment of the requirements as described above can not yet be verified.

The operation company will purchase a noise measurement device (e.g. testo 816-1 from Testo AG or comparaable) to be able to execute noise measurements self.

With the already purchased emission analyser as well as a noise measurement device, the operation company will be in a position to execute all emission measurements on his own. This provides a good basis for the regular measurings which have been recommended in the EIA as part of the EMP.

*Conclusion: No usable noise data available, measuring device will be pirchased.*

### 3.5.3 Identified Gaps

Summarising the Analysis with respect to "Pollution Prevention and Abatement and Emission Guidelines" the following environmental gaps have been identified:

- Disposal concept for used coolant to be finalised
- A new storage area for oil and cooing water additives shall be erected. The provisional storage area as operated to date does not fulfill the requirements.
- Noise measurements to be established on a regular basis

## 3.6 Performance Standard 4: Community Health, Safety and Security

### 3.6.1 Main Objectives and Requirements

Objectives of PS 4 are

- To avoid or minimize risks to and im pacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances

- To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security.

### 3.6.2 Actual Situation

As mentioned in 3.3.2, Hlawga site is an area where since many years power generation units are in operation.

The location of the gas engines power plant is in the vicinity of the existing combined cycle power plant and substation Hlawga. The Highway No.1 from Yangon to Mandalay passes on the east part of the power plant. The nearest buildings to the gas engines plant are the buildings of the existing combined cycle power plant. The nearest housing area is in a distance of approximately 400 m, on the east side of the Highway No. 1.

The new gas engines power plant has been connected to the existing MOGE gas station, situated close to the site. No increased traffic through fuel delivery will occur.

The plant has respectively will be erected in accordance with good international industry practice and under consideration of the local requirements, e.g. fire fighting.

Engine oil will be storaged on a concrete floor in form of a catch basin with oil-resistant coating to avoid spills which could contaminate ground water or the nearby lake.

Generally, the risks imposed to health and safety of local communities by the new gas engines plant operation or adverse effects can be are assessed as almost negligible.

*Conclusion: No critical issues with respect to PS 4.*

### 3.6.3 Identified Gaps

No substantial gaps identified.

## 3.7 Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management

### 3.7.1 Main Objectives and Requirements

Main objectives of PS 6 are

- To protect and conserve biodiversity
- To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.

Habitat destruction (land or water areas) would be the major threat to maintenance of biodiversity.

### 3.7.2 Actual Situation

The Myanmar Investment Commission (MIC) issued in September 2013 the permit to operate Hlawga Gas Engines Power Plant to the Myanmar Central Power (MCP), see ***Attachment A3***. This permit includes all relevant and necessary Ministry Approvals, including Environmental Conservation and Forestry.

As mentioned in the EIA Report, the new Hlawga gas engines power plant has been erected close to Hlawga Lake and to a national park with forest reservation. The Hlawga site itself , however, has been excluded from the forest reservation by the Ministry of Environmental Conservation and Forestry (***Attachment A11***).

*Figure : Site in Year 2006*


As mentioned in section 3.2, it has to be noted that the land for the gas engines plant is not a "new" site. The site was covered with buildings till few years ago as can be seen on a Google Earth picture of 2006. Furthermore, no big trees had to be cut down in course of the site preparation for the new gas engines power plant. Insofar, no habitat on land had to be destructed for the plant.

Considering influence on the water area, only rainwater and surface water from the plant has to be discharged to the lake. This water does not carry harmful substances and no destructive influence has to be expected.

*<u>Conclusion:</u> The plants influence on the biodiversity in Hlawga Lake and natual park area is minimised and can be assessed as negligible.*

### 3.7.3 Identified Gaps

No substantial gap has been identified and no action is needed.

# 4 Conclusion and Action Plan

The following table summarises the main findings of the Environmental Gap Analysis and a proposed Action Plan.

| Environmental Gap Analysis<br>Project: 50 MW Gas Engines Power Plant in Hlawga, Myanmar | | Summary and Action Plan<br>Client: Z&A / Myanmar Central Power (MCP) | | | |
|---|---|---|---|---|---|
| Ref. Report | Issue | in place / fulfilled<br>not / partly / yes | Action / Deliverable | Due Date | Responsible Person/Position |
| 3.3 | **PS 1: Environmental and Social Assessment** | | | | |
| 3.3.2.1 | Environmental and Social Assessment | yes | | | |
| 3.3.2.2 | Permit | yes | | | |
| 3.3.2.3 | Management Program | partly | ISO 9001 to implement also for operation company | Commercial operation whole plant | |
| 3.3.2.4 | Organisational Aspects | partly | Environmental Engineer to integrate | Commercial operation whole plant | |
| 3.3.2.5 | Training Aspects | not | Training to be prepared and executed | First few months of whole plant operation | |
| 3.3.2.6 | Community Engagement | yes | | | |
| 3.3.2.7 | Monitoring & Reporting | partly | Reporting to be established on regular basis | Commercial operation whole plant | Environ. Eng. |
| | | | | | |
| 3.4 | **PS2: Labor and Working Conditions** | | | | |
| 3.4.2 | Compliance with Labor and Working Conditions | yes | | | |
| | | | | | |
| 3.5 | **PS3: Pollution Prevention and Abatement and EHS Guidelines** | | | | |
| 3.5.2.1 | Greenhouse Gas CO2 | yes | | | Environ. Eng. |
| 3.5.2.2 | Emissions into the Air (NOx) | yes | | | Environ. Eng. |
| 3.5.2.3 | Water and Wastewater | yes | | | Environ. Eng. |
| 3.5.2.4 | Waste | yes | | | Environ. Eng. |
| 3.5.2.5 | Used Coolant | partly | Disposal of used coolant is under investigation together with YCDC | Commercial operation whole plant | |
| 3.5.2.6 | Chemicals and Oil Storage | partly | New storage area will replace provisional solution | Commercial operation whole plant | Environ. Eng. |
| 3.5.2.7 | Noise | partly | Regular measurements to establish | Commercial operation whole plant | Environ. Eng. |
| | | | | | |
| 3.6 | **PS4: Community Health, Safety and Security** | | | | |
| 3.6.2 | Community Health and Safety | yes | | | |
| | | | | | |
| 3.7 | **PS6: Biodiversity Conservation and Sustainable Nature** | | | | |
| 3.7.2 | Biodiversity Conservation | yes | | | |
| | | | | | |

The needed actions to close the identified gaps as well as the recommended due dates are included in the table.

Z&A Management noted the gaps and open issues and confirmed to take care in order to initiate and to perform the needed actions in compliance with the proposed plan.

# 5 Attachments

A1 MCP Company Registration

A2 Layout Phase 2

A3 Permit Hlawga Gas Engines Power Plant

A4 ISO Certification Z&A

A5 Organisation Phase 1

A6 Organisation Phase 2

A7 Article Labor & Employment Myanmar

A8 Z&A Labor & Employment Regulations

A9 Agreement Used Oil

A10 Licence Used Oil

A11 Cancellation Hlawga site from Forest Reserve