

The State of Cleaner Production and Eco-efficiency in Western Australia

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Abstract

This report looked at the development of cleaner production and the changes it has gone through over the years to become an effective tool in sustainable development. Its implementation is beneficial to the environment and the industries that use the tool in its design and production processes.

The report focused on Western Australia which has a population of 2,617,074 with 73% living in Perth the capital city of the state. The region's economy is based on mineral extraction, processing and agribusiness. These industries are highly dependent on environmental resources as the major inputs and the waste products are highly toxic if not well handled. The process of mineral extraction has effects on the environment during mining and after mining. Excavation lead to loss of a lot of biodiversity. This report looked at the process of cleaner production assessment and gave an outline of the process and the benefits of it. A summarized case study on Tiwest Joint Venture showed the importance of cleaner production. Tiwest Joint Venture is titanium mining and processing company in Western Australia that has effectively implemented Cleaner production in its process and has realized major improvement in its business.

1 Introduction

The state of cleaner production and eco-efficiency in Western Australia

The purpose of this report is to study the state of clean production and eco-efficiency in Western Australia and discuss the effects of clean production and the challenges that this technology faces.

Sustainable development is a guiding principle in development that aims at meeting human development goals and at the same time sustain natural systems to provide environmental resources and service upon which the economy and society depends on. Cleaner production (CP) and eco-efficiency are inter woven with sustainable development (Van Berkel, n.d). CP is a method used to reduce industrial impact on the environment by reducing waste at the production level rather than dealing with them after they are generated (Van Berkel, n.d, Dieleman, 2007) while eco-efficiency is the production of goods that have a lower ecological impact and satisfy the needs of human beings. CP and eco-efficiency are important in the development of any city, state or country its implementation improves the quality of life and the profitability of businesses. This report will look at CP implementation in Western Australia.

Western Australia is the largest state in Australia, its capital is the city of Perth. As of 2015/2016 the estimated population of Western Australia stood at 2,617,074 with 73% living in Perth (Australia Bureau of Statistics, 2017). The economy of this state is largely driven by extraction and processing of minerals and oil commodities. Minerals mined include: iron-ore, gold, oil, coal and bauxite. Agriculture is also a major contributor to the economy of the state with major investments in wheat, barley and beef. (Wikipedia, 2017). Most of these economic activities has a lot of impact on environmental resources, the mining industry consumed 326

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gigalitres of water while the manufacturing and electricity and gas supply consumed 61 gigalitres and 27 gigalitres respectively for the year 2013-2014 (Australia Bureau of Statistics, 2016).

2 Literature Review

The focus to reduce environmental impacts from industrial activities through changes in industrial behaviors and technology has been growing since the second half of the 20th century. This was after the realization that human activities contributed to environmental degradation, in the initial stages as cleaner production was taking shape the focus was on pollution control i.e. building of sewerage plants to treat waste water (Nilson et al., 2007). Over the years there has been a paradigm shift from pollution control to pollution prevention and the 3M company in the United States was instrumental in demonstrating the importance of pollution prevention through its “Pollution Prevention Pays” concept. In 1990, the United Nations Environmental Programme (UNEP) defined CP as “The continuous application of an integrated environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment” (UNEP, 2017). Eco-efficiency established the link between the environment and economic performance, eco-efficiency and CP are complimentary concepts in that eco-efficiency is from the perspective of economic activities that have a positive ecological impact while CP starts from the perspective of environmental efficiency that have a positive outcome on economics (Nilson, et al., 2007). At its conception, cleaner production was mainly used by large industries and corporations but it has become evident that the concept can be applied to small and medium sized enterprises (Van Berkel, 1999).

According to Van Berkel (n.d) the concept of cleaner production started to catch on in Western Australia after the opening on the Centre of Excellence in Cleaner Production in 1999. Since then the Government of Western Australia has been actively involved in environmental

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matters by continuously reviewing its environmental master plan. Through its Department of Training it has undertaken the initiative to train its citizens on the importance of cleaner production (Western Australia Department of Training, 2002).

3 Western Australia Environment and Clean Production

Western Australia's economy is predominantly supported by the mining, energy and agribusiness industry these industries heavily depend on environmental resources. This part of the report analyzes the current state of the environment and the benefits of CP on businesses and the environment.

3.1 State of the Environment

The extractive nature of the mining industry has major effects on the environment. Mineral exploitation has left behind undesirable effects such as radioactive tailings in some area and the collapse of some gold mining companies left behind disused pits which are unsafe to animals and human beings. Despite good collaboration between the environmental agency and the mining industries to mitigate the impacts of mining at times unforeseen situations crop up later after closing of mines. An example is the abandoned mineral sand mines at Beenup, the mining activated acid sulphate soils which have become a long term environmental issue (Nicol, 2006). Tracks and on-site plant machinery pollute the environment through the emissions they release, major air pollutants from mining include dust, Sulphur dioxide, carbon monoxide and oxides of nitrogen. High concentration of these gases can lead to acid rain, respiratory problems in human beings and generally contribute to global warming. Western Australia has rare biodiversity that is being lost to mining activities, in an article by Tim Nicol (2006), gave an example where a decision by the Environmental Protection Agency was overturned by the government to allow mining in the Windarling Range which had an endemic species of low native shrub. All these

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rare species would be lost to mining. Water bodies are at risk of pollution, they can be contaminated through:

- Acid mine drainage – excavated rock with sulphide minerals interact with oxygen and water to form sulphuric acid which is washed into water bodies.
- Processing chemical pollution- agents used in the processing of minerals (cyanide, sulphuric acid) contaminate nearby water bodies when they get leached into the soil and are washed by run -off water.
- Heavy metal contamination- many mineral ores contain heavy metals that get exposed during the excavation process.

Other than mining deforestation is affecting the quality of soil, as trees are cut down the salinity of soil greatly increases and as a result run off water from these areas can affect the quality of water downstream. The World Wildlife Fund(WWF) estimates that about 7% of Agricultural land in Western Australia is suffering from increased salinity due to deforestation (WWF, 2017).

All these industries can develop a clean production method suitable to their industry not only to protect the environment but to increase efficiency in their production process and eventually their profitability.

3.2 The process of cleaner production and its benefits

CP is a technique/tool that is used to answer three important questions, where and why a company is losing resources in the form of waste and how these losses can be minimized

Cleaner production assessment process can be divided into 5 phases (Unep)

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- Phase 1: planning and organization, the objective of this phase is to allocate resources, initiate systems and importantly to get the commitment of the management and organization at large. At this phase, a project team is established to analyse and review the practices of the organization at present and draw a work schedule that is guided by an environmental policy drafted by the assessment team. The policy document and the work plan will outline the time line to achieving the goals and aims of the company in concern to cleaner production achievement.
- Phase 2: pre- assessment, the objective is to attain an overview of the processes of the company. Analysis of the production process should identify the inputs, outputs and environmental issues that arise at each step
- Phase 3: Assessment, the objective at this stage is to collect data and evaluate the environmental performance and production efficiency of the company. It is important to collect quantitative data on the amount of input consumed to produce one unit of product. This helps in establishing if the amount of input equals the output, it is at this point that inefficiencies can be identified and cleaner production solutions designed to solve the problem.
- Phase 4: Evaluation and feasibility: at this phase, the proposed cleaner production techniques are evaluated to see their suitability. The selected method is evaluated according to their technical, economic and environmental merit.
- Phase 5: Implementation and continuation.

3.3 Benefits of cleaner production

Less use of raw materials and energy: successful implementation of CP that save on energy and raw materials bring direct reductions in production cost thus increasing profitability of the

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business. In addition to this efficient use of raw materials is in line with the sustainable development concept.

New and improved market opportunities: Increased consumer awareness on environmental issues has led to increased demand for green products. Therefore, producing green goods and using clean production methods opens the business to newer markets.

Better access to finances: Investment proposals that concern and care for the environment are easily funded especially in the international market where there is increased awakening on environmental issues.

Better working environment: CP improves the occupational safety and health conditions of the employees. Favorable working conditions boost the morale of employees and productivity of the employees increase since there are fewer cases of sick offs due to occupational hazards. Use of CP also increases the awareness of the employees to environmental and they can transfer the ideas and technologies to their communities.

Better compliance with environmental regulations: cleaner production eliminates waste production at the source this leads to production of less harmful waste thus less conflict with environmental agencies.

3.4 Challenges and Barriers to Cleaner Production

Traditional philosophies and unwillingness from the management: lack of awareness and co-operation from the management is the biggest hurdle in the implementation of CP. The unwillingness from the management could be informed by myths such as: the cost of implementing CP being expensive or that CP is for large enterprises only.

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Outdated and ineffective machines and production processes: inefficient machines and production methods will automatically hamper any CP method employed since the method and the tools are the source of the problem.

Focus on end of pipe solutions: most government policies and regulations are focused on control of pollution rather than on prevention of pollution. Such policies technically orient the policies of companies to also focus on treating their waste product rather than to reduce the emissions at source.

4 Case study: Tiwest Joint Venture

Tiwest is a titanium mining and processing company in western Australia that has success in implementing CP. Tiwest implemented CP in its water, energy and material consumption.

4.1 Energy Efficiency

To become energy efficient Tiwest has a cogeneration plant, a gas turbine generates electricity and the exhaust gases are used to produce super-heated steam which is used in the micronizer which is the last step in production. This reduces greenhouse gas emissions and generates enough power for the Tiwest plant.

4.2 Material Efficiency

The Tiwest plant produces its own Hydrochloric Acid (HCl), previously the company used to neutralize the HCl in a waste treatment plant. The HCl is recovered and used again in the plant and it is used as ammonium chloride in another plant that it owns.

4.3 Water efficiency

After a conclusive CP assessment commissioning of counter current washing in pigment filtration and the installation of a recovery water tank for re use has helped Tiwest cut its water consumption by 50%.

5 Conclusion

“Environmental resources are not inheritance from our parents but a debt we owe to future generations.” CP implementation is important in achieving sustainable development, this method is beneficial to the environment and the industries that implement CP.

Growing environmental concern has been growing since the publication of “Silent spring” by Rachel Carson, this book brought to the attention of the world the effects of man’s activities on the environment. It led to development of end of pipe technologies that dealt with treatment of waste after its production but developments in CP put focus on reducing waste and toxics at production level and reducing inefficiencies in the production method. This method is far more superior than end of pipe methods due to its ability to increase a company’s profitability and still protect the environment, thus meeting the needs of the future and present generation.

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