

Life Cycle Thinking & Social Sustainability based on Capacity Building: An Insight from Indominco Mandiri, East Borneo – Indonesia

Dewi Permatasari, Institut Teknologi Bandung, Indonesia
Suharyono N, Indominco Mandiri, Indonesia
Raymond S, Indominco Mandiri, Indonesia
Leo Krisna Estiarko, Indominco Mandiri, Indonesia
Taryono M, Indominco Mandiri, Indonesia
Era Tjahya Saputra, Indominco Mandiri, Indonesia
Bayu Styawan, Indominco Mandiri, Indonesia

The Asian Conference on Sustainability, Energy & the Environment 2021
Official Conference Proceedings

Abstract

The coal mining's environmental management issue has become a severe global concern. Various mining management activities in Indonesia are currently starting the mine closure phase and are concentrating on developing environmentally beneficial and low-emission products. Indominco Mandiri, a coal mining company in Bontang, East Kalimantan, has implemented a capacity-building program based on social and environmental sustainability and a life-cycle appraisal culture. IMM conducts various leading environmentally sustainable activities through this program, including The Establishment of a Solar-Farm in a mixture of non-renewable power plants into a single Micro Grid system for energy efficiency 7,200 GJ and emission CO₂-eq reduction of 2,000 tons each year. The reduction and usage of sources also conducted in the management of tons of B3 and Non-B3 waste to minimize the residue collected in the waste landfill. Concerning the aspect of community empowerment, IMM also focuses on the primary challenges related to the crisis of clean water with total water conservation calculated in m³, and product development from integrated plant cultivation and re-vegetation activities of Aren Genjah palm trees. In addition, IMM contributes to acid mine drainage control by reducing pollutant load. All of these activities contribute to the Sustainable Development Goals (SDGs) by ensuring economic, social, and environmental preservation in business activities and each stakeholder involved. There are numerous challenges in preparing for capacity building in all aspects, but this is considered a learning process with long-term advantages

Keywords: Environmental Program & Sustainable Activities, Indominco Mandiri, Capacity Building

iafor

The International Academic Forum
www.iafor.org

Introduction

Indominco Mandiri, known as IMM, is an Indonesian coal mining company located in Bontang City, East Kalimantan Province, under ITMG (see Figure 1). IMM handles coal mining and processes operations using the most acceptable mining operational principles and focuses on environmental sustainability. This is in line with what is mentioned in this paper, where IMM recognizes the need to strengthen the capability of employees in their area to implement an environment-based culture and sustainability in every line of the process to achieve environmental sustainability. This is also known as life cycle thinking initiatives, in which the operational principle ought to reduce waste and emissions.

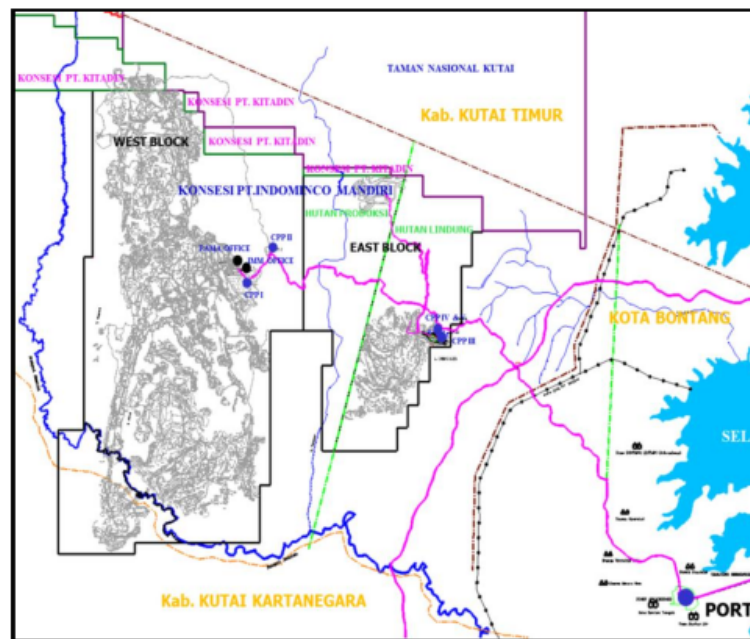


Figure 1: IMM Operational Area

Several programs generated and implemented by IMM are presented in this paper, including the operation of a 2 MW Indonesia's first solar farm which is integrated into the energy mix for power generation in an isolated Micro-Grid system. Regarding waste management, 3R approach is used to reduce waste discarded in the final shelter for B3 and non-B3 waste. Furthermore, acid mine waste management is conducted using effective techniques, and online monitoring is implemented to alleviate government movement across the country. Programs that promote community empowerment efforts in overcoming the issue of clean water crisis are carried out for water conservation and efficiency. Similarly, in the field of plant conservation and revegetation, seedling was conducted in the development of Aren Genjah plants to be cultivated by the community in order to produce products that support sustainable livelihoods.

Most of these activities are conducted in stages, with stakeholders involved, and are regularly monitored and assessed. This paper focuses on the program implementation process, which is centered on capacity building for the relevant team members. We hope that the SDGs' approach would be supported to balance the management of the new and renewable energy mix and operational activities that hold the future generations' welfare.

Overview of Life Cycle Thinking in Indominco

The Life Cycle Assessment (LCA) is the standard to measure the impact on the environment of specific operational activities, such as coal mining and its supporting utilities, in order to keep it in line with minimizing the resulting environmental impact. The programs described above are primarily implemented using the life cycle concept to produce a more environmentally sustainable cycle of activities. The operating system in Figure 2 represents the description of LCA on activities at IMM.

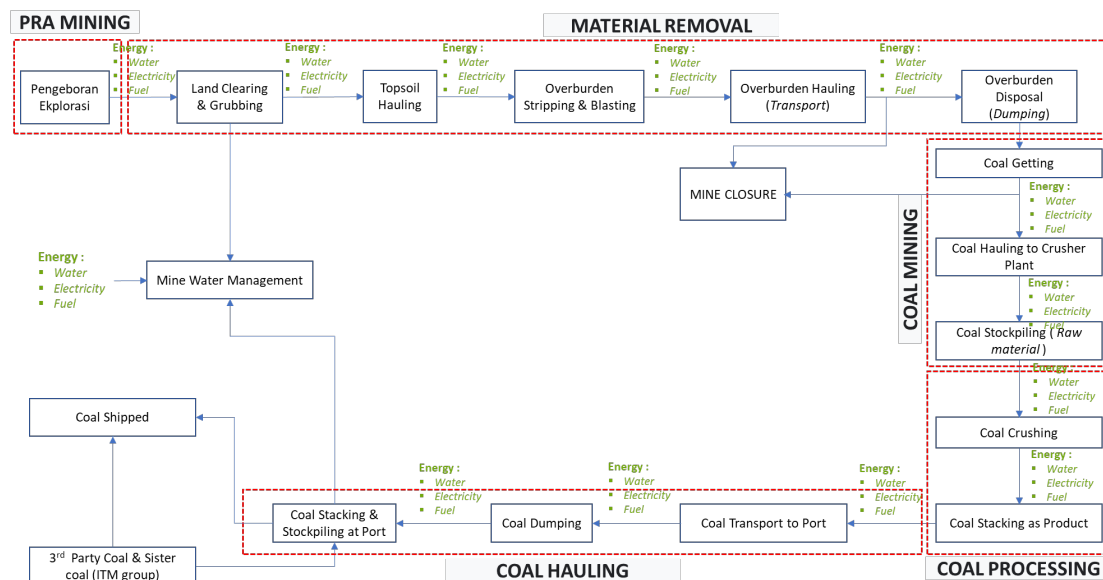


Figure 2: LCA-Based Activity Process Cycle at IMM

In contributing to the implementation of the life cycle assessment, IMM also conducts a basic inventory such as using raw materials to assess the impacts on the environment, such as emissions, wastewater, energy intensity, and so on. The system product from IMM's activities includes tons of coal, with Cradle to Grave as the initial step. The coal produced is then processed and used to generate power using a Micro-Grid system that utilizes solar and wind energy. The impact category is primarily concerned with emissions, eutrophication, and energy consumption, while the other categories will be adapted to the complexity of the monitoring activities. The goal is to identify hotspots with the most significant impacts on the environment. Thus, evaluations could be organized according to a priority scale for more effective and efficient managing resources, both in terms of industrial processes and environmental monitoring.

In addition, superior programs based on environmental management and sustainable livelihoods are explained below.

Energy Efficiency: Bontang Solar PV Hybrid Project

IMM has been running a 3 MW PV program with a 2 MW Battery Energy Storage and Micro Grid system since 2020. This program is a pioneer in Indonesia and Asia and is contributing to the use of more efficient and ecologically friendly energy. Figure 3 represents the appearance of the solar farm developed by IMM.



Figure 3: 3 MW Solar Farm IMM

Previously, IMM focused on electrical energy generated by its Steam Power Plant and Diesel Power Plant. The consumption of diesel and coal fuels can be reduced using this system which combines electrical energy sources with Solar Power Plant, with a total energy efficiency range up to 7,200 GJ per year.

GHG Emission Reduction from Renewable Energy Mix

As exposure to energy efficiency programs that are indirectly related to reducing greenhouse gas emissions. This reduction in GHG emissions is very significant because it is able to make 3 MW of electricity use from non-renewable fuels. In applying Life Cycle Thinking, this program has the potential to improve operational systems in all lines of coal mining activities that use a combination of solar and wind energy. Figure 4 represents the trajectory of reducing GHG emissions from the IMM Solar Farm mix.

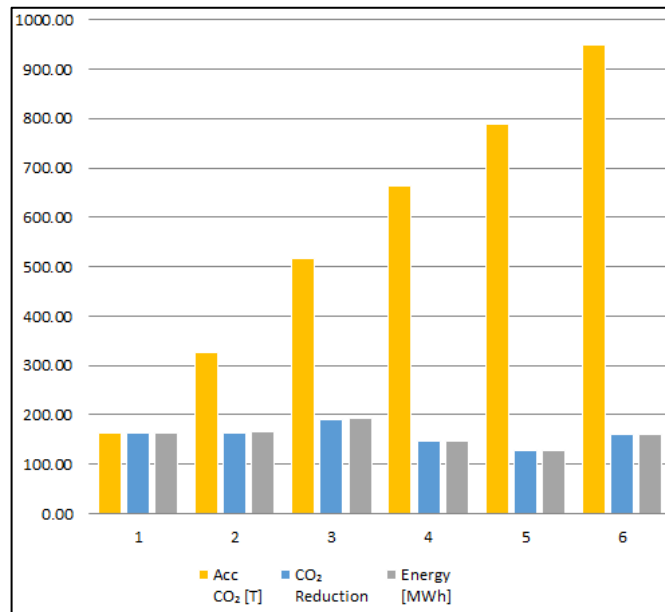


Figure 4: The trend of GHG Emission Reduction from Solar Farm Operation

According to this, the program can reduce emissions by an average of 2,000 tons of CO₂-eq each year. This means that the development of solar energy is a potential that provides a competitive advantage to the resulting product because it is based on the principle of sustainable energy conservation.

Water Efficiency: Provision of Clean Water and Community Sanitation

In terms of water conservation, there is an issue of the clean water crisis in the community, which is one aspect of promoting environmentally friendly, sustainable livelihoods and community welfare. This section explains the water efficiency program, which assists the community in acquiring clean water and substituting groundwater, which typically suffers from drought during the dry season. Figure 5 represents the process of providing clean water.



Figure 5: Water Treatment Plant Installation Activities

This program began in Santan Tengah Village in 2013 and has subsequently expanded to include numerous IMM-supported villages, including Santan Ulu Village, Santan Ilir Village,

and Kandolo Village. The total benefit of conserved water in this program is estimated to be 1,176.00 m³ per year. This program is in line with the activities conducted in the IMM area, where rainwater utilization is also carried out with a piped scheme. This will be explained further in the next publication.

Mining Wastewater Management: Making Trap Ponds for Road Watering

In terms of acid mine water management; the main focus is on reducing the load of wastewater which, after being treated and meeting the quality standards, will then flow into water bodies. In order to support the Life Cycle Thinking culture, efforts were made to minimize waste by utilizing rainwater and runoff that previously flowed into the pond sediment channel. This approach is conducted by making a trap pond in the reclamation area for watering hauling road. In principle, the runoff water does not come from mining activities; but if it has been channeled to the sediment pond, the same treatment must be conducted with other wastewater. The activity of watering plants in the reclamation area is shown in Figure 6.



Figure 6: Drainage system in IMM Mine Site

This program also reduces the load on the wastewater treatment unit by an average of 396,461.00 m³ per year. In addition, it can optimize plant conservation approaches as well as water use efficiency. All of these activities form an interconnected natural resource life cycle and can minimize environmental impacts.

3R of Hazardous Waste: Lubricating Oil Reduction through Lifetime Selection

In efforts to manage B3 waste, currently, the principle of applying 3R (Reduce, Reuse and Recycle) is being carried out by prioritizing the minimization of waste from the source. One of the efforts made in reducing the B3 waste is by selecting the type of lubrication oil material with a longer service life. The lubricating oil is used for equipment maintenance, especially in the area of coal processing and power plants. The activity of using oil as an equipment lubricant is shown in Figure 7.



Figure 7: Equipment with Oil Use in Operation

Even though it requires a higher cost, this activity can reduce the impact of lubricant waste, causing it to have the activity continued. This program has been running for 3 years and has succeeded in reducing the waste of used lubricants by an average of 13 tons per year.

Reduction of Solid Waste: Online Application System to Reduce Paper Usage

In terms of managing non-B3 solid waste in supporting activities at IMM, efforts were made to reduce paper usage massively by implementing an online application system in several lines of activity. At least until now, there are 4 types of online applications: for internal reporting, approval systems, Android-based for Yellow Cards, and requests for vehicle use. Some of the views of these applications are shown in Figure 8.

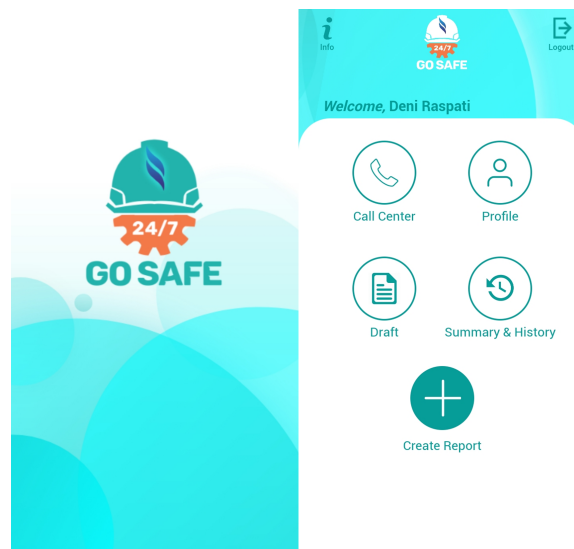


Figure 8: Online Application in One of Paper Reduction Program

From all these information system-based activities, the paper can be effectively reduced up to 1.25 tons of paper per year. In terms of life cycle thinking, this paper reduction contributes to reducing the potential for tree cutting as the main raw material for paper products. In addition, although the online system requires electricity, it uses a renewable energy mix as described in the energy efficiency section. This means that these are interrelated with each other and together can reduce the environmental impact of supporting activities.

Biodiversity Nursery and Conservation: Voluntary Seed Bank

In terms of the conservation of biological resources, IMM implements a program of collecting fruit seeds from employees and contractors to increase environmental awareness. It starts from small steps; the fruit seeds are to be planted in the reclamation area. The unity of this program is carried out by inviting employees to voluntarily keep the remaining fruit seeds and collect them in the nursery. This activity of voluntary fruit seeds collecting is shown in Figure 9.



Figure 9: Voluntary Fruit Seeds Activity for Nursery

The monitoring and recording of this program has been effective since 2019, and at least 500 kg fruit seeds have been collected. Furthermore, nursery and seeding activities become an inseparable part of reclamation and re-vegetation activities. This voluntary contribution is a manifestation of capacity building in terms of environmental awareness, not only for operational activities but also for employee daily activities.

Community Development and Social Sustainability: Product Development from Aren Genjah Palm Trees

In the aspect of community empowerment, the main focus of the program implemented is economic welfare and sustainable livelihoods. One of the programs that has been implemented for more than a decade is the Cultivation of Aren Genjah Palm Trees and its derivative products. Initiation activities have been conducted since 2006 with a focus on ‘one village, one product’ in Kandolo Village. From this program, derivative products from palm plants such as palm sugar, *pasak bumi* palm sugar, etc. are produced. After several years of consistency in program implementation, approaches were then taken to institutional, licensing, and group strengthening, which are still in progress today. The management activities of Genjah Palm are shown in Figure 10.



Figure 10: Aren Genjah Palm Cultivation along with the Community in Kandolo Village, one of IMM's program

This empowerment activity includes activities that are highly integrated from upstream to downstream of the program, starting from seeding and planting, processing sugar palm products to selling their products by community groups. To date, IMM has empowered 15 persons of group members with an average economic benefit of 50% higher comparing to local standard per year. The products produced have been marketed as many as variety of products.

Conclusions & Recommendations

From all the programs discussed above, the average program launched is based on mining activities and management of waste. At least there are several benefits in supporting social and environmental sustainability based on Life Cycle Thinking mentioned as follows.

- The use of Solar Farm is able to increase energy efficiency by 7,200 GJ
- Emission reduction from Solar Farm by 2,000 ton CO₂-eq
- Reduction of B3 lubricant waste by 13 tons
- Reducing paper usage by 1.25 tons
- Empowerment-based clean water conservation of 1,176.00 m³
- Decreased wastewater load from the use of runoff water by 396,461.00 m³
- The total fruit seeds collected from the Seed Bank program is able to produce 500 kg of seeds
- The total number of people empowered from Genjah Palm Cultivation is 15 people with economic benefits 50 % of the minimum wage.

The capacity building conducted for all layers of the IMM work team is still in the pilot stage and requires further monitoring and development in the future. In its implementation, each personnel need to adapt to many challenges and adjustments, and eventually will get better along with the intensive discussion and problem-solving process of the various programs.

Acknowledgment

We would like to thank the management of Indominco Mandiri, the management of ITMG Jakarta, as well as the entire work team and stakeholders involved in each program implementation. We realize that it is not easy to pioneer environmental culture efforts in supporting the sustainability of business processes without the cooperation and mutual support among teams in various areas. Hopefully, there will be better communication and integration of sustainability-based programs in the future.

References

- Mandiri, Indominco., “Indominco Mandiri Environmental Feasibility Study: an Update”, EIA Report, Bontang-Indonesia, 2018.
- Pombo, O., Rivela, B., and Neila, J., “Life Cycle Thinking Toward Sustainable Development Policy-Making: The Case of Energy Retrofits”, *Journal of Cleaner Production* Vol. 206: pp. 267-281, 2019.
- Estiarko, L.K., *et.al.* “Bontang Solar PV Hybrid Project: 3 MW PV with Battery Energy Storage and MicroGrid System”, Inspection Presentation to Ministry of Energy and Mineral Resources, 2020.
- Suharyono, *et.al.* “Preliminary Life Cycle Inventory for IMM Coal Mining Operation with Solar PV Energy Mix”, Internal Report, Unpublished, 2021.
- Rangkuty, J.T.B., and Estiarko, L.K., “PV Hybrid Optimization Scenario 2020-2025”, IMM Operational Report, Unpublished, 2020.
- Rudianto, W., *et.al.* “PV-Hybrid CO₂ Credit to GHG Reduction”, Internal Report, Unpublished, 2021.
- Sujarwanto., Syamsuddin, A.A., Sulaiman., and Napitupulu, T.V.W., “Clean Water Access Program: From Health to Wealth”, Banpu HSEC Summit, Bangkok, 2019.
- Martin, B., *et.al.*,
- Andiang, A., Pawiloi, E.D., Randy, A., “
- Pratama, W.A., Raspati, D., and Randy, A., “IMM Go-Safe: Android Based Paperless Program”, Internal Report, Unpublished, 2021.
- Styawan, B., Sholiqin, M., and Ariestya, L., “IMM Biodiversity & Nursery Program”, Internal Report, Unpublished, 2021.
- Sujarwanto., Syamsuddin, A.A., Sulaiman., Napitupulu, T.V.W., Raymond., and Styawan, B., “Towards Sustainability of Reclamation & Post Mining Management”, IMM Internal Report, Unpublished, 2021.