

## Geelong's approach to the recycling process and domestic waste problems in the context of economic and environmental sustainability: a research proposal

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**ABSTRACT:** Recognising the problem of domestic waste in the community is one of the most important aspects of community life, especially as domestic waste management impacts significantly on the environment. Society has to be aware of the costs, risks and health issues related to domestic waste collection and disposal and, as such, a proper education system needs to be devised and implemented. The aim of this research is to investigate methods and approaches towards waste management in general, and domestic waste collection, disposal and recycling in particular, based on a case study of the City of Geelong in Victoria, Australia, in order to devise a system of education for the general population in this field. The Environmental Protection Act of 1970 regulates the system of domestic waste management. This research would also explore all of the relevant challenges that modern society faces for more efficient material use, lower waste generation, promoting products that have recycled content, waste avoidance, protection of landfill disposals and associated greenhouse gas emissions. To ascertain how industry, and engineers in particular, should be involved in waste wise management, new material-recycling technologies and cleaner production are also important aspects in this research.

### INTRODUCTION

People, as well as other parts of nature, are part of the environment; however, we are the only ones making our surroundings worse through the destruction of natural forests and the erosion of natural eco-systems, the unsustainable extraction of natural resources, and the long-term pollution of the land, water and air.

In return, we humans dump an enormous amount of waste materials, emit greenhouse gases and contaminate precious water resources. Indeed, the damage inflicted upon the Earth is sometimes irreversible and beyond our control.

On the other hand, the following can be affirmed:

*Materials make a key contribution to the industrial economy. It is the capacity of humankind to extract, transform and use materials of every kind ... The environmental cost has, however, been very high [1].*

So, human actions provide no balance in living within the environment: human production and consumption are unsustainable.

Tyler Miller Jr stated that:

*... current economic systems are based on depleting the natural capital that supports them. High discount rates (an estimate of a resource's future economic value compared to its present value) worsen this situation by encouraging such rapid exploitation of resources for immediate payoffs that sustainable use of most potentially renewable resources is virtually impossible [2].*

### RECYCLING AND WASTE MANAGEMENT

So in what areas should efforts be made in order to prevent further degradation and even recover some of what has been lost? Indeed, is it even worthwhile to carry this out?

The answer is an affirmative to the latter question; everybody can contribute to environmental protection by being aware of its actions in everyday life. Households generate waste every day; Australians are placed second (after the USA) as the biggest domestic rubbish producers *per capita*. As such, *domestic waste problems* are extremely relevant in today's world with regard to sustainability. Rubbish not only directly pollutes the land but, even more importantly, its disposal in landfill is linked to energy waste and contributes to, for example, greenhouse gas emissions. In turn, this leads to ozone depletion, which is dangerous for human health (eg skin cancer, asthma and air pollution related diseases).

The mining and processing of raw materials uses energy. Plastic packaging products are actually made from the carbon found in fossil fuels. Energy is also utilised to cultivate, harvest, transport, process and sell food. Therefore, it is worthwhile to search for methods in order to save this *embodied energy, which is energy consumed in every part of a product's life, including production and transportation* [3]. This can be achieved by reintroducing certain materials into the production cycle.

Ultimately, the best thing to reduce the amount of waste is segregation, followed by recycling, which has been defined as

*... a process designed to collect, process, remanufacture and reuse materials instead of throwing them away ... Recycling keeps materials out*

*of landfills, saving scarce landfill space. Recycling also helps reduce the pollution that may result from waste disposal [4].*

Separating and recycling is a step forward to sustainability because it closes one part of the cycle of the raw materials used to produce a product. Undertaking this follows the natural process of *no waste* (this relates to *biomimicry*), where the waste from one process becomes the raw material for another in continuous closed cycles.

Long-term action is clearly needed to reduce the use of finite resources so as to reduce unnecessary wastage in production and consumption and to minimise the quantity of waste ultimately requiring disposal. However, households, as waste producers, are not the only ones responsible for rubbish; the enormous amount of packaging and materials and energy used for the production of packaging is largely imposed on final consumers by manufacturers, with resource-extracting industries providing their products within certain legal regulations.

The quantity of waste generated in Australia places serious demands on engineers, waste management and disposal infrastructure and facilities, as well as on the environment to start to improve material and economic sustainability. It is also equally important to recover as much of the valuable resources from the waste pile as possible.

This problem requires regulations and closer cooperation with society to generate waste disposal awareness for economic, social (ethical) and environmental reasons.

#### Identification of Local Waste Solutions

The vague term of *globalisation* contains a multitude of small and local problems and solutions as a characteristic of human civilisation. Micro-scale solutions can contribute to solving larger global problems. The old environmentalist slogan stated: *think globally but act locally*, not the other way around. As such, this proposal focuses on domestic waste problems, utilising Geelong as a local case study.

This will include the following key elements:

- Identifying the newly introduced recycling systems at Geelong's Recycling and Waste Collection System (three-bin system) from the point of view of waste minimisation and reusing material in the production process, and determining the split rubbish percentage between:
  - Recycling bin (yellow);
  - Green waste bin (green);
  - General garbage bin (brown).
- Classifying the purity of the collected materials found in recycling bins and whether it could be directly reintroduced into industrial processes (eg VISY company's recycling technology designed for Geelong and introduced in the new recycling site), especially with regard to the segregation/production process;
- Identifying the key figures, the economic reasons for choosing the current system and the current market for recycled materials (eg VISY Recycling reintroduced materials in products produced by VISY Packaging as an example of *closing the loop* process) [5];

- Establishing the role of the local municipality in the process as a provider of bin emptying collection and rubbish transport services;
- Seeing how the community is involved (eg access to basic information about the new recycling system, educational strategies, designed and organised by local government with the close cooperation of Barwon Regional Waste Management Group);
- Cataloguing what is monitored with regard to improving current waste management in the City of Geelong's evaluation of people's habits concerning packaging and encouraging them to buy products with recycled content;
- Identifying the long-term goals for recycling processes in Geelong.

The Barwon Regional Waste Management Plan states the following with regard to the above points:

*Alternative markets for recycled paper and plastics will be investigated and initiatives to determine alternative, more environmentally friendly, materials for packaging promoted. The packaging industry will be encouraged to use uniform rather than composite materials to increase the potential for recycling [5].*

#### CASE STUDY: GEELONG

Geelong has an approximate area of 1,300 km<sup>2</sup> and a population of 184,800 people. It is Australia's 11<sup>th</sup> largest city and Victoria's largest regional centre and municipality. It is a coastal city and the major commercial and service centre for southwestern Victoria.

The following has been commented about Geelong regarding the city's waste management:

*Every year, the greater Geelong area generated approximately 55,000 tonnes of waste and, before introducing recycling and waste collection system, 45,000 tonnes were buried in landfill tips annually. Operational costs and landfill costs are on the rise and, since 1996, the Environmental Protection Authority (EPA) has charged a levy on all landfill sites. The levy is based on weight, so the more garbage that goes into landfill, the higher the cost to the Geelong community [6].*

Furthermore, one day in the future, it is expected that Geelong will run out of space for landfill, and identifying a new location and building new landfill sites will cost a lot of money. New landfills must be identified by Barwon Regional Waste Management group and, for now, they do not exist in their plan. The Corio landfill will close in 2010, while the Drysdale landfill is expected to keep operating for another 40 years, and the Fyansford landfill for another 10 years. However, it is better to invest in more ecological solutions like recycling and *closing the loop* systems. Indeed, the buying of recycled products *closes the loop*. However, products cannot be described as truly recycled until they have been incorporated into new products.

It has been reported that *By providing an integrated recycling and waste collection system, significantly more recyclables and green waste could be reused to create new products [7].* It is a matter of encouraging and promoting cooperation and awareness within the community (because household waste

tends to be the easiest to recycle), and advancing education in this field, as well as taking a closer approach to the environment.

Putting rubbish into recycling bins, or separating it for collection, is only one element of the recycling loop. People can play a fuller part in the recycling process by buying products that contain recycled materials. Recycling has not actually taken place at the community level until people choose to purchase the recycled products. Thus, people can influence the market to promote the recycling of materials.

The Victorian Environmental Protection Act (1970)

Obviously, any approach to waste management and recycling needs to be based on existing laws and regulations of the relevant area and country. In this case, the Victorian Environmental Protection Act of 1970 provides the basis for the area of Geelong [8]. The principle of shared responsibility is covered in Section 1G, which affirms the following:

1. *Protection of the environment is a responsibility shared by all levels of Government and industry, business, communities and the people of Victoria.*
2. *Producers of goods and services should produce competitively priced goods and services that satisfy human needs and improve quality life while progressively reducing ecological degradation and resource intensity throughout the full life cycle of the goods and services to a level consistent with the sustainability of biodiversity and ecological systems [9].*

## RESEARCH SCHEME

### Research Hypotheses

The hypotheses of this research rely on the solutions undertaken by the City of Greater Geelong as options for consideration. Recycling seems to be the best way to carry out waste management, but does it make economic sense? The answer is yes and no, depending on different ways of looking at the economic and environmental costs and benefits of recycling. Recycling cannot be above criticism, particularly with regard to the costs involved to communities.

The case study of Geelong and its region, as well as a literature study of the subject, provide alternatives for the following questions:

- What is the aim of the recycling process: do we actually know whether recycling is helping the environment? It has been stated that *Recycling as an important step in the quest for sustainability; it is a wonderful start, but not a solution [10].*
- Does the economic and environmental costs justify the further development of a new *recycling industry* within the local community and at the national and global levels? Indeed, industrial systems tend to be *linear, take-make-waste systems. Natural, cyclical living systems are destroyed when resources are depleted and waste accumulates in the biosphere [10].*
- Are engineers the main factor concerning environmental sustainability? Research needs to be undertaken on the

level of cooperation between designers and industry with regard to sustainability, eg the Centre for Design at RMIT University [11].

- What are the short- and long-term analyses and prognoses concerning recycling and recycled materials in the Geelong area?
- What are the education strategies for people's waste wise behaviour?

### Objectives

The main objective of this research is to find out the way in which recycled material from domestic waste is reintroduced into an industrial process and how this affects the economic results. However, it has also been stated that:

*Possibly, we may be able to save more resources by burning old paper at incineration plants, making use of the heat produced and felling more trees, instead of using energy to collect the old paper to be sorted, prepared and filtered [12].*

It is very important to determine how this process is linked with engineering education in order to establish priorities about material use, reduction and recycling in industry processes. This is because the recycling sector requires processes and infrastructure that itself pollute and produce waste, in the context of the definition of recycling, which is as follows:

*Recycling is the best way of waste treatment but it addresses waste after it has been produced, so prevention pollution and waste reduction should replace pollution control and waste management [2].*

### Engineering Focus

The implementation of this strategy will be a great success for engineering education, which is a vehicle of development. Engineers design and make decisions on how something is manufactured and/or processed, so they mostly determine the type of waste that is generated.

Furthermore, engineering educators have an important role with regard to the following:

*... [to] re-design existing engineering curricula, and to develop future curricula within the environmental framework, if the environment and sustainability are to play an important and integral part in engineering education [13].*

Governments also directly influence the use of raw materials by establishing taxes on the exploiters of resources. More weight in research into technologies, as well as on regulations, should be put into incorporating existing materials for a sustainable future.

So the combination of redesigning engineering education and governmental assistance to facilitate sustainability is needed in order to improve the environment before it is too late. Otherwise, the waste management system and the production system will still work separate from each other and engineers will be placed to work on opposite sides of a problem, instead of cooperating with each other.

## Structure

The proposed structure for implementing this research will be as follows:

### 1. Introduction

### 2. Review:

- Trace the beginnings of waste management strategies back to the 1970s, when the environmental movement started to criticise landfill disposals as the only form of waste treatment;
- Analysis of the Victorian environment protection system based on the Environmental Protection Act of 1970, including the key agencies involved, as well as their roles. Legislation places the responsibility on the State of Victoria to integrate economic growth with social and environmental development for the benefit of future generations. Waste management is an integral part of environmental practices. Figure 1 shows the development of the waste management plan [5]. The key State Government agencies involved in the management of waste in Victoria include the following:
  - The Environment Protection Agency Victoria (EPA) is responsible for statewide policy development and regulation [14];
  - EcoRecycle Victoria is responsible for strategies and programmes to assist implementation of these policies [15];
  - Sixteen regional waste management groups, such as Barwon Regional Waste Management Group (BRWMG) in Geelong, which is responsible for planning municipal waste management at the regional level in partnership with municipal councils;
  - Local Governments, eg the City of Greater Geelong, which plays a key role in providing collection, infrastructure and direct community programmes, as well as implementing regional plans developed by the BRWMG [16].

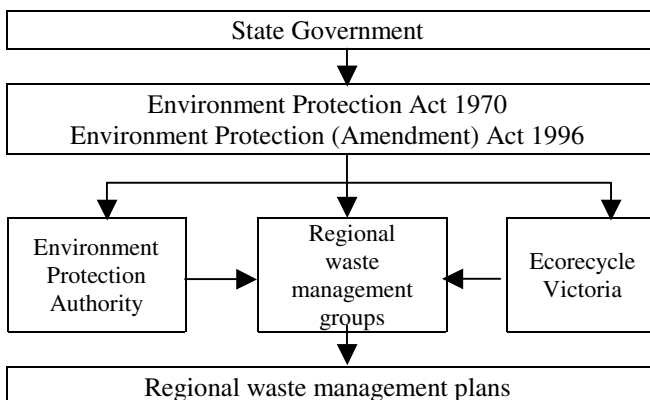


Figure 1: Waste management plan development [5].

- Review the existing conditions of research in the field with an objective to determine how the new recycling system has been designed (such as the Local and State Governmental agencies identified above, as well as other elements, such as the National Packaging Covenant, which is a prime agreement between government agencies, the packaging supply chain and local governments concerning

the minimisation of packaging and recycling programmes – this is an important component for waste management arrangements in Victoria, etc);

- Review of the existing three-bin system for waste collection, the method of its adoption, the variety of different factors influencing the quantity of the recycled materials obtained (eg different suburban density, lifestyle and rubbish monitoring);
- Research methods in implementing certain issues and strategies in engineering education, which form the prevention priority for the use primary resources within the context of the definition of waste to be used in the research, ie:

*Waste includes both products that have reached the end of their useful life and by-products of other processes such as manufacturing, commerce, construction and demolition. The actual waste generated at that point is a fraction of the materials used in the process and transport the product throughout its life cycle [17].*

- Review existing educational bodies and organisations, as well as their strategies towards educating consumers to achieve a waste wise community. This includes an analysis of the Victorian waste management hierarchy, which was entrenched in legislation with the Environment Protection Act of 1970. This affirms that rubbish should be managed according to the following hierarchy:

- Avoidance
- Reuse
- Recycling
- Recovery of energy
- Treatment
- Containment
- Disposal

*Notably, avoidance ranks highest on the waste hierarchy due to avoided impacts across the entire product lifecycle, including disposal [18].*

### 3. Methodology

The existing state of research will be investigated by the following:

- Direct contacts with relevant persons, eg the BRWMG EcoRecycle, VISY, Cleanaway, EPA, etc;
- Interviews with municipal bodies in the area, eg the Environmental Department of the City of Greater Geelong;
- Literature search;
- Internet search;
- Review of existing case studies;

in order to investigate the identified hypotheses set out in the project.

The quantity of recycled material data collected within the Geelong community will be used to estimate the financial and environmental impacts of recycling. This means translating the environmental impacts into dollars so as to compare costs and benefits. This data will be collected from VISY Recycle, based

in Geelong, which collects on a daily basis such recyclables as:

- Paper;
- Glass;
- Plastic;
- Steel;
- Aluminium.

Variations and trends will be identified to determine local tendencies with regard to the generation of recycled materials. A significant quantity of household waste is organic so waste management solutions for this kind of waste need also to be incorporated in this project.

Other, currently predominantly unrecyclable materials cover:

- Batteries;
- Mobile phones;
- IT equipment;
- Tyres;
- Paint, household chemicals, etc.

Such disposed materials should not be neglected and their future recycling needs to be considered to reduce landfill waste. Such information creates the basis for an approach to develop strategies and priorities for the future recycling management of the Geelong region.

Engineering education is seen as having a critical role to play in the process of focusing on material efficiency and general sustainable consumption. Engineering education may be the main factor in creating a scientific approach towards the environment and the use of the best available knowledge in order to avoid waste. A study of the causes and reasons of what stops engineers to implement environmental ethics into industry, governmental regulations, ethical investments groups, etc, is another important objective of the project. Research will also be conducted on already existing liaisons between engineering education, modern technology and ecodesign-solutions towards sustainability, and will cover Internet searches, literature reviews and personal interviews.

The aim of consumer education in this context is to make people aware about waste disposal, waste marketing involving shopping centres and the role of the local council towards waste avoidance. It could be stated that nobody will be interested in environmental protection if such an action does not involve the *dollar* – meaning reasonable rewards for those who do it. Thus, consumers influence industry by their choices on what to buy, eg cheaper products in bulk that have less packaging or the same quality products that are more expensive due to individual packaging.

#### 4. Discussion

There are several issues of importance to be discussed and critical questions to be answered, as follows:

- What does stop engineers from adopting environmentally friendly technologies (eg not enough tough environmental rules throughout developed countries)?
- Is the waste management sector itself hazardous for the environment when using transport, materials etc, as all others sectors of industry (eg transport pollution, office materials use, etc)?

- Would consumers' actions influence producers to use resources more efficiently (eg less and reusable packaging, etc)?
- Are producers really interested in reducing harmful effects to nature (environmental costs considerations with regards to bigger profits for industries and larger taxes for governments)?

#### 5. Conclusions

It would appear that the above research plan covers all the requisite steps to investigate the research hypotheses and to determine the efficiency of waste management in the Geelong area.

#### 6. Recommendations

#### 7. Glossary of terms

#### 8. Bibliography and References

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