Career Episode 1

Aluminum Smelters Environmental Impact Assessment

A) Introduction

[CE 1.1] This project was my Masters in Professional Engineering project at ABC University, Australia.

Name of Project: Aluminium Smelters Environmental Impact Assessment

Duration: [Date] – [Date]

Location: ABC University, Australia

Position: Masters Student

B) Background



[CE 1.2]The manufacturing industry is strictly regulated over the past few decades and this is mainly for taking concrete steps for the reduction of the environmental effects. The best available techniques are adopted despite the reduction of the complete emissions with the industrial waste generators still require suggestions for the production processes minimization linked with the reduction in the overall environmental effects. The metal industry is continued with significant waste generation sectors.

[CE 1.3]The project work was conducting a detailed environmental impact assessment based on the LCA assessment from the process of aluminum production with the consideration of the major steps related to the smelting of aluminum. Lexecuted the research with the analysis and quantification made on the environmental impacts throughout the process of smelting to the finished products from the raw materials. I selected the production parameters in the input and output datasets form which were taken from sources particularly Boyne Smelters Ltd.

[CE 1.4] I considered three hypotheses utilizing various electricity sources and it included 100% solar-based, 100% coal-based and 20% solar and 80% coal-based. I obtained the results which indicated that the electricity consumption was dependent on the smelting process and it had an adequate impact on the environment when carrying out the comparison with the other processes included in the production of aluminum. I assessed the impacts based on the sensitivity analysis and it was performed with the electricity generation modes from various sources in the process of smelters. I assessed the eight environmental impacts which were dependent on the Boyne production of aluminum and it had a direct impact on global warming, acidification, and ozone layer depletion when compared with the solar-based energy source.

[CE 1.5]

[CE 1.6] I had these assigned duties:

- I applied mechanical engineering research based on the analysis and quantification related to environmental impacts throughout the smelting process.
- I did the production parameters selection in the input and output datasets which were taken from the defined sources.
- I worked on getting the efficiency which was an adequate element in the consumption of the energy and it was based on the reduction stage determination.
- I executed the framework with the usage of the ISO standards and split the whole process into four sections based on the goals and objectives.
- I did the anode carbon addition with the oxygen during the process of electrolysis which resulted in carbon dioxide emission.
- I worked on analyzing the impact factors which were dependent on the chemical oxygen requirements along with the consideration of the nitrogen oxides.
- I conducted a multifunctional process analysis in the system which was for generating higher output.

C) Personal Engineering Activity

[CE 1.7]I executed the life-cycle assessment which was followed with the measurement of the environmental impacts from the manufacturing process. I provided the framework using the ISO standards and it split the process into four stages with the goal and scope definition. I also worked on the inventory analysis which was created for the analysis of LCA. I executed the impact assessment which was required to be carried out depending on the LCIA technique with the results obtained accordingly.



[CE 1.8] I worked on analyzing the overall smelter's process in which the carbon anode produced in the carbon plant mainly worked for mixing with the alumina which underwent the resultant reaction from the refinery into the production of aluminum in the smelter's process. I analyzed the by-products which were dependent on the atmospheric emissions including the carbon dioxide and hydrogen fluorides, etc.I combined the anode carbon with the oxygen during the electrolysis process resulted in the alumina emitting carbon dioxide. I proved the current efficiency as an important element in the energy consumption determination at the reduction stage.



[CE 1.9]I quantified the life cycle assessment as the goal was dependent on the quantification of the environmental impacts with the smelting of the aluminum at Boyne Smelters Ltd. I executed it mainly for the comparison reason with the identification and development carried out in the project. I did the comparison of the potential environmental impacts of Boyne Smelters in which the primary production was dependent on the electricity generating sources. I took adequate precautions for comparing the definite functional units. I successfully applied the technical knowledge for the LCA technique demonstration which worked as a powerful tool in the assessment of the environmental impact of the defined system. I understood the aluminum smelter process which was followed with the quantification of the display where the improvements were executed for reducing the negative impacts related to the environment based on the electricity generation sources.

[CE 1.10]I analyzed the aluminum manufacturing process which was an energy-intensive process and the resources utilized for electrical energy generation with the energy mainly contributed to the environmental impact product classification. I worked on the fossil and biogenic carbon dioxide assessment which was mainly from the assessment outcome in the

atmosphere and it played an adequate role in the global warming from which carbon dioxidebased fossil added the most. I obtained the impact factors which were from the ammonia, chemical oxygen needs outcome along with the nitrogen oxides. I analyzed the inventory which indicated that the copper, beryllium, and fluoride were liable for the eco-toxicity impacts. I analyzed the results which indicated the utilization of the solar energy consumption which was ideal for the emission-related issues and these were not adequate because of the cost and space constraints. Thus, I applied technical knowledge for the electricity grid mix which was an alternative technique for the emissions reduction in case if not eliminated adequately. Furthermore, I justified the results based on the score of normalization which resulted to be 4 times higher than that of the solar-based power plants. It was reduced to the value of 3 times in case if an electricity grid mixed with the 20% solar and 80% coal. Thus, I suggested an alternative generation of energy which improved the system efficiency resulted in the reduction of the environmental impact.

[CE 1.11] I analyzed the multifunctional processes in the system and it assisted well in the generation of more output as that of the intended product. Furthermore, Lincluded the inputs in the process which was dependent on the intermediate processes products with the allocation of the resources that proved to be a definite solution for the undertaken problems. I obtained the allocation which resulted in an optimum solution for the issues and included the input and output flow portioning of the complete process under consideration while fully utilizing the mechanical engineering concepts.

D) Summary

[CE 1.12]I carried out the comprehensive research regarding the life cycle assessment which was adequate in terms of proving to be an important element in the project. I conducted the comprehensive LCA which enabled the business to correct and evaluate the material of input with the respective environmental burden. It even assisted well in the determination of the steps for further reducing it. I researched aluminum manufacturing in the country which benefitted on a larger scale and proved to be an adequate contribution in the region. It also assisted well in overall improving the environmental impact.