ENVIRONMENTAL AND ENERGY EFFICIENCY EFFORTS ALONG WITH CREATING SHARED VALUE TO THE COMMUNITY: AN INITIATIVE FROM MANUFACTURING INDUSTRY OF CEMENT TONASA, PANGKEP - SOUTH SULAWESI, INDONESIA.

[1]DEWI PERMATASARI, [2]MAGDALENA SUMULE, [3]BAMBANG EKO PRASETYO, [4]BAMBANG HARYANTO

[1]Environmental Professional – Renewable and Non-Renewable Energy
[2]Head of Environmental Bureau, PT Semen Tonasa – Semen Indonesia Group
[3]Director of Finance , PT Semen Tonasa – Semen Indonesia Group
[4]Director of Production, PT Semen Tonasa – Semen Indonesia Group
E-mail: dewi16permatasari@gmail.com

Abstract - Semen Tonasa is one of Indonesian Cement Manufacturing Industry which plays an important role in construction development in Eastern Indonesia. As a consequence of industrial activities, the impact on the environment is a must to be reduced. Thus it is very crucial for the environmental-behaved team to reduce and also manage the environmental impactsaround the industrial area. Over the last decade, Semen Tonasa has initiated several programs that cover environmental aspects, not only in physical aspects but also in social and diversity aspects. Some programsare pioneersinthe application of technological innovation, such as the Utilization of Biomass as an alternative energy that can be contribute to emission reductions, as it is registered in carbon trading flexibility mechanism. There is also utilization of hazardous waste of Fly Ash and Bottom Ash (FABA) with an introduction of eco-friendly technology. Replacement of new equipment is sometimes also applied to produce better energy efficiency output. For water and wastewater applications, there is an optimization of recyclable water utilization and reuse of treated wastewater. The most underlined sustainable program is the combinations with Creating Shared Value (CSV) of the surrounding community, such as Bank Sampah and Rumah Baca TaraweangHijau (waste management and children capacity building), SekolahImpian (dream school for elementary student in remote area), utilization of post-mining land for rice fields, and also socio-nature conservation in PangkepGeopark. Considering the complexity of the processes, together with efforts to create the most significant environmental sustainability, Cement Tonasa aims to become one of the leading cement industries to achieve the Sustainable Development Goals in the future. Hopefully, this paper presents the spirit of environmental preservation not only in the cement industries but also for all related sector.

Keywords - Semen Tonasa, Environmental Efforts, and Sustainable Development Goals.

I. INTRODUCTION

Semen Tonasa, a member of Semen Indonesia Group, is one of national cement manufacturing company situated in BiringEre Village, Pangkajene and Kepulauan District, South Sulawesi Province, Indonesia as depicted in Figure 1.Tonasa is also the biggest leading cement producer in East Indonesia Region over the last six decades. Besides its main activity to process raw materials into products, Tonasa also operates supporting facility such as Independent Coal-Fired Power Plant withintotal installed capacity of 120 MW in Biringkassi Village, about 17 km from the location of the cement factory [1].

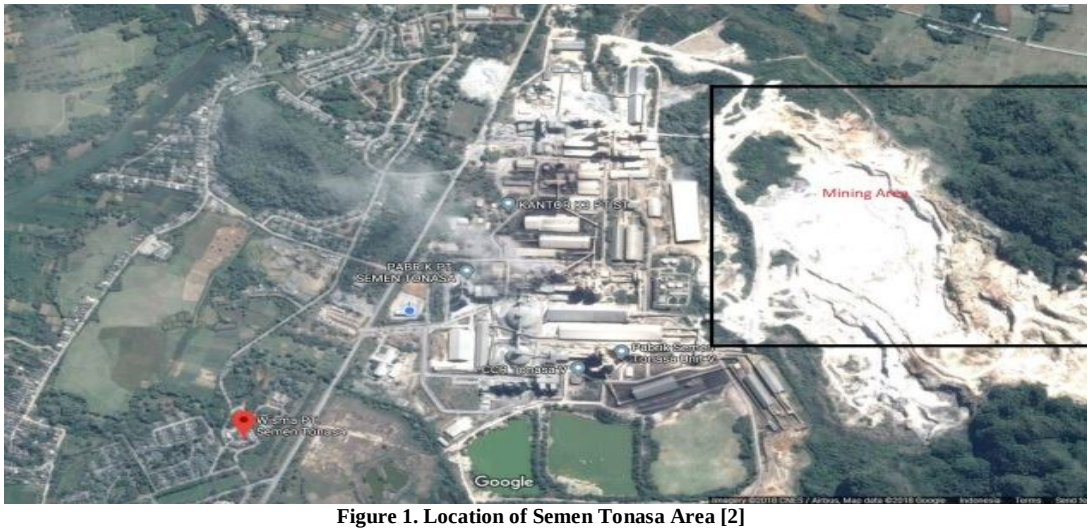


Figure 1. Location of Semen Tonasa Area [2]

This paper will present environmental effort to reduce and manage the surrounding impact caused by main industrial processes and supporting activities in Tonasa. Aspects to be discussed in this paper including energy and water efficiency, hazardous and non-hazardous waste management, emission reduction, wastewater management, nature conservation, and also social responsibility in creating value for the surrounding community. Some progress periodically reported to the certain government institutions, which Semen Tonasa also contributes in many governmental participation programs, such as PROPER, Green Industry [3], etc. Furthermore about PROPER contribution and participation of Semen Tonasa will also be discussed.

OVERVIEW OF PROPER IMPLEMENTATION IN SEMEN TONASA

As mentioned above that Semen Tonasa is periodically participated to some of the governmental environmental programs. This paper bringing some overview of one of the most respected assessments for environmental performance, as known in Indonesia as PROPER (Program PenilaianPeringkatKinerja Perusahaan dalamPengelolaanLingkunganHidup). PROPER assessed and awarded by the Indonesian Minister of Environment and Forestry annually to the industries that applied compliance and beyond compliance activity besides doing manufacturing process only. There are criteria and steps of PROPER assessment, based on current regulation of the Indonesian Minister of Environment and Forestry 03/ 2014 [4], as discussed below.

- Preparation; which is the very first step, consists of time series data collection, practical lesson learned from the best companies awarded from the previous PROPER result, and program inventory of the ongoing year activity.
- Compliance Assessment; which every participant of the industry should report certain document and supporting evidence. There are several environmental aspects in this sequence, for Manufacturing and Coal-Fired Power Generation sector (as Semen Tonasa is one of it) such as water and air pollution control including ambience monitoring, hazardous waste management, environmental permits (EIA, sub-EIA, etc.), socio-environmental responsibility for post-mining land, and also company profile with total numbers of employee and production capacity. This step delivers the results of percentage which divided into Comply (Blue Ranking), Below Comply (Red Ranking), and Not Comply (Black Ranking).
- Beyond Compliance Assessment; the candidates of this step were chosen based on results of compliance percentage. Only “100% Compliance” participants will be invited to propose their PROPER beyond compliance document. There are several aspects assessed: the Summary of Environmental Performances, Environmental Management System, Energy Efficiency, Hazardous Waste Management, Solid Waste Management, Emission Reduction, Water Efficiency, Wastewater Management, Biodiversity Protection, and also Community Development (a CSR non-charity paradigm). Results on this sequence categorized as 25% bottom percentile (back in Blue Ranking), in between 25% to 75% percentile (Green Ranking), and 25% highest percentile (promoted to the Gold Assessment– latest known as Gold Candidate).
- Gold Assessment; the last but the hardest step to follow. Only the top 25% per sector can be promoted. There is also consideration of environmental consistency as in PROPER required at least twice Green Ranking in a row of previous periodical assessment (last 2 years). The chosen candidates will present their Not-Business-as-Usual (NBaU) and innovative way of thinking, and if necessary, there will be field verification to make sure the effectiveness of the program. This step delivers Gold Ranking and Green Ranking (if does not meet Gold Standard of the year).

Semen Tonasahas a goal to achieve excellent environmental sustainability by improving quality of its programs. This paper discussed thoseprogramsin many environmental aspects, taking into account energy efficiency and socio-cultural-biodiversity point of view. The goal is not only to focus on the achievement of governmental working program, but also on the society and surrounding environment as beneficiaries. Which is deliver some types of program, such as technological innovation, retrofit of outdated equipments, substitution and/ or replacement of instruments, and social innovation as part of creating shared value to the local community.

II. MATERIALS AND METHODS

2.1. Materials

Materials required in program that presented in this paper are divided into several types. Firstly is material for substitution and/ or replacement in order to increase energy efficiency percentage. Secondly, there is also material and certain facility to utilize both hazardous and non-hazardous waste. Thirdly, water and wastewater aspect is required pipeline modification and reusable fluid gathering system.Finally, for integrated socio-cultural-biodiversity aspect, it is required physical and non-physical materials for improving community skills,

such as tools for field implementation and to provide capacity building.

2.2. Methods

There is some methodology that applied in the program discussed in this paper:

- Energy Efficiency – Reducing Energy Consumption using Variable Speed Drive.
- Emission Reduction – Biomass Utilization for Fuel Alternative.
- 3R of Hazardous Waste –FABA Utilization for eco-friendly concrete technology.
- 3R of Non-Toxic Solid Waste – Integrated Waste Management Facility in Bank Sampah(as in Bank of Waste) Sociological Scheme.
- Water Efficiency – Optimization and technological modification for rainwater and recycled water utilization.
- 3R of Treated Wastewater – Reuse for processed water substitution in boiler power plant application.
- Nature Conservation (I) – Development of Surrounding Karst Geopark by bringing cultural development in remote area.
- Nature Conservation (II) – Paddy Field formingupon the post-mining land area.
- CSR – Student Development within SekolahImpian (as in Dream School) and Rumah Baca (as in House of Book) TaraweangHijau.

Those methods for program implementation have been through a systematic planning process, together with the involvement ofstakeholder (local universities, surrounding communities, local and regional governmental agencies, and other nearby industries) [5]. Therefore discussion below is taking into account the brief process and the progress of theresult.

III. RESULTS AND DISCUSSIONS

Over a decade, Semen Tonasa has been certified by the International Standard Organization ISO 14001 – Environmental Management System [6]. There are also several business-related standardizations that havebeen implemented to support Tonasa as they lead the cement manufacturing production in the Eastern Indonesia Region. According to the ISO Guidelines, there is a certain pattern to drive companies to have continuous improvement by applying PDCA cycle as depicted in Figure 2.



Figure 2. PDCA Cycle of Problem Solving Method for Continuous Improvement Process (Lean Six Sigma, 2018) [7]

Programs discussed in this paper is PDCA-based, where each environmental impact has been identified and then to determine effort to manage the chain of primary, secondary, or even tertiary impact. These efforts particularly represents as annual working program based on the priority of its impacted area. This means that the program in many environmental aspects, taking into account energy efficiency and socio-cultural-biodiversity could be initiated not in the same year. It is depend on the importance of the impact and the readiness of industrial resources. Some program that already been initiated at least for the last couple years is discussed as follow.

Energy Efficiency

- **Reducing Energy Consumption Using Variable Speed Drive.**

This program is one of the energy efficiency innovations in cement processing systems. This is due to the electricity consumption in the area of Kiln 3 mostly higher than target plan, so the installation of Variable Speed Drive is carried out in a 240 kW ESP Fanmotorcapacit. Prior to the installation, the load factor was about 86%, and can be reduced by up to 50% using VSD. The activity of VSD Installation is depicted in Figure 3.



Figure 3. Activity of VSD Installation in Tonasa Kiln 3

Over three months of the VSD installation, it has effectively reduced energy consumption by about 625,753 MJ [8]. This program is not only contributing to the energy conservation, but also to the reliability and emission reduction that released to the environment.

Emission Reduction

- **Biomass Substitution for Alternative Fuel Consumption**

Tonasa has been utilized biomass from rice husk to substitute the use of coal as a fuel in Clinker unit. Over the last five years of implementation, this program has been utilized the amount of biomass

about 1,234,441 GJ [9]. The biomass in Tonasa storage area then depicted in Figure 4.



Figure 4. Rice Husk Storage Area in Tonasa Cement Production Facility

This program has multi-socio-environmental impact, such as reducingin coal consumption; simultaneously reducing greenhouse gas emissions to the atmosphere, andalso reducing the source of rice husk produced by local farmers in rice cultivation area, could improve the spirit of community development by the same time avoid the potential rice husk to be dispose.

- **Carbon Trading Participation**

In addition to technical biomass utilization in the field, Semen Tonasa also contributes to the carbon trading flexibility mechanism, known as Clean Development Mechanism (CDM). CDM allows developing countries to trade their effort in reducing green-house gases released to the atmosphere, in exchange for Certified Emission Reduction (CER) as an incentive from developed countries. Semen Tonasahas been registered under the United Nation Framework Convention on Climate Change (UNFCCC)for their participation to the CDM with current status under pursuance of the next CER [10].

Hazardous Waste Management

- **Utilization of 40% Fly Ash in Eco-Friendly Concrete Technology**

Semen Tonasa also operates a Coal-Fired Power Plant to support electricity demand in most of entire business process. As an environmental consequence, there are by products from coal combustion that produce Fly Ash and Bottom Ash (FABA). It is widely known that FABA still contains energy to be utilized into something environmental friendly product, such as concrete. Therefore, Semen Tonasa utilized 40% Fly Ash as mixing material for eco-friendly concrete technology. Over the last 5 years of implementation, this program has been reduced fly ash dumping to the environment about 117.206 ton of fly ashes [11]. Fly Ash from Coal-Fired Power Plant of Biringkassi gathered in the Silo unit as depicted in Figure 5.

Semen Tonasa also utilized FABA from other related industries as a substitution of clay as one of raw material component. This will be discussed in the future publication.



Figure 5. Fly Ash Gathering System in Biringkassi Silo Unit

Solid Waste Management

- **Bank Sampah – TaraweangHijau Community**

Bank Sampah in TaraweangHijau Community has initiated since 2014 with current total community relationship more than 170 people [12]. This is the pioneer of the first Bank Sampah in PangkajenedanKepulauan (Pangkep) District, South Sulawesi. To date, this program has been developed with community library from voluntarily donations (see Creating Shared Value in the CSR Section).There is also improvement on the integration of property tax payments through Bank Sampah account incollaboration with local government. This program drives community as a role model to be aware to their most consequences of life, which is solid waste that will always be generates.The situation of Bank SampahTaraweangHijau is depicted in Figure 6.



Figure 6.Administration Desk in Bank SampahTaraweangHijau

Semen Tonasa also utilizes Non-Hazardous Waste from rejected packing paper to be recycled in Cement Clinker. There are also numbers of programsrelated

to 3R of waste, which will be discussed in the future publication.

Water Efficiency

- **Optimization of Rainwater and Recycled Water Usage**

Semen Tonasa utilizes post-clay mining area that has been filled with rainwater to reduce the use of river water as raw water. The rainwater capacity reaches 1.200.000 kl [13], so it is very potential to be used as process water and also for sanitation.

- **Control System for Operational Water Treatment into One Integrated Platform**

Water Treatment in Tonasa Operational System starts with manual monitoring technique. By the time of implementation, it is known later that water consumption cannot be monitored effectively. Due to lack of environmental impactconsideration, Panel Logic Control (PLC) is then replaced the manual system in the water intake area. There is also the installation of flowmeter at the Cement Plant to re-examine the water consumption in the factory area. The interfaces of PLC system are depicted in Figure 7.

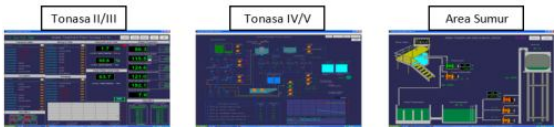


Figure 7.PLC Monitoring System

This program is calculated to improve water efficiency up to 178,825 m^3 of water during the first six months implementation [14].

Wastewater Management

- **Reuse Drain Steam Air Heater (SAH) for Water Filling Substitution in Boiler Power Plant**

This program aims to improve the efficiency of make-up water boiler in 2 x 25 MW Coal-Fired Power Plant Facility. The condensation water that has been used to open several valves then flows into gathering system. Commonly this water just become drained overflow, but due to the quality of the water shows that it still beyond standard for boiler water then this program is applied.The drained water overflow is depicted in Figure 8.



Figure 8. Drained Water Overflow in Biringkassi Coal-Fired Power Plant

It shows that this program can reduce ammount of wastewater in water treatment unit up to 120 m^3/day and has been implemented since year of 2016 [15].

Nature Conservation

- **Socio-Cultural-Biodiversity of Geo-Park Development**

Semen Tonasa'soperatingarea has a uniqueness compared to other cement industry in Indonesia. Tonasa operates in integrated districts, ranging from Limestone and Clay Mining, Cement Processing Unit, Packaging Unit, Coal-Fired Power Plant, Medical Clinic, Integrated Schools from Pre-School to High-School, and also Housing Unit. Tonasais also surrounded by Karst Topography, which is the second largest in the world after China. It turns out that it has a potential to be developed as Geopark due to the significant findings from archeologist about valuable siteson the inside of the Karst, called Bulu-Sipong (Bulu in Buginese means Mountain, while Sipong means Alone). The Geo-Park situation is shown in Figure 9.



Figure 9.The View from Inside Bulusipong Geo-Park formed by Dissolution of Soluble Rocks

The development is under progress with relevant stakeholders and the geopark architectural team. This program is also considered as one of Cultural Heritage Site in Indonesia. To that the Geo-Park progress of development was appreciated from CSR Award 2016 in Culture-based Community Category [16].

- **Post-Mining Land Restoration for Rice Field Cultivation**

This program initiated based on the needs of local farmers to expand rice cultivation area but required high capital and institutional administration (e.g. legal permit, etc). Semen Tonasa, on the other hand, hasseveral post-mining areas that dedicated for land restoration. Since year of 2013 this program has been implemented by collaboration of Semen Tonasa and Local Farmers within intention to preserving the environment and promoting community welfare. The location of post-mining rice cultivation is depicted in Figure 10.



Figure 10. Post Mining Area for Rice Farming

The rice cultivation is applied on critical land that requires high technology approachfor a higher success ratio. This collaboration has resulted in a cultivation area about 13 ha and two harvests annually [17]. As for potential economic benefit, this program is able to achieve IDR 900 million per annum.

Corporate Social Responsibility: Creating Shared Value

- **Dream School in Remote Area**

Semen Tonasa's main factory operates in remote area, where formal education become one of top demand for their employee's family and also local communities. From the very beginning of Semen Tonasa's operation, Dream School has been run and managed by The Welfare's Foundation of Semen Tonasa (YayasanKesejahteraan Semen Tonasa). It consists of two Kindergartens, an Elementary School, two Junior High Schools, and a Senior High School. As per year of 2016, the total of registered students is about 1,726 students, which almost 60% of them are from local communities [18].

This Dream School has achieved Independent Adiwiyata(2016) from the Government for the school success from their efforts to teach individuals to be responsible for their surrounding environment. This accomplishment then drives other schools in Pangkep District to also contribute to being part of Adiwiyata program.

- **Rumah Baca TaraweangHijau**

As part of Bank SampahTaraweangHijau, one of the social innovations to create community's sustainability is to drives their interest inpreserving the environment. One of the ways to do that is by self-improving their knowledge of environmental preservation through Rumah Baca (House of Books).This idea was initiated by considering a lot of book donations in Bank Sampahwhich are still quite suitable for reading and learning [19]. This one has the benefits of intangible nature preservationfor future sustainability.

- **Tonasa Goes Green: a Local Women Community Empowerment**

One of socio-environmental-integrated program in Semen Tonasawas inspired bydomestic solid waste treated as organic compost. It is then used for land applications surrounding green space in Tonasa working area. More often, the compost produced also applied for South-Sulawesi endemic nursery along with local community empowerment. So that there will be a multiplier effect for nature and for human-being near impacted area. One of activity of Tonasa Goes Green is depicted in Figure 11.



Figure 11. Socio-Environmental Reflection in Compost Application for Crops Nursery

For the nature, the treated waste becomes energy to improve natural plantations without chemical fertilizers. As for the community, this program has succeeded inimproving local community welfare with the total member about 86 persons [20]. The empowerment has now developed as an economic institution through women cooperative union.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

We conclude that sustainable programs based on continuous improvement process will result in Creating Shared Value for the community, as in the most significant changing paradigm to transform environmental impact of economic improvement on the community.

Recommendations

We recommend that the program initiation be based on local community demand, so that we can generate energy and the environment program based community development and vice versa.

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environmental concern and awareness for future generations.

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