Proceedings World Geothermal Congress 2020+1
Reykjavik, Iceland, April - October 2021

Integration of HSE Principles on Project Design Stage: A Lesson learn from PGE

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Keywords: Geothermal Development, EPC project, HSE Management System, International Loans

ABSTRACT

The project schedule is usually very tight in an effort to start up the facilities sooner. Due to these difficulties and the criticality of ensuring the proper implementation of the Health, Safety, and Environmental (HSE) requirements, an HSE Management System is required. Early implementation of HSE principles are essential to the success of engineering, procurement, and construction (EPC) projects and can prevent negative consequences as poor HSE and quality outcomes, rework, schedule delays, cost increase and further in operation stage.

Developing the projects design basis early in the project provides a clear definition of the design criteria that will be applied to the project and allows consistent engineering practices to be employed across the project life cycle. Thus makes it essential to also incorporate HSE principles and government regulations into the project design basis. The scheduling of key HSE tasks and milestones is an integral part of the overall project schedule.

PT Pertamina Geothermal Energy continues to prove the consistency of the clean energy acceleration by conducting geothermal activities in 14 Geothermal Working Area (WKP), managing five geothermal areas, three geothermal development projects, managing three geothermal exploration fields, and five joint operation contract. At the end of 2018, six geothermal power plants were successfully commissioned, which has a total installed capacity of 617 MW. Integration of HSE principles into preliminary stage minimizes loss of project development and operation and to fulfill stakeholder expectations.

1. INTRODUCTION

PGE, a subsidiary of PT Pertamina (Persero) is one of the geothermal companies in Indonesia. In order to improve Ministerial Regulation of EMR No.2067K/30/MEM/2012 has been developing geothermal energy resources in fourteen existing Geothermal Working Area (GWA) as well as to generate electricity from these resources and to sell such geothermal energy or electricity to PLN. The fourteen GWA known as "existing GWA" is being developed by PGE in some existing projects as part of government's crash program on 10,000 MW Phase II.

As of the June of 2019, the company had managed five (5) geothermal areas, three (3) development projects, and three (3) geothermal fields in exploration stage in parallel. In order to develop all commercialized and ongoing projects, nearly USD 2 billion is spent with the character of high capital investment, long construction periods, long capital payback periods. In addition to that, all projects operate concurrently. Managing projects in a multiple-project environment present a consequence toward its schedules and resources when the same resources are assigned to several different projects. Multiple project management practices have been employed in PGE in order to improve management and efficiency (Patanakul, 2009).

To develop all projects, PGE was relied on the equity and as well assisted to kick-start its ambitious program by two lenders (World Bank & JICA). The development of the upstream steam field will be funded by PGE's own resources (equity) through the support of its parent company, Pertamina. Both lenders financed the construction of the power plant. The project financed by the World Bank includes the development of two geothermal fields: Ulubelu, which is located in the Lampung district in the southern part of the island of Sumatra, and Lahendong (Tompaso), located in the northern part of the island of Sulawesi. PGE's expansions of approximately 110 MW in Ulubelu (Units 3 & 4) and 40 MW in Lahendong (Units 5 & 6). JICA financed Lumut Balai which is located in South Sumatra with a capacity of 110 MW.

In order to construct power plant, an Engineering, Procurement, Construction, and Commissioning (EPCC) contract is build on the term of turnkey basis based on each lender standard bidding document meanwhile the equity funded project follows PGE's standard bidding document. The consequence of using the assistance of lenders, PGE needs to follow its guidelines, including the HSE Management System.

The construction stage is the final stage of the development project before it could be commissioned. It has a potential risk to the environment, safety, and health. The mitigation measures are needed to minimize the risks and to achieve the goals of the projects successfully. This paper present how to manage HSE multiple projects which simultaneously running in parallel and how to integrate the HSE standard of lenders into PGE's Management System.

2. PGE'S HSE MANAGEMENT SYSTEM

Geothermal project development faces various risks throughout all its stages development, moreover on managing EPC contractors in a multiple-project environment which operates projects simultaneously. To manage HSE aspects for a multiple-project development, incorporated HSE principles (i.e., standards and requirements) are required into project planning and project execution. Proper planning will facilitate the long term multi-project organization's capability to meet the planned project milestone on later stages (Yagootkar, 2012).

PT Pertamina Geothermal Energy issues a guideline, namely Geothermal Integrated Management System (GIMS). The process approach of the guideline embedded international standards such as ISO 9001: 2015, ISO 14001: 2015 and ISO 45001: 2018, one it is the element of managing contractors (PGE, 2018).

As mentioned above, PGE ensures that processes project activities are carried out following the standards and requirements. Implementing a Contractor Safety Management System (CSMS) as a control system for HSE management aspect for contractors working in PGE's project sites as well to select a contractor who has adequate technical and HSE qualifications (PGE, 2018). The CSMS cycle includes :

1. Administrative stages
   a. Risk Assesment
      It evaluates and classifies risk project based on low, medium, and high categories. A different requirement of HSE principle is applied based on the risk classification of the project
   b. Prequalification
      It defines criteria of selected contractor based on HSE principal
   c. Selection and contract award
      It selects awarded contractors and to ensure the HSE principal being incorporated in Contractor's HSE plan document
2. Implementation stages
   a. Pre-job activities
      To ensure the commitment of the contractor on whether it is appropriately implemented in its HSE plan document and to identify gap requirements between PGE and selected contractors.
   b. Work in progress
      To monitor HSE principal being implemented during project execution
   c. Final Evaluation
      To evaluate the overall performance of contractors during project execution
3. Contractor Database
   Database of contractor contains a list of qualified contractor and record of contractor's performance. The database also serves as a reference for the company to select a competent contractor on implementing the HSE principal. Poor implementation of HSE principal would lead contractor to be sanctioned.

Administrative penalties applicable to the contract are as follow:

1. Yellow category; receive an unsatisfactory evaluation in the CSMS Final Evaluation, does not fulfill the requirements in the HSE aspect implementation during project execution, with contractor's final performance evaluation score < 90% (less than 90%) from the CSMS evaluation
   a. Proven through investigation result to have caused light injury accident due to the incident which resulted in the worker not able to perform his/her previous duty for more than one day and less than three weeks including weekends and holidays.
   b. Proven through investigation result to have caused the occurrence of environmental pollution/fire incident, which is/are not a fatality.
2. Red category
   a. Imposed with warning due to HSE aspect violation in the yellow category within the period of validity of previously issued warning letter in the yellow category; or
   b. Proven through investigation result to have caused light injury accident due to an incident which resulted in the worker not able to perform his/her previous duty for more than three weeks including weekends and holidays, including permanent injury (invalid)
3. Black Category
   a. Imposed with two red category sanction within five years;
   b. Proven through investigation result to have caused fatality accident (≤ 24 hours) which resulted in the death of workers of the contractors or other parties, due to the worker's negligence or that of the contractor.;
   c. Caused environmental pollution and other loss at a certain level of impact during project execution

In addition to the above standard and requirements, the lender owns its HSE standards. Some elements of its standards could compliment PGE's standards for implementing CSMS. However, PGE also introduces its standard into Biding Document on Employer Requirement. This action is expected to accommodate the gap between Lenders and PGE's Management System.

3. PROJECT FINANCING IN GEOTHERMAL DEVELOPMENT

PGE could be classified as project-based organization. The projects are operated in parallel in order to reach the GOI's target. As of Fast-Tracked Program stage II launched in 2008, eight development projects are performed (five projects have been put on the operation, and three are still in the development stage). The detail can be seen below :

Table 1 : List of Geothermal Projects Financed by Equity and Internasional Loans

No	Name of Project	Units	Supply to 3rd party	Project Equity/Loan	Remark
1	Kamojang Unit 5	30 MW	Electricity	Equity	operation
2	Karaha Unit 1	30 MW	Electricity	Equity	operation
3	Lahendong Unit 5&6	2x20 MW	Electricity	World Bank	operation
4	Lumut Balai Unit	2x55 MW	Electricity	JICA	development

No	Name of Project	Units	Supply to 3rd party	Project Equity/Loan	Remark
	1&2				
5	Ulubelu Unit 1&2	2x55 MW	Steam	Equity	operation
6	Ulubelu Unit 3&4	2x55 MW	Electricity	World Bank	operation
7	Hululais Unit 1&2	2x55 MW	Steam	Equity	development
8	Sungai Penuh Unit 1	55 MW	Steam	Equity	development

In addition to the project itself, the activities of each project perform in parallel. It is intended to accelerate project delivery as well as value creation to its stakeholders. From Figure 1 below, PGE has been in massive activities to support its multiple project organization. In order to support multiple projects structure, a temporary team is needed to assist a permanent team. It is in the form of Project management Consultant (PMC). Specialized resources are also needed to be kept, including the expertise in HSE aspect.

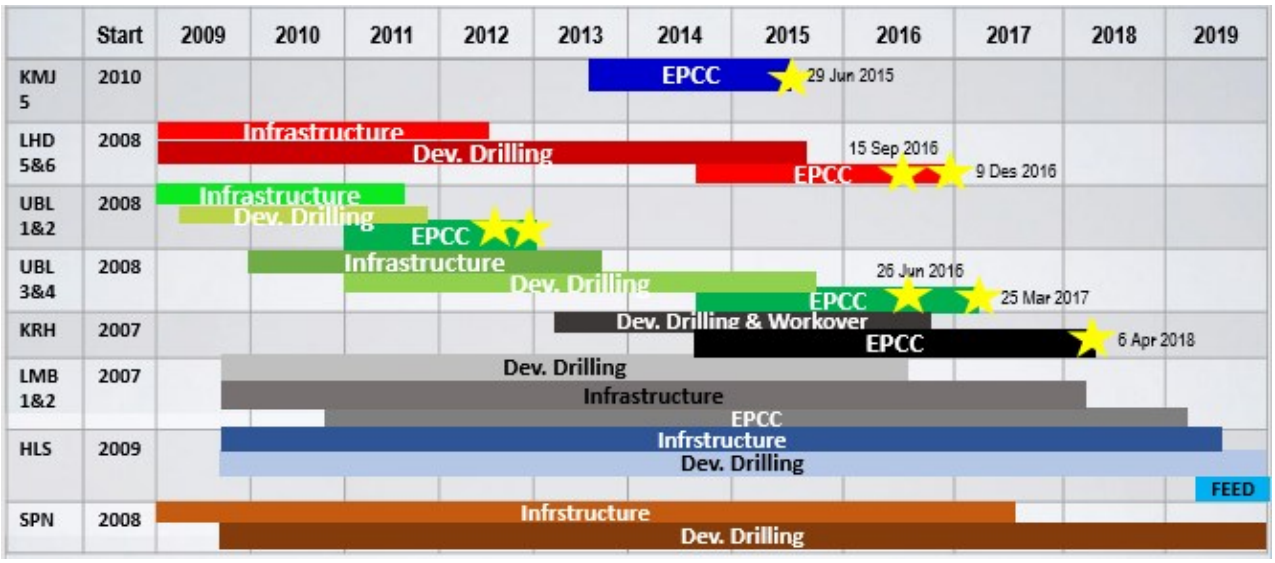

Figure 1: Multiple Project activities

4. HEALTH SAFETY AND ENVIRONMENT REQUIREMENTS (EQUITY V.S. LENDER)

Project deliverables of engineering, procurement, and construction (EPC) for an organization should be established for environment and safety. International Finance Corporation highlights environmental, social, and governments standards are part of their assessment to provide loans to the financiers. Adopting the standards is essential to bring the organization to achieve sustainability and business successfully (IFC, 2019).

As mentioned previously that several projects exploitation is financed by the World Bank and Japan International Cooperation Agency (JICA). Therefore, PGE as a lender needs to fulfill their requirements for all the stages of the EPC project (World Bank, 2019 and JICA, 2010)

The lender's requirements which cover the following points:

1. World Bank Operasional policies, standards, and guideline
2. Environmental Social Impact Assesment (ESIA) for Ulubelu Units 3&4 and Lahendong Units 5&6 (MML, 2011).
3. General EHS Guidelines
4. EHS Guideline for Geothermal Power Generation and/or power transmission and distribution
5. JICA Guidelines For Environmental And Social Considerations
6. Internasional good practices

Furthermore, we identified the gap of HSE requirements between PGE's HSE Management System and HSE requirements from lenders. The following table provides a brief of comparison of those HSE requirements is summarised in Table 2.

Based on the comparison of both HSE Management System, PGE highlights several improvement items to be integrated into their HSE Guideline and Contractor's HSE plan document.

Table 2: Gap Analysis of HSE Requirements (Equity v.s. Lender)

No	Description	Equity/Indonesia Standards	Loan	
			World Bank	JICA
1	Environmental Study - Big project - Small to medium scale	Goverment Regulation No 27/2012 - AMDAL/Environmental Assesment NA	OP 4.01 – Environmental Assessment-Chategories A	Guidelines For Environmental And Social Considerations--Chategories A
2	Noise Standard - Environmental - Occupational Health and Safety	 - Ministry of Environment No 48/1996 noise standard Day time : 55 dB(A)* Night time : 55 dB(A)* - Ministry of Manpower No 13/2012 for workplace 85 dB(A) for 8 hrs exposure limit per day	 - WB Safeguard policy/IFC standard 2007 Day time : 55 dB(A)* Night time : 45 dB(A)* - International best practice	Comply with the laws or standards of host countries
3	Air Quality - H_2S Air Ambient - H_2S emission	 - Ministry of Manpower No 50/1996 odor standard 28 $\mu g/m^3$ for 2 hour - Ministry of Environment & Forestry No 15/2019	 -WHO Guideline 150$\mu g/m^3$ for 24 hour -NA	 - Guidelines For Environmental And Social Considerations - Comply with the laws or standards of host countries
4	Non-Hazardous and Hazardous Waste	- Government Regulation No. 81/2012 - Government Regulation No. 101/2014	Solid Waste Management	Comply with the laws or standards of host countries
5	Waste Water Quality	Ministry of Environment No 19/2010	EHS Guidelines 2007	- Guidelines For Environmental And Social Considerations - Comply with the laws or standards of host countries
6	Occupational Health and Safety	- PGE's Guideline - National and international standards	EHS Guidelines 2007	Guidelines For Environmental And Social Considerations
7	Restricted material or equipment utilization	NA	Free persistent organic pollutants (POPs) and Asbestos	Free persistent organic pollutants (POPs) and Asbestos
8	protection forest (Hutan Lindung) / Land Use	Government Regulation No. 24/2010 updated Ministry of Environment & Forestry No P.27/2018	Not applicable	Comply with the laws or standards of host countries
9	Land Acquisition	PGE's Guideline for Land Acquisition (principal willing buyer willing seller)	- Land Acquisition and Resettlement Policy Framework - OP 4.12 – Involuntary Resettlement	PGE's Guideline of Land Acquisition (principal willing buyer willing seller) OP 4.12 – Involuntary Resettlement
10	Sexually Transmitted Diseases (STD)	NA	HIV/AIDS	HIV/AIDS
11	Substance	Alcohol and drugs	Alcohol and drugs	Alcohol and drugs
12	Indigenous Peoples	NA	Not applicable	Not applicable
13	Management of Cultural Heritage object	NA	Applied	NA
14	Social Environment and Human Rights	PGE's Guideline	Applied	Applied
15	Disclosure and Consultation	PGE's Guideline	Grievance Mechanism	Grievance Mechanism
16	Grievance Mechanism	PGE's Guideline	Applied	Applied
17	Report	Environmental Report	Quarterly Performance Reports (QPRs)	Quarterly Performance Reports (QPRs)

*residential area

5. CONCLUSIONS

It is very important for the project to deliver its output in a quicker and better way. However, the HSE aspect should not be neglected. The ignorance towards HSE standard will cause negative consequence toward overall project performance and its stakeholder. During performing multiple projects, the integration of HSE standard shall be performed starting from project initiation toward project closure.

Since PGE adopt multiple project environment, the risk of lack of resources has been addressed by employing a consultant for each project during EPCC stage. In addition to that, personnel from Head Quarter are also fully on hands toward each expertise.

HSE standard should be introduced to the involved parties to perform in order to have a similar level of understanding. Lenders' standard has been integrated into PGE's HSE Plan document (CSMS), and opposite way, the HSE standards of PGE has also been integrated to Lender's standard on Employer Requirement (ER).

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