Ministry for the Environment
Manatū Mō Te Taiao

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20-D-00784

s 9(2)(f)(iv)

Dear s 9(2)(f)(iv)

Thank you for your email of 18 May 2020 requesting the following under the Official Information Act 1982 (the Act):

> *The BERL report detailing the merits or otherwise of Waste to Energy plants and their fit with NZ circular waste economy vs. landfills.*

The Ministry for the Environment (the Ministry) has identified one document within the scope of your request:

> BERL, *Waste to energy: the incineration* option, Pipiri/June 2019.

This report was commissioned to provide an initial independent assessment of the potential impact that waste to energy (specifically incineration) facilities might have on New Zealand's transition to a circular economy, including the signals and incentives that these facilities could have on the existing resource recovery and waste management sectors. Please note that the report focuses on incineration-based technology only, and does not consider other waste to energy technologies. Please note that the document requested has been released to you in full.

The report provides useful information and context for the Ministry's ongoing work on the challenges facing New Zealand's waste and resource efficiency sector, and the opportunities that new technologies might provide

You have the right to seek an investigation and review by the Office of the Ombudsman of my decisions relating to this request, in accordance with section 28(3) of the Act. The relevant details can be found on their website at: www.ombudsman.parliament.nz.

Please note that due to the public interest in our work the Ministry for the Environment publishes responses to requests for official information on our OIA responses page shortly after the response has been sent. If you have any queries about this, please feel free to contact our Executive Relations team: ministerials@mfe.govt.nz.

Yours sincerely

Shaun Lewis
Director – System Change and Investments, Waste and Resource Efficiency Division

berl

Waste to energy

the incineration option

Pipiri 2019 www.berl.co.nz

Author: Nick Robertson, Merewyn Groom

Executive summary

In New Zealand today, landfill is the predominant method for waste disposal. We estimate that in 2018 New Zealand generated 17.6 million tonnes of waste, of which 12.7 million was disposed of in landfills including farm dumps. Some areas are facing urgency to invest in new solutions as the waste flow has increased, severely shortening the projected life of existing local landfill.

One solution proposed to reduce the amount of waste going to landfills is Waste to Energy (WtE). WtE is the process where waste is incinerated to generate heat and electricity, while disposing of the majority of the waste that the WtE facility consumes.

In May 2018, the Government adopted a circular economy policy approach. A circular economy is an alternative to the traditional linear economy in which resources are kept in use for as long as possible, the maximum value is extracted from them whilst in use, then at the end of product service life products are regenerated, or materials recovered.

The Ministry for the Environment (MfE) considers transitioning to a circular economy will reduce waste and associated pollutants, help protect and restore natural capital, and benefit efforts to address issues including climate change and water quality.

The introduction of WtE could affect New Zealand's efforts to move to a circular economy. By creating an alternative to landfills, WtE could affect efforts to reduce the creation of waste and the reuse, recycle, or reprocessing of waste.

Despite being promoted by some as renewable energy or recycling, the European Commission have mapped the various WtE methods against the waste hierarchy and finds that this is not the case. Anaerobic digestion of organic waste where the digestate is used as fertiliser is considered recycling. Incineration and co-incineration with a high level of energy recovery and reprocessing of waste into solid, liquid or gaseous fuels is considered recovery. Incineration and co-incineration with limited energy recovery is considered disposal in the same way as current landfill with gas capture.

Further impacting efforts to move to a circular economy is the pressure that has been put on recycling. In 2018, 4.9 million tonnes of recyclable material was recovered from the waste stream. Recycling operations within New Zealand are limited and New Zealand's ability to export waste has been reduced by the decision of the Chinese government to severely limit the volumes and types of waste they will accept. In 2018 New Zealand exported $573 million worth of waste. Local authorities are now reducing recycling services that are no longer affordable, due to declining prices for recyclable materials. WtE has been promoted as a solution to this increased need to dispose of the materials within New Zealand.

The decision to adopt WtE as a disposal method for New Zealand's waste will need to consider more than the relative financial cost. Waste companies and local authorities considering WtE will weigh up other factors such as environmental and reputational impacts, and public acceptance of waste incineration.

Two large companies, Waste Management and EnviroNZ (also known as EnviroWaste), dominate the New Zealand waste sector. These two companies control the majority of New Zealand's waste either through direct contracts with private customers, or through contracts for waste services for local authorities. The sector has a number of smaller participants, and some local authority operated services, but there is no central control of the New Zealand waste stream. Any successful WtE facility will need to work with these companies to source the waste volumes required. Complicating any

move to WtE will be the heavy influence these companies have. They are unlikely to support a move to WtE, given the investments they have made or will be making in new or expanded landfills. The parent companies of these waste companies themselves operate WtE facilities in other countries, and have not expressed an interest in doing so in New Zealand.

Disposal of waste through any method creates emissions, both of greenhouse gases and toxic substances. Adoption of WtE would affect total greenhouse gas emissions through two avenues. The total effect will be the difference between reduced landfill use, and increased incineration emissions, plus the difference in emissions between generating electricity from the WtE facility and the type of generation that this displaces from the market. This sum effect could be either positive or negative depending on the electricity market, WtE technology employed, regulations around the operation of the WtE facility, and the standard of ongoing maintenance and management. Likewise toxic emissions can be managed though use of technology and operations practices, however WtE creates some amount of toxic ash which has to then be disposed of, most likely into landfill.

To ensure that WtE does not hinder efforts to move to a circular economy, there are steps MfE and the government can take. We recommend that MfE carry out further research into the types of WtE other than incineration, and should set standards based on international best practice. These standards should include a requirement for a proposed WtE to regularly report the contents of their feedstock. This will enable MfE to consider the impact this will have on New Zealand's waste goals. There should be tight controls over the waste that is used by WtE facilities, with penalties for non-compliance to discourage the incineration of materials that should be put back into the circular economy.

Alongside setting minimum standards, MfE should improve data capture of the waste sector to enable informed decision making by central and local government and those who are proposing WtE facilities. Accurate forecasting of future volumes of waste and disposal capacity to avoid an under or over supply of waste disposal facilities. Waste disposal facilities are significant investments that take a number of years to progress from concept to completion. Knowing what the future looks like will enable better controls over the supply of waste disposal and the impact this has on the circular economy.

Finally, MfE and the government should continue to promote incentives to reduce the creation of waste and increase reuse and recycling. Creating domestic recycling infrastructure would support this, while reducing reliance on overseas destinations to handle our waste. Increased domestic recycling would also reduce the need to import new raw materials further diminishing the waste stream.

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1 Introduction

New Zealand has a limited range of options for the disposal of waste, with landfill currently most prominent. Alternatives to landfill are limited. In particular, there are few plastic recycling operations within New Zealand. In some areas the waste flow has increased such that the projected life of the local landfill is severely shortened creating urgency to invest in new solutions. The increases appear to be due to both consumer habits and increased population.

In 2018 New Zealand exported 1.02 million tonnes of recyclable materials overseas for processing. This option was sharply constricted due to the National Sword policy introduced by China on 1 January 2018. Under the National Sword, China will accept only a small subset of the material it previously purchased. Several other countries which have accepted waste for processing are now introducing similar policies constricting the export option further. Kerbside collection of recyclables continues in much of the country, and stockpiles are accumulating where material is unable to be sold.

Having noted the immediate pressures on waste disposal, a Waste to Energy (WtE) incineration option was proposed by a New Zealand/Chinese partnership. Such an option may appear attractive, particularly to local governments who are faced with considerable establishment and operating costs for landfills and increasing waste flows.

The proposal has since been withdrawn. However, the information regarding the proposed facility provides an insight into the WtE facilities proposed for New Zealand. The considerations and relationships presented are equally applicable to any other WtE proposal.

There is a possibility that the introduction of a WtE facility could result in diluting incentives to minimise waste. Additionally, it may hamper efforts and activities to foster recycling efforts if the cost of recycling is higher than the cost of incineration.

On-going reliance on the landfill option is inconsistent with the objective of the Government to build "a productive, sustainable, and inclusive economy". The concept of a circular economy, as opposed to the conventional linear economy, highlights the imperative to minimise waste and maximise reuse and recycling of all elements along the value chain. To succeed, this has to begin at the design stage, such that the principles underlying a circular economy are embedded within the production, delivery, and consumption processes. Achieving this requires policy intervention to establish incentives that encourage this design approach. One such intervention is the Waste Levy that is under review at the time of writing this report.

Greenhouse gas emissions will be affected by any significant change to the country's waste disposal systems. All methods of waste disposal produce emissions, though the amounts and timeframes of these emissions vary considerably. Mitigation measures such as landfill gas capture can have benefits of their own such as the production of electricity.

WtE too has benefits besides the disposal of waste, facilities overseas use the waste to fuel the production of electricity, and energy in the form of heat can be tapped for secondary use.

Designing New Zealand's future waste management processes will require the balancing of incentives, costs and benefits. There may be a place for WtE in the future. To contribute towards the circular economy vision will require a location close to the waste production, and careful selection of technology to ensure the lowest possible greenhouse gas and toxic substance emissions.

2 Waste legislation in New Zealand

Waste management and minimisation planning legislation in New Zealand is primarily provided by three Acts; the Waste Minimisation Act 2008, the Local Government Act 2002 and the Resource Management Act 1991.

2.1 The Waste Minimisation Act 2008

The Waste Minimisation Act 2008 encourages a reduction in the amount of waste we generate and dispose of in New Zealand. This is to protect the environment from harm and provide environmental, social, economic and cultural benefits.

To achieve its aims, the Act:

- imposes a levy on all waste disposed of in landfills to generate funding to help local government, communities and businesses minimise waste
- establishes a process for government accreditation of product stewardship schemes which recognises those businesses and organisations that take responsibility for managing the environmental impacts of their products
- requires product stewardship schemes to be developed for certain 'priority products' where there is a high risk of environmental harm from the waste or significant benefits from recovering the product
- allows for regulations to be made to control the disposal of products, materials or waste, require take-back services, deposit fees or labelling of products
- allows for regulations to be made that make it mandatory for certain groups (e.g. landfill facility operators) to report on waste to improve information on waste minimisation
- clarifies the roles and responsibilities of territorial authorities with respect to waste minimisation
- establishes the Waste Advisory Board to give independent advice to the Minister for the Environment on waste minimisation issues.

The Waste Minimisation Act 2008 puts responsibility on local government (territorial authorities) to promote effective and efficient waste management and minimisation within their districts.

Since the introduction of the Waste Minimisation Act 2008 measures taken include:

- imposition of a levy of $10 per tonne on all waste disposed of in Class one landfills
- establishment of product stewardship schemes that give the responsibility to a product designer, seller or user to minimise its impact on the environment
- regulations made to control the disposal of products, materials or waste
- empowerment of the responsibilities of regional authorities that need to write a waste assessment every six years.

2.1.1 Requirements for Waste management and minimisation plans

The Waste Minimisation Act 2008 requires territorial authorities to prepare waste management and minimisation plans (WMMPs). The plans have to be reviewed every six years. Requirements for WMMPs are set out in sections 43 and 44 of the Waste Minimisation Act 2008.

Plans must state:

- objectives, policies and methods for achieving effective and efficient waste minimisation and management within the district
- how implementing the plan will be funded (including how local authorities intend to use allocated waste disposal levy money).

When preparing, amending or revoking a plan territorial authorities must:

- consider the waste hierarchy
- have regard to The New Zealand Waste Strategy: Reducing harm, improving efficiency (2010) and their most recent waste assessment
- publicly consult on the WMMP.

2.1.2 The waste hierarchy

The waste hierarchy is a framework for establishing the order of preference for different waste management options. It is based on the cradle-to-grave principle - where the product is followed from its production to its 'grave' or final disposal. The hierarchy draws on the precautionary principle, in that reducing waste is likely to cause far less harm to people and/or the environment than putting it into landfill will. The waste hierarchy establishes a priority order from prevention, preparation for reuse, recycling and energy recovery through to disposal, such as landfilling.

The order is usually as set out below:

Step one – Reduce. We should aim to reduce and/or prevent the amount of waste produced such as unnecessary packaging. We should design-out waste at the manufacturing stage. Plastic shopping bags can be used as a simple example of this principle. If we do not accept or use products that become waste, we reduce resource consumption and prevent those materials from entering the waste stream in the first place. Reduction or prevention is the best option.

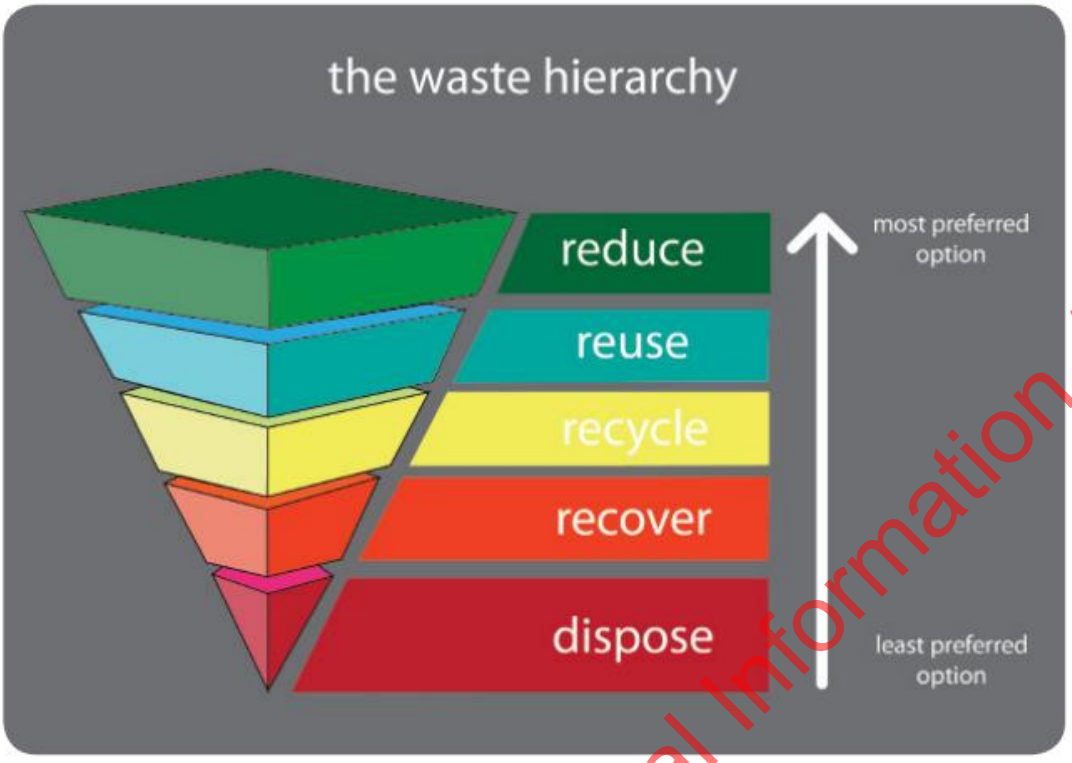
Step two – Re-use. We should try to reuse materials for the purpose for which it was designed, or sometimes for other purposes (e.g. wooden pallets can be use in reuse building projects).

Step three – Recycle & Compost. We need to recycle and compost as much as possible that is left after reduction and reuse. Landfill bans of organic waste and existing recyclable items could eliminate half of what currently goes to landfill.

Step four – Recover Energy. Recover the energy and raw resources embedded in the waste.

Step five – Residual Disposal. What waste remains after steps one to four, we would send to landfill. This is the last option.

Figure 2.1 The waste hierarchy



Source: Ministry for the Environment

2.2 The Local Government Act 2002

The Local Government Act 2002 empowers councils to promote the wellbeing of communities. The purpose of local government is to enable democratic local decision-making and action by, and on behalf of, communities. To promote the social, economic, environmental, and cultural wellbeing of communities in the present and for the future. Solid waste collection and disposal is identified as a core service to be considered by a local authority.

2.3 Resource Management Act 1991

The Resource Management Act 1991 (RMA) is New Zealand's main piece of environmental legislation and provides a framework for managing the effects of activities on the environment. The RMA controls the environmental impacts of waste facilities such as disposal facilities, recycling plants and cleanfills.

3 The circular economy

Traditional waste management mechanisms have not effectively controlled waste produced throughout the lifecycle of products and infrastructure. As a result countries, regions, and cities around the world are deliberately moving to a circular economy. A circular economy seeks to rebuild capital, whether this is financial, manufactured, human, social or natural. This ensures enhanced flows of goods and services.

The circular economy is based on the idea of using the same resources over and over again rather than continuously extracting more from nature. A core aspect of transitioning to a circular economy is designing out waste from products and services, both solid waste and waste to air and water.

The circular economy is a global concept that represents a change in thinking. The idea is that products are designed from the start to last a long time and be easily repaired, or to be 'unmade' after use and the materials either made into something new or returned to nature – all without creating pollution or greenhouse gas emissions.

In the face of proliferating signs of resource depletion, the quest for a substantial improvement in resource performance across the economy, government and businesses have started to explore ways to reuse products or their components and restore more of their precious material, energy and labour inputs.

A circular economy is an alternative to a traditional linear economy (make, use, dispose) in which resources are kept in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life.

Figure 3.1 The linear economy and the circular economy

Source: Ministry for the Environment

The essential concept at the heart of the circular economy is to ensure that we can unmake everything we make. A circular economy is based on the following three principles:

- Design out waste & pollution
- Keep products & materials in use
- Regenerate natural systems

The circular economy should not be confused with recycling, where the focus is on finding new uses for waste that has already been generated.

Transition to the circular economy requires changes throughout value chains from product design to new business and market models and consumer behaviour. Despite its name, the circular economy is not a separate economy but a multisectoral and profound change in the modes and practices.

It is not just in New Zealand where the circular economy is being promoted. On 16 July 2018 China and the European Union (EU), world leaders in circular economy policy, signed a Memorandum of Understanding on Circular Economy Cooperation at the 20th EU-China Summit in Beijing. Transition to a circular economy in the world's two largest economies should accelerate adoption of circular economy practices at a global scale, creating potential for a 'system shift' towards a low carbon, regenerative economy

Analysis from the Ellen MacArthur Foundation found that transition to a circular economy in China's cities could make goods and services more affordable for citizens, and reduce impacts normally associated with middle class lifestyles, such as traffic congestion and air pollution. Earlier research found that Europe could, by 2030, add €0.9 trillion to its GDP by moving to a circular economy, while halving its CO2 emissions.[1]

3.1 Ministry for the Environment and the circular economy

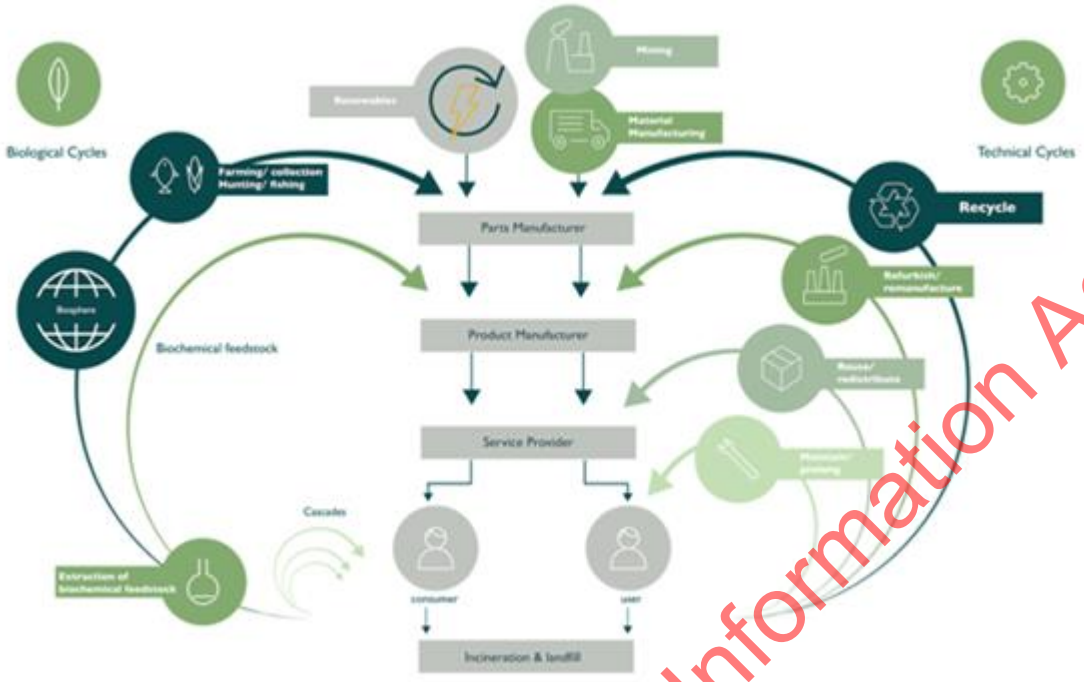
In May 2018, the Government adopted a circular economy policy approach to waste minimisation in New Zealand. MfE considers transitioning to a circular economy will reduce waste and associated pollutants, help protect and restore natural capital, and benefit efforts to address issues including climate change and water quality.

MfE believes that the products used for all aspects of life are often designed and manufactured with little thought for the resources consumed in making them or what happens to them at the end of their life. Apart from the most expensive purchases like a house, when something breaks in our modern world it is often more expensive to repair than to buy a new one, and usually it goes to the landfill.

MfE support the view that when a product is designed for the longest use possible, and can be easily repaired, remanufactured or recycled (or used, composted and nutrients returned) it is considered to have a circular life cycle.

[1] Ellen McArthur Foundation (2018). China-EU agreement paves way for global adoption of circular economy.

Figure 3.2 The New Zealand circular economy expanded



Source: Ministry for the Environment

New Zealand has already begun a shift towards a circular economy approach, with many businesses starting to make positive changes. The New Zealand Plastic Packaging Declaration, includes 17 local and multi-national businesses who have publicly committed to use 100 percent reusable, recyclable or compostable plastic packaging in their New Zealand operations by 2025, which means none of their packaging should end up in landfill.

Taking a circular economy approach will help to reduce carbon emissions. It takes more energy to extract raw materials and manufacture them into goods than to reuse materials that have already been extracted.

To support the transition to the circular economy MfE are encouraging manufacturers to take responsibility for the whole-of-life environmental impacts of their products. There are currently 14 Government-accredited voluntary product stewardship schemes in New Zealand, and mandatory product stewardship schemes are under consideration for problematic waste streams, including e-waste, vehicle tyres, agrichemicals, refrigerants and other synthetic greenhouse gases.[2]

3.2 The European Union approach to the circular economy and WtE

In 2015, the European Commission (EC) adopted an ambitious Circular Economy Action Plan[3], which includes measures that will help stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs.

The European Union Action Plan for the Circular Economy established an ambitious programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials and a revised legislative proposal on waste. The EC believes the proposed actions in the plan will contribute to "closing the loop" of product

[2] https://www.mfe.govt.nz/wastefreesummer/shop-smart/circular-economy-101
[3] European Commission (2015). Closing the loop - An EU action plan for the Circular Economy.

lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy.

The revised legislative framework on waste entered into force in July 2018. The legislative framework sets clear targets for reduction of waste and establishes an ambitious and credible long-term path for waste management and recycling.

Key elements include:

- A common EU target for recycling 65 percent of municipal waste by 2035
- A common EU target for recycling 70 percent of packaging waste by 2030
- Recycling targets for specific packaging materials
    - Paper and cardboard 85 percent
    - Ferrous metals 80 percent
    - Aluminium 60 percent
    - Glass 75 percent
    - Plastic 55 percent
    - Wood 30 percent
- A binding landfill target to reduce landfill to maximum of 10 percent of municipal waste by 2035
- Minimum requirements are established for extended producer responsibility schemes to improve their governance and cost efficiency.

The EC believes that the transition to a more circular economy, where the value of products, materials and resources is maintained in the economy for as long as possible, and waste generation is minimised, is an essential contribution to the EU's efforts to develop a sustainable, low carbon, resource efficient and competitive economy. The EC believes the circular economy will boost the EU's competitiveness by protecting businesses against scarcity of resources and volatile prices, helping to create new business opportunities.

3.2.1 Waste management in the circular economy

When addressing waste management in the context of the circular economy the EC recognises the importance of waste management to the circular economy as it determines how the waste hierarchy is put into practice. The waste hierarchy aims to encourage the options that deliver the best overall outcome. The EC identifies in the paper that the circular economy "aims to encourage the options that deliver the best overall environmental outcome. The way we collect and manage our waste can lead either to high rates of recycling and to valuable materials finding their way back into the economy, or to an inefficient system where most recyclable waste ends in landfills or is incinerated, with potentially harmful environmental impacts and significant economic losses."[4]

The EC also found that it is important to address the obstacles facing those considering waste management in the context of the circular economy. The EC found that often, higher recycling rates are limited by administrative capacity and a lack of investment in separate collection and recycling

[4] European Commission (2015). Closing the loop - An EU action plan for the Circular Economy.

infrastructure and insufficient use of economic instruments such as landfill charges or pay as you throw schemes.

When addressing WtE and its place in the circular economy the EC believes that where waste cannot be prevented or recycled, recovering its energy content is in most cases preferable to landfilling it, in both environmental and economic terms. The EC believe that WtE can play a role and create synergies with EU energy and climate policy, but guided by the principles of the waste hierarchy.

4 The New Zealand waste sector

The New Zealand waste sector is a highly complicated industry with many entities. Most people do not think much about how their waste is collected sorted or disposed of when they put it out on the kerbside, throw it in a skip bin or drop their trailer load of waste at the local transfer station. While responsibility for waste management and minimisation is placed on local authorities the way this is carried out differs across almost all local authority areas.

As well as local authorities, private companies play a major role in the New Zealand waste sector. Two Chinese owned companies dominate the sector. EnviroNZ which is owned by CK Infrastructure Holdings and Waste Management which is owned by Beijing Capital Group. These two companies dominate the collection market in New Zealand and own and operate some of New Zealand's largest landfills.

As well as two large players there are also a number of smaller New Zealand owned companies operating in the sector including Smart Environmental and Green Gorilla. Additionally, Australian company VISY has a strong presence in the Auckland recycling market.

This section seeks to set out the structure of the New Zealand waste sector including the various approaches to waste collection and disposal, who bares the costs of waste collection and disposal and the biggest challenge facing the New Zealand waste sector.

4.1 Collection

Collection of waste in New Zealand comprised of three key sources:

- Kerbside collection that is provided by or under contract for local authorities that covers the full process of collection, sorting and disposal
- Drop off by individuals to transfer stations or direct to a recycling centre or a landfill
- Private companies that enter into contracts for collection and disposal.

Due to the varying ways that waste is collected and disposed of and how local authorities collect data on waste it is not possible to breakdown the proportions of waste that come from each of these sources. For example, Wellington City Council contractors collect council rubbish bags at the same time that it collects waste from their private customers.

Despite being the most public method of waste collection, kerbside collection only represents a small proportion of the total New Zealand Waste Stream. Through conversations with local authorities, we estimate that the proportion of waste collected by or on behalf of local authority services represents approximately 10 percent to one third of the total waste that is collected.

Kerbside collection practices vary across most local authority areas but usually have a combination of collection of refuse waste, glass, metals, plastic, and paper recycling collection. Once this waste has been collected it is taken for disposal at a number of locations.

In a number of rural areas that do not have kerbside collection drop off facilities are made available to residents. The services offered in these locations vary, the facilities commonly accommodate most recycling and in some cases refuse waste facilities are available.

4.2 Disposal

Disposal of waste in New Zealand is primarily directed into one of two destinations, refuse waste disposed into landfills or recycling.

4.2.1 Refuse waste

In 2018, 3,701,807 tonnes of waste was sent to class one landfills. Refuse waste is either sent direct to landfill from the back of the collection vehicle or is processed through a transfer station. Transfer stations act as a single location where rubbish can be collected before it is taken to a landfill.

The Hamilton refuse transfer station was built to manage the majority of the city's general solid waste from both the residential and commercial sectors. Waste is collected here before it is transferred to landfills outside of the city.

In Christchurch EcoDrop, a council owned company, operate three transfer stations. EcoDrop receives waste into these transfer stations from kerbside collection or directly from public and commercial operations. Eco Drop then compact this waste into trucks who take the waste to the Kate Valley landfill.

4.2.2 Landfills

Our research of local authorities and waste companies has shown that class one landfills in New Zealand are predominantly owned by local authorities, by one of the big two waste companies, Waste Management and EnviroNZ or in a joint venture with one of these companies.

Local authorities own the majority of landfills in New Zealand, including Wellington City Council, Dunedin City Council, Hastings District Council and Marlborough District Council who all own their own landfills that receive metropolitan solid waste. These landfills are either operated by the local authority or by an operator contracted to operate the landfill on their behalf. In some cases, the landfill is the only landfill in the local authority area so all waste collectors use the facility. Some local authorities stipulate that their landfill must be used for disposal of kerbside waste while other councils leave the decision with the waste companies who handle the waste collection and sorting.

In the North Island, the large waste companies have established their own privately owned landfills. EnviroNZ has established and operates the Hampton Downs landfill which collect waste from across the upper North Island. Waste Management owns and operates the Redvale landfill in Auckland and is seeking consent to establish a new landfill at Dome Valley north of Auckland. In the Central North Island Midwest Disposals Limited owns and operates the Bony Glen and Levin landfills. Midwest Disposals is a joint venture between Waste Management and EnviroNZ who both hold a 50 percent share.

Bony Glen was previously a council owned landfill that was sold to Midwest Disposals. Bony Glen is situated 7kms west of Marton in the Rangitikei District and accepts waste from Taranaki, Whanganui, Palmerston North, Wairarapa, Manawatū and Horowhenua.

The final type of ownership is a joint venture between local authorities and one of the waste companies. The Kate Valley landfill in Canterbury is operated by TransWaste Canterbury, which is a joint venture between Waste Management and five Canterbury local authorities, Christchurch City, Selwyn District, Ashburton District, Hurunui District and Waimakariri District. Waste Management have 50 percent ownership with the local authorities sharing the other 50 percent.

In smaller locations, such as Westport, there is no landfill suitable to accept the town's waste. Waste from Westport is transported in trucks to Nelson's York Valley landfill.

4.2.3 Recycling

Materials for recycling are commonly sorted at Material Recovery Facilities (MRF) that are either owned by local authorities or by waste companies. Where the MRF is owned by a local authority it is often operated under contract.

The Auckland MRF is a joint-venture project between Auckland Council and Visy Recycling (NZ) Ltd. The MRF now handles recycling collected from Auckland Council's 265,000 households - catering for over 770,000 people or approximately 20 percent of New Zealand's population.

Typically, materials are transported to a MRF facility in the recycling collection trucks. Once the materials are delivered to the MRF it is sorted. The methods of sorting vary depending on the MRF. In larger areas the sorting is initially done by machinery followed by a manual process to remove the final waste not removed or sorted by machinery. In smaller locations, or where investment in machinery has not been made, the sorting is done manually. This results in variation in the quality of sorting and separation.

Glass bottles are commonly separated into storage hoppers for transportation, while all other materials are then sorted into separate streams and are then compressed and baled. These bales are then ready for export or reprocessing in New Zealand.

Any item that is collected and cannot be recycled is separated out and sent to landfill. Key issues faced by MRF operators include glass being put in the bags and wheelie bins instead of the crates, and plastic being put in the crates with glass.

The destinations of the recycling materials vary depending on who is responsible for the disposal of the materials, and the contractual agreements that are in place. For the majority of local authorities we spoke with, glass collected in their local authority areas is colour sorted and goes to O-I New Zealand, in Auckland.

A number of local authorities surveyed send clear PET (plastic clear bottles and clear containers) for processing in Wellington by Flight Group Ltd. Here the materials are recycled into food grade packaging.

Local authorities surveyed send some paper and cardboard to Oji Fibre Solutions where it is turned into cardboard products.

The remainder of the recycling materials are sent to various locations both within New Zealand or overseas to export markets, although sourcing overseas markets is becoming more difficult.

4.3 Cost incidences

How New Zealanders pay for their waste varies depending on whether they use a private service or one provided by the local authority. For people who use private contractors to collect and dispose of their waste consumers pay the full cost of the service at a price that is determined by the private provider. The costs that consumers face varies depending on a number of factors including the volume of waste, the collection location, the disposal location and the cost of disposal that the private company faces.

For those who make use of services provided by or on behalf of the local authority how they pay for their waste collection depends on the local authority area they live in. Of the local authorities we

spoke to we identified the following ways in which local authorities charge their residents for their waste:

- Full user pays
- Part user pays, part rates
- Fully rates funded
- No council service provided.

Under the full user pays scenario, the cost of collection and disposal of refuse and recycling is completely user pays. For example within Wellington City residents using local authority collection are required to purchase specific bags sold by the city council. The revenue collected from the sale of these bags covers the cost of collection and disposal, plus the city's residential recycling service.

A number of local authorities that we spoke to have a combination of user pays for their refuse waste and a rates charge for recycling. For example, Dunedin has a pay as you throw system for refuse waste while recycling is funded through a rates charge. The value of the rates charge varies depending on the service that is provided. Those who have a kerbside service pay more than rural residents who have a recycling centre facility where residents can drop off recycling for collection.

In Palmerston North, collection is funded through rates which pays for the truck to drive past properties providing the option for residents to make use of the service or not. For those residents who choose to make use of the council collection service they pay for bags which covers the cost of disposal of the waste.

Other local authorities have established a system whereby kerbside refuse and recycling collection and disposal are fully funded through rates. Again, these rates vary depending on the level of service the property receives. In the Hastings District Council area, both refuse and recycling are both fully funded through rates. For residents who would prefer to use a private provider there is nothing stopping them from doing this however they will be required to pay for the council run service through their rates and the cost from the private contractor.

Some local authorities including the Kāpiti Coast District Council and Waipa District Council no longer provide waste collection services and the Kāpiti Coast District Council no longer collects recycling. Since 2013 kerbside collection services for rubbish and recycling in the Kāpiti Coast District have been provided to residents solely by private operators. These operators are licensed to operate by the Kāpiti Coast District Council. Collectors are required to provide waste and recycling collection for their urban residential customers. The price residents pay for their waste service includes the cost of a recycling service. The role of the Kāpiti Coast District Council is to monitor all collectors to make sure the companies comply with their licence conditions and the Kāpiti Coast District Council Solid Waste Bylaw.

4.3.1 Revenue from sale of recyclables

Some local authorities use the revenue from the sale of recyclables to offset the cost of collection and disposal. However, the revenue from this has recently declined as a result of the Chinese National Sword decision. The local authorities we spoke to approached the revenue from the sale of recycled materials in different ways. Some local authorities have a mechanism in contracts with their recycling contractors that sets out a profit sharing agreement. These agreements vary across local authority contracts.

Where local authorities do not have a profit sharing agreement for the sale of recyclables the risk or rewards for sale of recyclables falls on the recycling contractor responsible for disposal of waste. This additional source of revenue for the recycling contractor is reflected in a lower contract price for the local authority.

Given the recent developments because of the Chinese National Sword policy local authorities have found some contractors are struggling to operate given the lower prices it receives for materials. In these situations, local authorities have been required to amend contract terms in existing agreements to ensure that these contractors can continue to operate their recycling services. These increased recycling costs faced by local authorities will ultimately be passed on to residents and rate payers through higher costs of refuse disposal through pay as you throw charges or through increases to rates, or if rates increases are not possible, through reductions to other council services.

4.4 The Chinese National Sword policy

Waste disposal across the world was given a shock in 2017 when China announced that it was going to introduce the Chinese National Sword policy. This policy has forced government, local authorities and private companies to reconsider the way in which it disposes of their waste in the short term, and how they will structure their waste and recycling activities well into the future.

The Chinese National Sword, also known as the Green Sword, is China's most recent restriction on the Country's imports of solid wastes as raw materials. The policy bans various plastic, paper and solid waste. The policy sets a much tougher standard on the limit of contamination in scrap plastic, and metals allowed in a shipment – increasing from 90-95 percent purity to 99.5 percent. This means that China is no longer accepting shipments of recycling that are mixed with rubbish, the wrong type of recyclable, or low-quality recyclables like greasy paper goods.

The policy was announced in July 2017, and the ban officially began on 1 January 2018. In addition to the bans, China is reducing the number of import licenses, meaning that fewer businesses will be able to import waste. The move is intended to improve China's air quality, reduce pollution from dirty or hazardous wastes.

The National Sword policy follows China's "Green Fence," a 10-month policy the country enacted five years ago, which set initial standards for lower contamination levels for recycling.

Prior to the new policy being enacted China processed 55 percent of the world's scrap paper and was the leading destination for other recyclable materials. The restriction has had a major impact on global waste management, including New Zealand. As China was a major destination for waste new markets have had to be found leading to a global decline in the price paid for recycled materials. Across Southeast Asia, recyclers operating in Indonesia, Thailand, Vietnam, and Malaysia bought some of the waste that would have gone to China, but were quickly overwhelmed by the sheer volume that China once easily absorbed.

These low prices have resulted in negative impacts for New Zealand. Recycling has begun to stockpile in some local authority areas as markets cannot be found to take the materials or the materials would be shipped at a loss. Local authorities have also reported having to renegotiate recycling disposal contracts to ensure that waste companies will continue to honour their contact agreement and in some extreme cases continue to remain in business.

The world market for recycling has since come under increasing pressure with India recently completely prohibiting the import of solid plastic waste by amending the Hazardous Waste Rules on 1 March 2019. Imports of plastic waste had previously been widely banned, but in some parts of the

country, regional provisions in special economic zones allowed local governments to accept plastic waste imports, while another scheme, export oriented units, allowed businesses to procure resources from abroad.

What has become clear is that New Zealand needs to investigate alternative methods for reducing waste and the need for waste and recycling disposal, as we can no longer rely on other countries to help us manage our waste.

5 Waste disposal in New Zealand

Waste in New Zealand is disposed of in two ways, landfills or recycling. There are currently four types of landfill classed from one to four.

- Class one landfills accept municipal solid waste or industrial waste as well as most wastes that go to other category landfills
- Class two landfills accept construction and demolition waste as well as some industrial waste. Class two landfills also accept non-putrescible wastes, controlled/managed fill and cleanfill
- Class three landfills are managed / controlled fill landfills and accept predominantly cleanfill materials but also other inert materials and soils with chemical contaminants greater than regional background concentrations
- Class four landfills accept only cleanfill material including virgin excavated natural materials, including soils, clays, gravels and rocks.[5]

Data is not collected on the volumes of waste that are collected in landfill classes two to four. The main source of data for annual waste volumes are those captured by the New Zealand Waste Levy. The levy, currently $10 per tonne, is payable on every tonne of waste that is disposed of into a class one landfill. In the 2018 calendar year New Zealand sent an estimated 3.7 million tonnes of waste into class one landfills. MfE estimate that this represents approximately 30 percent of waste dumped into New Zealand landfills.

In May 2017 Eunomia produced a report for WasteMINZ and a collection of local authorities, regional authorities and companies working in the waste sector titled The New Zealand Waste Disposal Levy. Potential Impacts of Adjustments to the Current Levy Rate and Structure.[6]

This report used 2014 waste levy data to calculate the volume of waste disposed into a class one landfill to estimate the volumes of waste into the other classes of landfill. Eunomia also estimated the volume of recycling with data provided from a number of sources. The results of the 2017 report are presented below.

Table 5.1 Waste destination by landfill type 2014

Waste Destination	Tonnes	Total %	Landfill %
Class 1 Landfill	3,220,888	21.0	33
Class 2 Landfill	2,575,771	16.8	27
Class 3 Landfill	64,394	0.4	1
Class 4 Landfill	3,799,262	24.8	39
Farm dumps	1,362,666	8.9	N/A
Recovery	4,288,743	28.0	N/A
Total Waste Generated	**15,311,724**		

Source: Eunomia, 2017

To estimate the total volume of waste for 2018 we used the proportions estimated by Eunomia in 2017 and applied the same proportions to the total volume of levied waste for 2018 (3.7 million tonnes). We estimate that the total volume of waste in 2018 was 17.6 million tonnes. Of this, we

[5] Source: WasteMINZ. 2016. Technical Guidelines for Disposal to Land

[6] Eunomia (2017).The New Zealand Waste Disposal Levy. Potential Impacts of Adjustments to the Current Levy Rate and Structure. 30th May 2017

estimate that 4.9 million tonnes was recovered through recycling. The table below provides 2018 estimates using the same proportions Eunomia used in their 2017 report.

Table 5.2 Waste destination by landfill type 2018

Waste Destination	Tonnes	Total %
Class 1 Landfill	3,701,807	21
Class 2 Landfill	2,965,362	17
Class 3 Landfill	74,134	0
Class 4 Landfill	4,373,908	25
Farm dumps	1,568,772	9
Recovery	4,937,424	28
Total Waste Generated	**17,627,654**	

Source: Eunomia, Ministry for the Environment, BERL calculations

Looking to the future and assuming that current conditions remain, we forecast that the total volume of waste generated in 2021 will be between 18.1 million tonnes and 19.6 million tonnes. The 2017 Eunomia report forecasted increases in waste of 1.7 percent in 2016, 2.2 percent in 2017, 2.1 percent in 2018, 1.7 percent 2019, and 1.4 percent in 2020 and 2021.

When comparing these forecasts to the actual volumes for 2016 to 2018 the actual rates going into class one landfills were between five to eight percent above the Eunomia forecasts. When setting the ranges for these forecasts we used the Eunomia forecast as the lower band and the 2018 eight percent actual increase above this as the upper band. We estimate that the volume of recycled materials in 2021 will be between 5.1 million tonnes and 5.5 million tonnes and the volume of waste to class one landfills will be between 3.8 million and 4.2 million tonnes. The table below sets out the upper and lower bands and destination of waste forecast for 2021.

Table 5.3 Estimated waste destination by landfill type 2021 (tonnes)

Waste Destination	Eunomia forecast	BERL forecast
Class 1 Landfill	3,870,889	4,192,290
Class 2 Landfill	3,048,973	3,302,130
Class 3 Landfill	76,224	82,553
Class 4 Landfill	4,497,235	4,870,642
Farm dumps	1,613,005	1,746,933
Recovery	5,076,640	5,498,155
Total Waste Generated	**18,124,683**	**19,629,581**

Source: Eunomia, Ministry for the Environment, BERL calculations

5.1 Waste exported

5.1.1 Value of waste exported

In 2018 New Zealand exported (free on board) $573 million of waste products overseas. This the value of the waste product sold to overseas buyers for recycling before it is shipped overseas. For example the value of paper that is shipped overseas and turned into cardboard. Australia was the largest market for New Zealand waste products accounting for $208 million (36 percent) of New Zealand's total exported waste. South Korea was the second largest export market by value with $70 million (12 percent) worth of waste exports going to this market. India and Indonesia ranked third and fourth

with $60 million (11 percent) and $41 million (7 percent) of exported waste by value. China ranked 9th by value taking $21 million (4 percent) of the total value of waste exported.

Table 5.4 New Zealand export waste destinations top 5 by value (2018)

Country	$ million
Australia	209
Korea, Republic of	70
India	60
Indonesia	41
United Kingdom	30
Total for all countries	**573**

Source: Statistics New Zealand

Of exported materials ferrous waste and scrap was the highest value of exported waste with $237 million exported in 2018. This is 41 percent of the total value of waste exported from New Zealand. Aluminium; waste and scrap, other than used beverage cans or aluminium extrusions was the second largest export by value with $91 million worth of the product exported in 2018. This was 16 percent of all waste exported.

Table 5.5 New Zealand export waste commodities top 5 by value (2018)

Commodity	$ million
Ferrous waste and scrap	237
Aluminium waste and scrap	91
Copper waste and scrap	50
Paper or paperboard	23
Stainless steel waste and scrap	23
Total for all commodities	**573**

Source: Statistics New Zealand

5.1.2 Volume of waste exported

The total volume of waste is difficult to measure due to the different measurements used to measure waste exports. While the majority is measured by weight, either kilograms or tonnes waste exports are also measured in litres, square metres and bone dry unit. The following analysis focusses on the volume of waste that is measured by weight.

In 2018 New Zealand exported 1.02 million tonnes of waste. Ferrous metals was the largest volume of waste exported and makes up 481,000 tonnes (47 percent) of total volume of waste exported. The remainder of the top commodities exported by volume are variations of paper and paperboard and aluminium. Variations of paper and paperboard commodities make up over a third of all New Zealand waste exports by volume.

Table 5.6 New Zealand top 3 export waste commodities by volume (2018)

Commodity	Tonnes
Ferrous waste and scrap	480,938
Paper or paperboard	305,147
Aluminium waste and scrap	43,970
Total	**1,017,478**

Source: Statistics New Zealand

The largest recipient of New Zealand waste was Australia, which accepted 361,178 tonnes (35 percent) of New Zealand waste in 2018. The largest volume of products exported to Australia were ferrous waste and scrap, paper or paperboard and aluminium.

Indonesia was the second largest market taking 196,665 tonnes of waste materials. The composition of the largest volumes of waste exported to Indonesia was similar to that of Australia with the addition of Plastics n.e.c. in heading no. 3915; waste, parings and scrap which accounted for 41 percent of the volume of exports to Indonesia.

Table 5.7 New Zealand export waste destinations top 5 by volume (2018)

Country	Tonnes
Australia	361,178
Indonesia	196,665
Korea, Republic of	77,292
India	75,687
Viet Nam	61,002
Total for all countries	**1,017,478**

Source: Statistics New Zealand

5.1.3 Impact of WtE on exports

At this point we cannot estimate the impact that WtE will have on waste exports. However, the exports of waste are sold to overseas buyers, generating a financial return to the seller the volume of waste New Zealand exports. Therefore, it is unlikely to decrease due to the introduction of WtE. WtE makes its profit by charging for waste disposal. It is unlikely that an exporter who currently makes a return on the product will look to make use of a WtE facility where they will pay for waste disposal.

If sorting of waste for WtE were to improve above current levels then there is the potential for New Zealand to increases its exports of recyclable materials. Improved sorting of materials for WtE could result in better separation of recyclable materials diverting waste that would have previously been sent to a landfill to export for recycling and reuse overseas.

5.2 Employment

The waste sector in New Zealand is a significant employer. In 2018 15,100 people were employed in the electricity, gas, water and waste services industry. Of these 6321 were working in the waste sector. Collection of waste, both solid and other waste collection accounted for 2360 full time equivalent employees (37 percent). A further 1990 people were employed in waste remediation and materials recovery services. These are the employees who are sorting waste and recycling at places such as MRFs. Finally 1972 people are employed in waste treatment and disposal services. These full

time equivalent employees (FTEs) include people working in landfills and those involved in the disposal or treatment of waste.

Table 5.6 Employment in the waste sector (FTEs)

Service	2016	2017	2018
Solid waste collection	1684	1965	2026
Other waste collection	222	302	334
Waste treatment and disposal	1548	1735	1972
Waste remediation and materials rec	1642	1825	1990

Source: Statistics New Zealand

5.3 Greenhouse gas emissions

All existing methods of waste disposal, including recycling and landfill, generate greenhouse gas emissions. Given it is assumed that the proposed WtE facility will use feedstock materials diverted from landfill, this section will explore the emissions which are currently created from landfilling these materials. For a comparison of emissions from landfill and incineration please see Section 5.2.

Emissions consist of several different greenhouse gases. Emissions from New Zealand landfills are predominantly methane (96.5 percent), with nitrous oxide contributing a smaller amount (3.4 percent) and the remainder being carbon dioxide (0.03 percent)[7]. Because landfills contain only a small amount of waste of fossil origin direct carbon dioxide emissions are relatively low. Decomposition of carbon of non-fossil origin is considered to be part of the natural carbon cycle.

For simplicity and to allow comparisons between activities, emissions are reported in terms of their equivalent amount of carbon dioxide (CO_2-e). The calculation for the total amount of emissions of all types, and the conversion into the equivalent amount of CO_2-e is captured within a ratio called an emissions factor. The factor describes the amount of CO_2-e emitted for each unit of activity, in this case each tonne of waste disposed into landfill. Emissions factors are used to calculate total emissions using the following formula:

Greenhouse gas emissions (t CO_2-e) = Qj x EFj

where:

Qj is the quantity of waste by type j

EFj is the emission factor of waste type j

These emissions factors are reviewed and updated regularly by the relevant authority in each country, to ensure they are as accurate as possible for the activities of that country. In New Zealand this task is carried out by MfE.

5.3.1 New Zealand emissions factors

Emissions information for New Zealand is published as part of our commitment to the Kyoto Protocol[8]. This information is being updated at the time of writing this report, and the new emissions factors have yet to be published. To approximate the most up to date emissions factor available, the 2016 emissions factor for landfilled waste (mixed, national value) without gas recovery has been used, with a modification to account for currently existing landfill gas capture. MfE advises that 71 percent

[7] New Zealand's Greenhouse Gas Inventory 1990–2016, Ministry for the Environment. (2016).
[8] Guidance for voluntary Greenhouse Gas Reporting. Ministry for the Environment. 2016.

of landfill gas in New Zealand is captured at the present time[9]. The base emissions factor is modified to account for this, giving a modified emissions factor of:

Modified EF (with 71% LFG): $1.13\ x\ (1 - 0.71) = 0.3277$

This means that for every tonne of Municipal Solid Waste (MSW) sent to landfill in New Zealand, 0.3277 CO_2-e is emitted.

5.3.2 International emissions factors

Emissions factors from a number of overseas jurisdictions were collected to enable an evaluation of the factor provided by MfE against a generally agreed overseas standard. Although the method for calculating the factor should be standard as it is determined according to rules agreed to in the Kyoto Protocol, the contents of MSW can vary significantly between countries due to differences in the economy, and cultural differences.

A direct comparison of the contents of the MSW streams from New Zealand and Australia shows significant differences in the proportions of component materials. The proportion of degradable organic carbon used as a basis for emissions calculations also varies between countries and across waste material types.

The implication of these variations is that the emissions factors from different countries are not directly comparable, and that each waste disposal method requires a specific calculation based on a survey of the component materials.

5.3.3 Current New Zealand waste emissions

In 2016 total emissions from the New Zealand waste sector were 3,838kt CO_2-e[10] or 4.9 percent of New Zealand's gross greenhouse gas emissions. Of this total the largest share was from solid waste disposal which was responsible for 3439kt CO_2-e. The solid waste disposal category covers both managed and unmanaged landfills, including privately owned landfills and farm fills, but excludes existing waste incineration, and wastewater treatment.

Due to improved management practices total emissions are falling even as the amount of waste produced each year increases. This is driven in part by the requirements of the Emissions Trading Scheme which has encouraged landfill gas capture.

[9] Ministry for the Environment (unpublished).
[10] New Zealand's Greenhouse Gas Inventory 1990–2016, Ministry for the Environment. (2016).

6 Waste incineration

Around the world incineration has been tried as a means to address ballooning waste problems, with varying degrees of success.

Many of the success stories come out of Europe where there are numerous WtE facilities in operation, mostly in the northern and western countries. Sweden is often pointed to as a world leader in the field with its 34 WtE plants. The largest plant is Högdalen in Stockholm which consumes 700,000 tonnes of municipal waste per year. EU regulations are strict about allowable flue gas contaminants, requiring sophisticated processing before exhaust gas can be released. Both Sweden and Denmark have stopped landfilling, and now incinerate so much waste that they are net importers, taking waste from neighbouring countries to feed their incineration plants.

Sweden does not see incineration as a complete solution for the management of waste. The country has adopted a Waste Prevention Programme with specific targets including a reduction in the amount of waste generated and an increase in reuse of goods such as textiles[11].

Since the late 1980s India has built 15 WtE facilities in an attempt to tackle that county's massive waste problem. More than half of these plants have shut down or construction was abandoned. Many were closed as they were uneconomic. The primary challenge appears to be feedstock which is low in calorific value and has a high water content as it contains high proportions of biological material (food waste) and inert substances such as soil and sand. Feedstock of this type requires auxiliary gas to incinerate, raising the cost of any electricity produced.

With rising prosperity the waste problem in India continues to worsen, and government agencies are proposing to build more and larger WtE plans in response. It is unclear how the previously encountered challenges will be overcome.

New Zealand has seen several WtE proposals in recent years. Waste incineration has been proposed for Auckland and Huntly, pyrolysis waste treatment for Blenheim, and there exist a number of small scale co-generation plants using waste as fuel.

6.1 WtE in New Zealand

New Zealand has not embraced WtE like a number of countries have. This can partially be attributed to the abundance of land in New Zealand that is suitable for landfilling at a relatively low cost. Some of the arguments raised against WtE by the Waste Management Institute of New Zealand[12] are:

- Community perception: Waste incineration has the potential to cause harm to both the environment and human health. The institute also noted that today's modern and efficient technologies can limit these health and environmental concerns through treatment and mitigation of emissions. Therefore, through engagement and consultation with affected communities, these perceptual issues can be overcome.
- Cannibalising recycling programs: The development of WtE plants contradicts with the recycling policy of New Zealand because those plants need feedstock.
- Consistency of feedstock issue: New Zealand has a relatively large land area as compared to its population. Hence, getting consistent volumes of waste are difficult. Only in an area such as Auckland, there is certainly no shortage of waste. However, there are many and varied

[11] Overview of national waste prevention programmes in Europe: Sweden. European Union, 2016.
[12] Waste Management Institute of New Zealand (2018). What about Energy from Waste?

disposal options already in existence competing for the same waste, many of which are likely to be cheaper solutions.

- Cost issue: Landfilling remains New Zealand's predominant mechanism for waste disposal as it is cost-effective. Only with significant waste disposal levies through regulatory intervention, a WtE plant can be considered economically attractive.

One of the benefits of WtE seen overseas has been the ability to create heat and electricity that can replace the reliance these countries have on fossil fuel. This is not much of a benefit for New Zealand as around 85 percent of New Zealand's electricity is generated from renewable resources.[13] Fossil fuels are still used during the dry seasons when hydro lakes are low. Additionally, New Zealand does not have the same heating needs as the European countries that have embraced waste to energy as our winter climates are not as cold.

New Zealand currently has some small-scale waste to energy facilities operating. There are currently three high temperature incinerators in operation at Auckland Airport, Christchurch Airport and in New Plymouth. Golden Bay Cement also use wood waste as fuel for its cement kilns. Previous studies have found that there are also some small-scale gasification and pyrolysis waste treatment projects but nothing on a large scale.[14]

6.2 WtE experiences in Europe

As noted above, Europe has been at the forefront of WtE as a method of waste disposal. In 2012 there were 409 WtE plants counted which were burning 74 million tonnes of waste producing heat and electricity.[15] The European Commission has identified that the transition to the circular economy requires action throughout the product lifecycle, including disposal. In the European Commission report The role of waste-to-energy in the circular economy[16], waste management is identified as one of the areas where further improvements are needed and within reach.

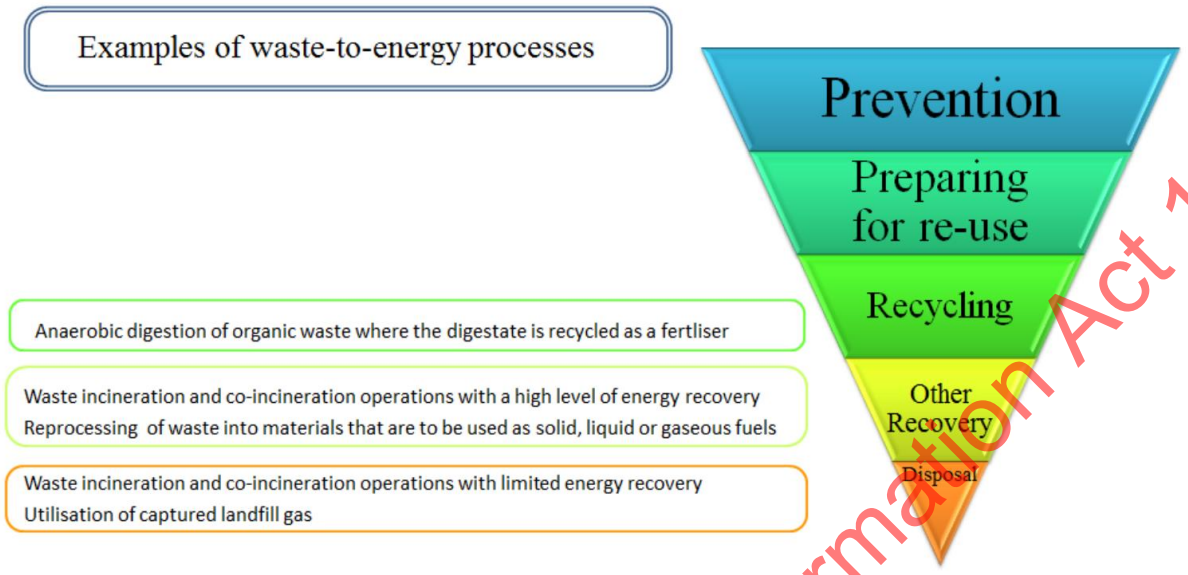
The EC identify that WtE processes encompass a range of waste treatment options. For example the process of anaerobic digestion which results in bio gas is regarded as recycling by the EU while incineration with limited recovery is considered as disposal. The EC report considers five main waste to energy processes:

- co-incineration of waste in combustion plants (e.g. power plants) and in cement and lime production, as is used by Golden Bay Cement in New Zealand
- waste incineration in dedicated facilities, like the one proposed by Renew Energy
- anaerobic digestion of biodegradable waste
- production of waste-derived solid, liquid or gaseous fuels
- other processes including indirect incineration following a pyrolysis or gasification step.

Figure 6.1 illustrates the positioning of these WtE processes against the EU waste hierarchy which mirrors New Zealand's waste hierarchy.

[13] Ministry of Business Innovation and Employment (2019). Energy in New Zealand.
[14] Perrot, J., Subiantoro A. (2018). Municipal waste management strategy review and Waste-to-energy potentials in New Zealand.
[15] European Commission (2017) The role of waste-to-energy in the circular economy
[16] Ibid

Figure 6.1 WtE and the EU waste hierarchy



Source: European Commission

As the figure above shows, the waste hierarchy also broadly reflects the preferred environmental option from a climate perspective. Disposal, in landfills or through incineration with little or no energy recovery, is usually the least favourable option for reducing greenhouse gas (GHG) emissions. Conversely, waste prevention, reuse and recycling have the highest potential to reduce GHG emissions.

The EU have implemented a policy whereby new investments in the waste sector are in line with the waste management plans of the member nations to meet reuse and recycling targets. As a result, investments in treatment facilities for residual waste, such as extra incineration capacity would only be granted in limited and well justified cases, where there is no risk of overcapacity and the objectives of the waste hierarchy are fully respected.

The EC communication recommends that where waste-to-energy processes are opted for, there is a need to ensure that the most efficient techniques are used. The EC study found that the best proven techniques to increase energy efficiency processes were as follows:

- Co-incineration in combustion plants: gasification of solid recovered fuel and co-incineration of the resulting syngas in the combustion plant to replace fossil fuels in the production of electricity and heat
- Co-incineration in cement and lime production: conversion of waste heat to power in cement kilns
- Waste incineration in dedicated facilities: like that proposed by Renew Energy for the West Coast
- Anaerobic digestion: upgrading of biogas into bio-methane for further distribution and use into things such as the gas grid or transport fuel.

The EC notes that the superior energy efficiency levels attainable by installations working in to provide both heat and power, compared to plants merely producing either heat or electricity.

Additionally, the study notes that supporting measures to improve energy and/or material efficiency in these WtE processes can be taken to make the facilities more effective. This includes the development of industrial parks where a waste-to-energy plant processes the waste generated by industries located nearby while providing them heat and power in return; or the recovery of materials found in incinerator bottom ash.

6.3 The proposal from Renew Energy

At the outset of this report a WtE facility was proposed for the West Coast of the South Island. Since the research for this report was completed the proposal has since been withdrawn. However, the information regarding the proposed facility provides an insight into the WtE facilities proposed for New Zealand. The remainder of this section focuses on the potential impacts of the WtE facility that was proposed for the West Coast of the South Island by Renew Energy, however the considerations and relationships presented are equally applicable to any other WtE proposal.

The proposal was to incinerate 330,000 tonnes of commercial and industrial waste which would otherwise go to landfill. The plan included a baseload electricity generator with a capacity of up to 28MW. This could have been used to generate electricity for export into the national grid, and thermal energy would be available in the event of a neighbouring development which could utilise industrial heat. If both opportunities were pursued it is likely that the electricity exported would be in the region of 18MW.

6.3.1 Benefits

The West Coast Region of New Zealand has seen the lowest employment growth and negative GDP growth over the last 10 years. A new development such as the proposed WtE facility would have brought much needed jobs and economic stimulation. If the opportunity of the available thermal energy is taken up by a further development, this could result in the creation of additional new employment opportunities.

Many parts of New Zealand are struggling to plan for increasing waste streams. Incineration could offer part of the package of solutions to this challenge if it can be effectively combined with sorting and recycling of recoverable materials.

6.3.2 Costs

The proposal had a range of potential costs and negative effects including visual pollution from such a large industrial development and stockpiled feedstock in an area with relatively few such structures. Waste incineration produces greenhouse gas and toxic emissions. Buller District would in effect have been importing the waste of other regions. This would have had traffic effects due to the import of feedstock and removal of ash, presumably to a landfill outside of the district.

One cost that was not addressed in the proposal is the disposal of ash. Ash is left behind when waste is incinerated. The volume of ash is dependent on the feedstock and what can be burnt. Currently all waste generated in Westport (in the Buller District) is trucked to the York Valley landfill in Nelson as there is not a suitable local facility. Ash volumes will be between three and 28 percent of the total waste consumed. This is equal to 9,900 to 92,400 tonnes per annum depending on the volume of ash used for other purposes. 10 to 25 percent of total waste consumed will become bottom ash that can be reused in the manufacture of other materials such as concrete. However, the only concrete facility in New Zealand is located at Golden Bay Cement in Portland, Northland. To put these ash volumes into perspective the total refuse waste landfilled by the West Coast in 2017 was 11,039 tonnes. Of this 4,309 tonnes were from Buller District.

Many of the negative effects will depend on the management and maintenance of the facility. For example, emissions mitigation requires strict monitoring and the feedstock will require proper bailing and storage to avoid windblown waste escaping from the site.

6.3.3 Emissions

Greenhouse gas emissions

Renew Energy provided some information on facilities in operation overseas and some high level information about the facility intended to develop in the Buller District. Specific information on the facility, the precise feedstock, and the likely emissions profile was not made available.

Documentation supplied by Renew Energy to support their proposal included a figure "330,000 tonne p.a. EFW Facility tonnes CO_2 p.a. comparison"[17]. This figure compares emissions from various waste disposal methods. The amount given for landfill is close to the total lifetime emissions expected from 330,000t MSW in a New Zealand landfill without gas capture, ignoring that 71 percent of landfill gas is captured. Landfill gas capture is used to generate electricity or to power facilities which would otherwise need an alternative energy source.

The amount given for "EFW" (WtE) appears to be the lowest reported emissions from incineration in Denmark, a country with infrastructure for waste management far more developed than exists in New Zealand.

By choosing these two statistics the picture presented was skewed to imply that landfill is far worse than the New Zealand average, and that all WtE plants operate at the lowest international emissions rate.

Emissions of toxins

Besides greenhouse gasses, incineration of material has the potential to release a range of toxic substances. The types and amounts emitted vary considerably according to the feedstock and the technologies and strategies employed to reduce pollution. Dioxin, furan, chlorides, and fine particulate released into the air are potentially damaging to the health of nearby communities. These can be reduced to negligible amounts if the correct mitigation strategies such as scrubbers and electrostatic precipitators are used.

Heavy metals and other toxins are usually present in the bottom ash and fly ash. The amount of bottom ash varies by feedstock and incineration technology but tends to range from 10 to 25 percent. A large proportion of the metals can be extracted for recycling, but the remaining material will require appropriate disposal, most likely to landfill. Ash must be tested for toxins, and if present it must be disposed of in a hazardous waste landfill which has measures to prevent the pollutants leaching into the water table.

Careful facility design and consent conditions will be essential to ensure these toxins are effectively managed, with ongoing monitoring to ensure compliance over time.

[17] Energy Recovery Facility. Presentation to Buller district Public Meeting December 2018. Renew Energy.

7 Effects on the market

Given the limited data available on gate fees and volumes of waste due to commercial sensitivity and confidentiality restrictions, we are not able to accurately forecast the effect the introduction of WtE as a disposal option will have on the New Zealand waste market. We have instead identified the factors that will need to be considered when WtE companies are determining whether to establish a facility and local authorities or waste companies will need to consider when deciding on WtE as a waste disposal option.

The considerations in this section assume that the landfill prices will remain as they currently are and that the waste minimisation levy will remain at $10. We also assume that prices for recycled materials will remain steady and that there will be no more shocks like the Chinese National Sword decision.

Our conversations with industry participants which included waste companies, landfill owners, recycling companies and local authorities made it clear that they see WtE, and in particular incineration, as a direct substitute for landfills and that both options should be considered the last resort. Participants believed WtE does not encourage waste minimisation or behaviour change. As a result we have assumed that the choice of how to dispose of waste will be between landfill, recycling and WtE.

7.1 Costs of disposal

7.1.1 Costs of WtE

At this stage without any firm proposals for a WtE facility, it is difficult to get an estimate of the cost of disposal through WtE. Renew Energy who were promoting the proposed West Coast waste facility were proposing a fee of $140 per tonne to bale waste, transport it from Canterbury (Christchurch) to the West Coast and then incinerate the waste at its WtE facility on the West Coast. The proposed service would bale waste in Christchurch at a facility close to the rail line where coal trains returning to the West Coast would be loaded with baled waste for WtE facility. The gate fee component of this cost, the fee the WtE facility would charge is $80 per tonne.

We asked Renew Energy what the additional costs would be for transport from other locations in the South Island and were advised that in discussions with Marlborough District Council it had recommended an additional $30 per tonne to cover the additional transport costs from Blenheim. It was not decided how this transport would be delivered.

Eunomia also looked at incineration as an option and found that "the principal reason [for not pursuing WtE] appears to be the relatively high cost compared to large scale landfill."

In 2012 Auckland Council commissioned a report by Campbell MacPherson into energy from waste as a possible option for the City. Campbell MacPherson concluded, "there is no clear indication at this stage that economic drivers are in place to ensure viability of WtE in the Auckland waste market". The study identified that combined capex and opex costs for a 200,000 tonne per annum incinerator would range between $140 and $210 per tonne. Campbell McPherson found that when taking account of income from electricity generation this would indicate gate fees of between $100 and $170 per tonne would be required.

We also spoke to one of the large waste companies that operates WtE facilities around the world and it informed us that they had looked into WtE in New Zealand previously and found that the gate fee it would need to charge to be profitable in New Zealand was around $400 per tonne.

Representatives from the company said that if it were profitable to run a WtE facility in New Zealand they would already be doing it as they already have the waste volumes available to support the facility.

A 2018 report by WRAP UK[18] found that the average gate fee for WtE facilities in the United Kingdom was £89 (NZ$169) this was within a range of £33 to £117 (NZ$63 to NZ$223) per tonne.

The Marlborough District Council recently carried out an assessment of what the change in costs would be to provide current services if it switched to WtE with a projected gate fee of $160 per tonne (including baling and transport). Based on this assessment the cost of the services offered by Marlborough District council would all increase above the current costs.

7.1.2 Costs of landfills

As part of this study, we intended to compare the gate fees at landfills across the county to try to establish an average gate fee across New Zealand to compare to the $140 total fee and the $80 gate fee that is proposed by Renew Energy. Due to the way waste is collected and disposed of and the confidentially and commercial sensitivity of contracts we were not able to accurately estimate an average gate fee. Often large landfill customers receive a discount on the posted gate fee. The posted gate fees at landfills used by the local authorities we spoke to were all over $100 per tonne when including GST and the waste levy and were as high as $253 per tonne at Christchurch EcoDrop facilities. Examples of the composition of gate fees and how these differ are provided below.

Palmerston North City Council currently pay a fee of around $170 per tonne to drop waste off at an EnviroNZ MRF facility in Palmerston North. As part of this cost EnvironNZ then process the waste and transport the waste to Bony Glen landfill. Using data produced by the Manuwatu District Council to support the Fielding Resource Recovery Centre[19] the estimated gate fee for refuse at Bony Glen would be $100 per tonne for kerbside refuse and $126 per tonne for waste from a refuse transfer station. The Manuwatu District Council also estimated that the transport cost from Fielding to Bony Glen, a distance of approximately 30 kilometres would be $32 per tonne.

Wellington City's Southern Landfill has a gate fee of $120 per tonne. This gate fee represents a 50/50 split of costs of disposal and for funding recycling activities. Without the additional charge for recycling this would have to be passed on to residents and businesses in other ways such as through rates or higher charges for council rubbish bags.

Christchurch City disposes of waste at Kate Valley landfill, which it owns a share. The price paid by those disposing of waste at an EcoDrop facility in Christchurch is $253.40 per tonne. This price includes the cost of handling, sorting, transport to the Kate Valley landfill and the gate fee for disposing of waste at Kate Valley landfill. In 2016 the gate fee at Kate Valley was $107.91 per tonne for containerised transfer station waste. Kate Valley is not open to the public and can only be used by approved organisations. As Kate Valley is partially owned by the local authorities the authorities receive a dividend from the profits made by the landfill that goes back into council budgets.

The only landfill that can receive metropolitan solid waste in Marlborough is the council owned Bluegums landfill. The gate fee at Bluegums is $132.20 per tonne for general refuse. This cost includes repayment of the capital investment, ongoing operations and maintenance and the aftercare costs once the landfill closes. The landfill also recovers a small profit for the local authority that is put

[18] UK WRAP (2015). Gate Fees 2017/18 Final Report.
[19] Pepper C., Lim V. (2018) Feilding Resource Recovery Centre. Opportunities for waste Diversion from Landfill.

towards council run services. This fee is similar to that charged at the Omaranui landfill in Hastings District where the gate fee for municipal refuse is $110.40 per tonne.

The gate fee for the Victoria Flats landfill, that provides services to Queenstown Lakes District Council, is approximately $80 to $85 per tonne.

Auckland has some of the lowest landfill gate charges in the county. In Auckland, gate fees at landfills that service the City are around $40 per tonne including the waste levy. Although this study does not look at the effect volume and competition have on landfill gate prices, on the surface it appears that the volumes of waste going to Auckland landfills and the level of competition in the region have resulted in these lower prices.

Eunomia reported in 2017 that "Waste disposal costs (i.e. bulk rates at the landfill) can vary significantly ($20- $190), but the average in New Zealand is determined to be in the order of $75 per tonne for active waste, and $10 per tonne for inert (cleanfill) waste. In comparison, recovery of putrescible material (e.g. food waste) can cost between $80- $160 per tonne, and processing of construction and demolition materials can cost between $5-40 per tonne"[20]

7.1.3 Cost of recycling

Despite the revenue that is received when recycled goods are sold, recycling collection and sorting is a significant cost to waste companies and local authorities, recycling is often more costly than sending all waste to a landfill. Landfills do not face the same operational costs of sorting. As the price received for exported recyclable materials has decreased this puts further pressure on the on-going provision of recycling services.

As noted above the cost of kerbside recycling is funded by rates or other forms of user pays funding like the additional gate fee in Wellington. Significant investment has been made in recycling and in MRF facilities by local authorities and private companies and all local authorities we spoke with have made a commitment to recycling.

However, due to declining prices for recycled materials, one local authority that we spoke to is investigating reducing its recycling services down to grade one and two plastics (PET) only as these are recyclable materials that can be sold for a profit. Other unprofitable materials will be sent to landfills. This is despite investment being made in recycling facilities.

Another local authority commented that for low or nil value commodities, WtE could be a solution and reduce the financial risk to the local authority.

If the cost of WtE disposal is less than that of recycling then there is a very likely possibility that there could be a reduction in the volume of materials recycled as unprofitable recycling is no longer sorted and is sent to the cheaper disposal alternatives.

7.2 Contract lengths

Any move to a WtE facility for disposal will be restricted by contractual agreements that are already in place. For the large waste companies receiving waste from private customers they would be able to change their disposal facility if this was financially beneficial to them. However, they are likely to continue to use their own facilities unless WtE is significantly cheaper than the costs they currently face. Despite a low cost of processing waste at the landfill the cost of landfill disposal includes the

[20] Eunomia (2017).The New Zealand Waste Disposal Levy. Potential Impacts of Adjustments to the Current Levy Rate and Structure.

recovery of the investment made to establish the landfill and a return on investment for the landfill owner.

Current contracts will have an impact on the ability of local authorities to move to WtE. Kate Valley is able to receive waste until 2040 meaning that the local authorities and Waste Management are unlikely to change before this time unless WtE is significantly cheaper than Kate Valley.

The contract Queenstown Lakes District Council has with the Victoria Flats landfill requires them to be the disposal location for waste collected for the local authority until 2029. This would prevent the local authority from moving to a WtE facility before this time.

Hastings District Council are about to make a decision on their future waste disposal options. With no WtE facility currently proposed for the region investment in a landfill looks like the only available option. Transport costs to Bony Glen make this option unattractive. If Hastings District Council make this investment it is unlikely to look to a WtE facility for disposal.

7.3 Volume of waste required

7.3.1 Volumes of waste for incineration

Eunomia (2017) found that a facility of 200,000 tonnes per annum in size or larger is likely to be necessary to be economically viable, and as such it would need to be located near to a large population centre to ensure sufficient feedstock (i.e. Auckland).

As noted earlier the proposed facility on the West Coast has capacity for 330,000 tonnes of waste. Renew Energy have indicated that the facility will require approximately 250,000 tonnes per annum as minimum to break even or return a small profit.

Christchurch City produced 217,503 tonnes of household and commercial waste in 2018 which alone would not be enough to ensure the facility remained profitable. It would require a collection of local authority areas to send their waste to the facility in order for it to reach the 330,000 tonne target.

Volumes of waste in most local authority areas will not be sufficient to fuel a WtE facility, such as the one proposed by Renew Energy, alone. Wellington City estimates that the city produces 65,000 tonnes of solid waste per year. In 2015 the Wellington Region produced 252,536 tonnes of general waste into class one landfills at a rate of 0.508 tonnes per person.[21] Waste from local authorises in Wairarapa is often sent to Bony Glen landfill in the Manawatū rather than landfills in the Wellington region. This means that waste on the Wellington City side of the Remutaka hills will be less.

Outside of Auckland, no one local authority will have the volumes sufficient to supply a waste to incineration facility the size of the one proposed for the West Coast. In order to reach the volumes required a WtE facility similar to the size proposed would require the support and waste supply from a number of local authority areas.

7.3.2 Volumes in local authority areas for bailing

Renew Energy identified that waste volumes of 60,000 tonnes per annum would be required in order for a bailing facility to be run profitably. For a number of smaller local authority areas the waste collected will not be enough for one of these bailing facilities. Marlborough District has just over 60,000 tonnes per annum of municipal solid waste going into landfills. For the bailing machine to be profitable to operate it would require almost all the waste collected in the region and would only

[21] Wellington Region Waste Management and Minimisation Plan 2017-2023. Prepared for the councils of the Wellington region.

allow for minimal flows of waste out of the district. Other regions including Queenstown Lakes District, Palmerston North and Buller would all fail to meet the 60,000 tonne requirement.

Larger population centres are serviced by large landfills owned by both local government and private companies. Waste from the Wellington region ends up at four different class one landfills Auckland has two and Christchurch has one. It would require the cooperation of both private businesses and the local authorities to commit to a loss of landfill revenue to support WtE to ensure that volumes would be enough to justify investment in a bailing facility.

Even in Christchurch where landfill gate fees are high, in the absence of a high waste levy or ETS cost, landfills across the country will simply behave competitively and drive their gate fees down until the bailing facility/waste to energy plant folds, then put them back up again.

7.4 Landfill lifetimes and investment

One dimension that will need to be considered when addressing a potential move to WtE are the actions of the large private waste companies and local authorities that currently have ownership of landfills. Large landfill owners have made significant investment in their landfill facilities and are unlikely to send waste to a WtE incinerator unless it is a cheaper alternative than the total costs of operating and maintaining their current investments. The landfill owners make a return on this investment by disposing of rubbish to the site and charging their customers fees for disposing rubbish at their site.

Using Kate Valley as an example, as the local authorities and Waste Management currently make a profit from the operation of the landfill they are unlikely to send their waste to a competitor, unless the price charged was lower than the ongoing costs of keeping the landfill open plus the continued maintenance after closure. Kate Valley has an expected lifetime that will enable it to accept waste until 2040. This means that Waste Management and the local authorities are unlikely to move to WtE.

The situation is similar in the North Island where having made a significant capital investment at Bony Glen, EnviroNZ and Waste Management are unlikely to send waste elsewhere. EnviroNZ is unlikely to divert waste away fror Hampton Downs to a WtE competitor.

Given the size of the waste supply for WtE to be successful, the support and commitment of the large waste companies and local authorities who control the majority of the waste supply is required.

7.5 Employment effects

Assuming that current recycling practices remain and that sorting of materials continues as it currently does there should be minimal changes to employment in the waste disposals sector. Employment in landfills is 0.1 FTE per thousand tonnes and for incineration this is also 0.1 FTE per thousand tonnes.

Table 7.1 Waste sector employment FTEs per tonne of waste, by disposal method

Disposal method	Employment
Class 1 landfill	0.1
Incineration	0.1
Anaerobic digestion	0.2
In vessel composting	0.2
Open air windrow	0.4

Source: Eunomia, 2017

Where the change will likely be experienced is in the current locations of these jobs. Where a council controlled landfill currently disposes of approximately 50,000-100,000 tonnes per annum employment is spread across a number of landfills meaning a spread of landfill jobs across different districts and regions. With a WtE facility potentially taking up to 330,000 tonnes this would concentrate employment around the facility. Those employees looking to stay in the waste industry will likely be forced to re locate to continue working in the sector. In the absence of people willing to relocate additional training will be necessary in the area around the WtE facility in order to meet the skills requirements of the facility.

While any WtE facility will directly create new jobs in the location it is established in it will also create indirect and induced benefits, these will be concentrated in the location of the WtE facility. However, these benefits will be lost to the areas losing the jobs resulting in a neutral outcome for the national economy.

7.6 Changes to greenhouse gas emissions

An assessment of the possible effects of a waste to incineration operation in New Zealand would not be complete without a consideration of the likely effects on greenhouse gas emissions (GHG). Total emissions could be impacted in two areas:

1. Some amount of waste will be incinerated rather than decomposing in landfill
2. Electricity will be generated, displacing electricity generated elsewhere.

The total effect on emissions will then be the difference between landfill and incineration emissions, plus the difference in emissions between generating electricity from the WtE facility and the type of generation which is displaced from the market.

7.6.1 Greenhouse gas emissions from waste incineration

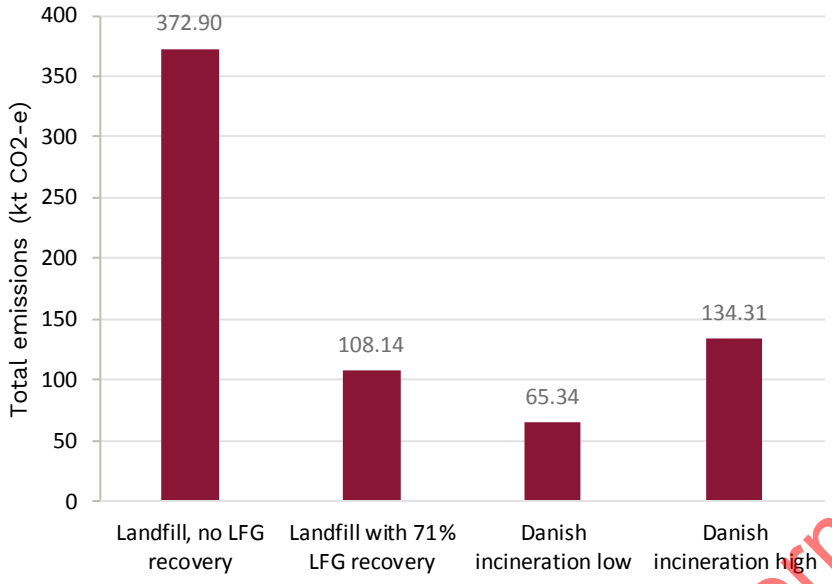
As discussed in Section 4.3, waste other than inert substances creates some amount of emissions as it decomposes, regardless of the disposal method. The relevant consideration is therefore the difference in GHG emission created by alternative disposal methods. This report focusses on high temperature incineration as compared to an average New Zealand landfill.

Existing New Zealand emissions factors for incineration are unlikely to be appropriate to this discussion, as existing incinerators are for relatively specialised purposes with a narrow range of feedstock materials such as wood waste only, or medical waste. Greenhouse gas emissions from incineration are dependent on a wide range of factors. These influences include:

- Composition of the feedstock (particularly the fossil carbon component)
- Water content of the feedstock
- Method of incineration
- Management and maintenance of the incinerator.

Once these factors can be quantified, a specific emissions factor for this facility can be calculated. In the absence of a specific emissions factor, a comparison of New Zealand landfill emissions against emissions from waste incineration in Denmark, where they have the second highest per capita incineration capacity, is provided below.

Figure 7.1 Greenhouse gas emissions from disposal of 330,000t municipal solid waste



To determine the likely GHG emissions from any specific facility, detailed information on the technology used and the materials comprising the feedstock would be required. Given the currently available incineration technologies and the general New Zealand waste stream it seems likely that a WtE facility could achieve emissions within the range of those seen in Denmark.

7.6.2 Greenhouse gas emissions of electricity generation

Energy generated from any new WtE facility can be used in one of two ways: Co-gen where the energy is used on site for industrial processes, or as electricity which is then sold into the New Zealand Spot Market via the National Grid.

In the case of electricity generation, there is theoretical potential to lower the national greenhouse gas emissions if the alternative displaced is thermal generation from gas or coal, rather than zero emissions renewable generation.

The extent to which thermal generation is displaced will depend on a range of factors:

- The location of the WtE generator
- If the WtE generator is operated as a base load supplier or as a peak supplier
- The price at which the electricity can be supplied.

Due to the structure of the spot market and the largest demand for electricity being in the northern half of the North Island, a new and relatively small generator located in the South Island is likely to displace thermal generation only some of the time, depending on relative prices. Generation specifically from coal is located close to the electricity demand, and is currently used as a base load supply. Coal generation is unlikely to be displaced by WtE unless the new generator is similarly close to the main demand, and is sufficiently large and reliable that one or more of the coal fired generators could be permanently retired.

8 The decision to move to WtE

Our assumption at the outset of this project was that there would be a price where local authorities and waste companies would change from using a landfill to WtE. However, we have discovered that a lot more goes into the decision than just price. As well as price, local authorities and waste companies will also need to consider the ability of the WtE facility to remain operational over the course of the contract and that the WtE facility will be able to take all their waste. Political concerns of decision makers will also play into any decision for local authorities to move to WtE.

8.1 Control over waste

Some of the local authorities we spoke with identified the need to keep control over the waste that is generated in their district. By moving to WtE and closing their landfills local authorities fear that they would be at the mercy of the WtE operator or larger waste suppliers to the WtE facility. Local authorities don't want their waste disposal to be impacted by the decisions of others.

By maintaining a local landfill that is supported and/or owned by the local authority provides assurances to the local authority that it will be able to ensure that their district or city is able to continue to dispose of its waste.

8.2 Supply of waste

Concerns have been raised about the ability of the WtE facility to ensure that supply remains high enough so that the facility has the waste supply to enable it to continue to operate. The concerns of local authorities and waste companies about supply have two elements.

- Ensuring supply volume is enough to feed the WtE facility and the impact if the facility fails to achieve required waste volumes.
- The ability to change the contract for supply of waste to the WtE facility if alternative waste disposal methods become available.

The supply of waste to feed a WtE facility was considered by the EC in their report on the role of waste-to-energy in the circular economy.[22] The EC was clear that investments in facilities for residual waste, such as extra incineration capacity would only be granted in limited and well justified cases, where there is no risk of overcapacity and the objectives of the waste hierarchy are respected.

The EC has also recommended that public funding should avoid creating overcapacity for non-recyclable waste treatment such as incinerators. In this respect it should be borne in mind that the feedstock for WtE is expected to fall as a result of ambitious recycling targets.

The EC recommends that when assessing waste to energy the impact of existing and proposed separate collection obligations and recycling targets on the availability of feedstock to sustain the operation of new incineration plants over their lifespan (20 -30 years).

Despite the EC finding that the EU does not have incineration over capacity as a whole some member states have become excessively reliant on municipal waste. The EC believes that this may be explained by demand for heat. None the less the EC found that such high rates of incineration are inconsistent with more ambitious recycling targets.

[22] European Commission (2017) The role of waste-to-energy in the circular economy

8.2.1 Ensuring supply to fuel to the WtE facility

As seen in India, if the WtE facility is not able to access the volumes of waste required to remain profitable there is a risk that the facility will be unable to continue to operate. If this situation was to arise additional suppliers of waste would be required or the fees charged by the WtE facility would have to increase.

If the WtE facility is forced to close the waste companies and local authorities who commit to supply the WtE facility move away from landfills could be left with limited disposal options. A reduction in the supply of waste disposal services could result in these waste suppliers facing higher costs of waste disposal at an alternative location. These higher costs would then be passed on to local residents and businesses.

For example, if a waste company was to leave Kate Valley and move to the WtE facility and the facility was unable to continue to operate there is a very real risk that the waste company would need to return to disposing of waste in Kate Valley. As a result, it could face increased charges from the landfill operator.

As identified most local authority areas do not have the waste volumes to support a large-scale WtE facility to operate exclusively on the waste generated in their district.

For a WtE facility to be attractive to waste suppliers it will need to obtain agreements for the minimum amount of waste required for the facility to continue to operate while also ensuring that their suppliers are able to continue to supply the required waste volumes for the duration of the contract. This is something that will need to be carefully considered against waste minimisation objectives when waste suppliers, both local authorities and private companies are considering WtE.

The opposite is also true if waste companies and local authorities collect more waste than the WtE facility can process. If this situation occurs and the WtE facility is unable or unwilling to accept additional waste the local authority will have to find an alternative disposal method.

8.2.2 Ability to amend contracts for changes in supply

One of the concerns raised during our research was that in order to keep the WtE facilities running you need to “feed the beast”.

Local authorities and waste companies expressed concern that the 30-year supply contracts required by the proposed WtE facility would lock them into long term supply contacts for a volume of waste they are unable to guarantee against obligations under the Waste Minimisation Act 2008 to reduce waste to landfill over time. Given that most contracts for collection and disposal are not for time periods of this length it would be difficult for the waste suppliers to agree to contracts of this length without the ability to vary the contract.

Additionally, if there is change in how waste is managed and regulated, or how externalities, such as emissions, are priced in the future then local authorities want to have the ability to be able to react. The 30 year contracts for supply would lock them in to supply a minimum quantity of waste for this fixed period. If waste volumes drop for any reason local authorities want to be able to react and reduce volumes. There was concern that if contracts are fixed for volumes then local authorities will be creating waste specifically to meet contractual agreements.

As noted above if contracts are not honoured or can be varied and volumes fall below the break-even point for the WtE facility and it is forced to close, or waste volumes exceed contracted volumes then local authorities and waste companies will be forced to find alternative disposal methods, possibly at short notice.

8.3 Political dimension

Local authority policy decisions can never be entirely about costs. While prudent financial management is important and valued by their constituents, other factors such as environmental and reputational impacts contribute to decisions.

For a number of local authorities the decision to move to WtE incineration will ultimately fall on local councillors. Local councillors will need to consider their constituents views on the appropriateness of WtE. The decision will balance the costs of waste disposal, flexibility to change if alternatives become available and environmental concerns.

9 Case studies

Changes in the management of the waste stream will have impacts on local businesses undertaking recycling. Case studies were undertaken to highlight how these businesses are making use of the existing waste stream in their operations and to gain a sense of the specific impacts, their magnitude and the likely effects on their businesses if WtE was to go ahead in New Zealand. Each business will have a unique set of margins, break even and trigger points. By investigating these within a set of recycling businesses it is possible to understand the wider effects on the industry overall.

9.1 Golden Bay Cement - replacing coal with recycled wood waste

Golden Bay Cement (GBC) is New Zealand's largest cement manufacturer and supplier and is the only cement company to have its manufacturing plant in New Zealand. Golden Bay Cement has a real commitment to the future of the New Zealand construction industry and the future built environment.

GBC's manufacturing plant is situated in Portland, 10kms south of Whangarei. From here Golden Bay Cement distribute over 900,000 tonnes of bulk cement by ship, and truck to eight customer service centres around the country, and then to customers in New Zealand and around the Pacific.

GBC employs a team over 200 people throughout New Zealand to deliver a complete range of cement products, technical expertise and proactive support to customers around the country.

Over the years, GBC has supplied cement to create some of New Zealand's most innovative infrastructure, including the Sky Tower, Victoria Tunnel, the Tauranga Harbour link, Te Apiti Wind Farm and the Clyde Dam to name but a few.

GBC is committed to proactive environmental management to minimise the effects of its operations on the environment. GBC have made a commitment to methods of operation that conserve energy, minimise waste and achieve optimal performance, in order to protect the environment.

This commitment has lead GBC to become an industry leader for its use of bioenergy to reduce CO_2-e emissions. In 1998, in response to the Kyoto protocol, GBC began investigating replacing some of the coal used in its kilns with wood waste. In 2004, GBC commissioned a facility to enable wood waste to be consumed as a substitute for coal. When GBC transitioned to using wood waste it initially made up seven to eight percent of the fuel burnt in its kilns. This has increased to average around 30 percent of fuel. Some level of coal is required to ensure temperatures in the kiln reach those necessary to make the cement products.

GBC has cut CO_2-e emissions by 58,000 tonnes per year, as a result of substituting nearly a third of the coal burned in its kiln for wood fuel, sourced from demolition and construction waste. In 2012 GBC won the Renewable Energy category in the EECA Awards.

The wood used by GBC is primarily sourced from a range of suppliers. GBC combust an average of 70,000 tonnes of wood per annum. If not for use by GBC much of this wood waste would have likely ended up in landfills in the Northland region.

All ash generated by the burning of coal and wood as fuel in the kiln is incorporated in the cement that GBC produces ensuring it is not disposed of in landfills. Emissions are limited by the use of state of the art dust collectors. Due to the calcium rich conditions in the gas streams other emissions are minimised.

9.1.1 Waste as a fuel source

One of the challenges GBC faced when entering into WtE as a fuel source was ensuring the quality of the fuel is up to the required standard, not deleterious to cement quality and that there is surety of supply to justify the investment. The quality of the fuel is essential as if the moisture content in the wood is too high it is more difficult to burn and the temperatures in the kiln would not reach the necessary levels of over 2000°C. To make the investment worthwhile a secure supply of materials is required. GBC has a ten year contract for supply of wood materials from a primary supplier in Auckland with three years to run. The remaining 70 percent is sourced locally and there are no current formal supply agreements in place for this volume. Earlier supply contracts (that have since expired) gave GBC the confidence to make the investment necessary to enable in alternative energy sources to be used in its cement making process.

If WtE was to become more popular as an alternative energy source then market forces would lead to an increase in the price of the alternative fuels GBC could use in their Portland facility. This places considerable risk on the project returns which could undermine the decision whether to advance a given project. GBC project investments are only constrained by the business case economics and achieving the projected economic outcomes. Risk and sensitivity analysis are considered as part of the overall assessment of whether a given project has merit and should receive funding approval.

9.1.2 Looking to the future

GBC have investigated alternative fuel sources including making more use of waste products. GBC believe that it could substitute 90 percent of their current coal use for other products such as tyres or plastic. Again, for these sources to be viable it is necessary that GBC is able to have surety over the supply of materials before investment of millions of dollars would be possible. For plastic materials, these would need to be carefully sorted and the quality and consistency would need to be assured.

Previously there has been limited markets in New Zealand for recycled plastics as markets overseas were willing to pay more. The decision by China to stop accepting recycled materials could cause this to change. Where people are able to make revenue from waste, there will be supply of waste for fuel available for purchase.

At such point where materials cannot be sold and instead incur a disposal cost, then the lowest cost disposal method will be chosen. WtE requires careful sorting and treatment of materials to make them suitable for WtE use, so this may well be landfill.

With investment from MfE's Waste Minimisation Fund, GBC have invested in their facility to enable shredded tyres to be used in the fuel mix to reduce the plant's reliance on coal by more than 15 percent.

GBC use of tyres as a substitute for coal will reduce tyres that are stored in semi-permanent stockpiles, illegally dumped or sent to landfills. Once fully operational, the kiln will take up to 3.1 million shredded tyres a year, replacing the need for over 15,000 tonnes of coal. Heated up to over 1,000 degrees celsius, the tyres will be burned with no increased emissions or waste to dispose of.

To ensure surety of supply GBC have entered into a long term contract with Waste Management who invested in the technology from the United States which will allow then to collect and chip tyres that meet GBC's needs.

9.2 Flight Plastics – from used plastic bottles to new food containers

Flight Plastics (Flight) are a New Zealand and Australian manufacturer who provide their customers with innovative plastics and packaging solutions. During the 1980's, Flight pioneered local production of Polyethylene terephthalate (PET) roll stock and thermoformed plastic containers.

PET is the most used packaging material in the world today, and Flight offers its customers a range of high quality food safe, rigid plastic containers made from recycled PET (RPET). Flight produce over 200 million items per year for customers, primarily in the food sector.

Flight believes the most sustainable solution for waste PET packaging is to recycle and re-use it locally. This belief lead to Flight opening a brand new integrated PET recycling plant in 2017 and are the first New Zealand company producing New Zealand recycled PET roll stock and finished containers on one site.

Flight's principle design, engineering and food packaging production facilities are all based in Wellington, where Flight operate the first and only state of the art RPET processing plant in New Zealand. All of the recycled materials used by Flight are sourced in New Zealand. The RPET processing plant has the capacity to take New Zealand's entire current recycled PET and re-process it for use in new PET packaging. Flight currently has capacity to recycle approximately 7000 tonnes per year into final products. Flight believe that there is the potential for them to take more of New Zealand's PET, but a large amount is still making its way into landfills.

The recycled clear PET containers that Flight produce are almost 100 percent from recycled materials and create a product that can continue to be 100 percent recycled. During Flight's production process the RPET material has a thin layer of brand-new virgin PET applied to each side, ensuring there are no food-safety compromises for customers and consumers.

The opening of Flight's fully integrated PET recycling plant in Wellington means:

- Flight customers in New Zealand and Australia can source eco-friendly RPET trays and containers made completely in-house by Flight
- RPET containers may themselves be recycled repeatedly
- Each tonne of waste PET Flight recycles is a tonne of material diverted from the waste stream, and simultaneously a tonne of new material is no longer required to be imported.
- Flight has now closed the loop for recycling of PET packaging in New Zealand, and this material is available to Australian customers as well

Flights competitors are companies that import virgin and recycled plastic materials. The price of virgin PET and the RPET produced by Flight have historically been roughly equal although there have been variations due to factors such as exchange rates and international commodity prices. Although production costs may be cheaper for overseas producers using virgin or recycled PET.

9.2.1 The impact of WtE

Flight are not opposed to the possible introduction of WtE into the New Zealand, if located in the right places, and do not believe that WtE will have much of an impact on their business.

While the Chinese National Sword decision has affected other recyclable materials there is still value in PET and Flight pays a rate that is equal to the rate paid overseas. Suppliers to Flight benefit from the ease of using local delivery verses the cost and effort to ship internationally making them a more attractive option than exporting PET.

Flight believe that as long as there is a market for recycled PET where the price received for the recycled PET remains viable for councils and businesses it will continue to be able to access recycled PET for their manufacturing. Flight has observed around the world that countries with significant WtE infrastructure are still recycling PET separately. The post-consumer recycled PET material is sufficiently valuable to warrant recycling rather than incineration.

PET bottles are relatively straightforward to separate from the recycle stream in MRFs. As PET becomes more popular for other packaging product types due to its recyclability e.g. such as food packaging trays, it becomes harder to separate while other plastic types are used for the same product. The current economics of PET bottle recycling would be less affected by WtE.

The mixed and non-recyclable parts of the recycle stream leaving the MRFs would likely end up going to WtE instead of landfill.

In some countries governments have further increased recycling rates by introducing Container Deposit Schemes (CDSs). These schemes act to increase the extraction of valuable recyclable materials (including PET) from the waste stream with minimal impact on WtE operations. Flight believe a WtE initiative combined with a CDS would create an exceptional recycling infrastructure in New Zealand and maximise the achievable reduction in unnecessary plastic imports.

9.3 Green Gorilla: stepping up to better waste management

Green Gorilla, is the largest non-landfill owning, full spectrum waste services provider in Auckland. The focus at Green Gorilla is to develop and provide sustainable waste and recycling solutions that maximise recovery and re-use, so waste can be diverted from landfill wherever possible. With a strong emphasis on sustainable business practices, Green Gorilla are constantly working to improve efficiencies, reduce emissions and develop market leading environmental solutions for their customers.

Green Gorilla provide business waste and recycling solutions for a full range of businesses such as; offices, retailers, cafés, stadiums, schools, banks, apartment complexes, facility management, retirement villages, universities, institutions, commercial, industrial and construction businesses.

Green Gorilla has approximately 150,000 tonnes of waste produce coming through its facility per year and have a team of over 100 people offering a range of planning, collection, recycling, and reuse and disposal services. From a 4,000m² building located on an old landfill in Auckland, Green Gorilla operate large scale mechanical and manual sort lines to process construction and demolition waste to achieve greater than 75 percent diversion from landfill. This equates to approximately 45,000 tonnes of waste per annum that is diverted from other facilities. To put this into perspective this approximates the volume of waste that is sent to landfills by a medium sized New Zealand city.

The plant is operated on a daily basis to process incoming waste material. Recovered product is shipped out continuously to nearby users or further processed at the facility.

Green Gorilla have recently made a significant investment to increase the volume and types of waste it can process. The investment in new systems and machinery will enable Green Gorilla to process more waste from additional sources where the residual waste that would have all previously gone to a landfill. As a result, the material diverted from landfill will increase to approximately 75,000 tpa or 50 percent of all incoming waste.

Impact of WtE

WtE incineration would be disastrous for Green Gorilla. If the price for WtE incineration were somehow less than the cost of recycling or other methods of disposal Green Gorilla believe that recycling and reuse of materials would drop. This is contrary to current thinking on sustainability and a circular economy. Green Gorilla believe that the high calorific value of plastics in particular would make them attractive as a fuel source for a waste to energy incinerator.

The investment that Green Gorilla and other recycling operators have made would become redundant if incineration became a more attractive option than recycling. In Europe, Green Gorilla have seen recycling rates stall and systems that were established to process recycling are no longer economical to run without subsidy. In New Zealand, if waste was sent to Waste to Energy incinerators instead of Green Gorilla the value of the investment Green Gorilla has made would be lost and 30 jobs would be lost.

Green Gorilla have already seen the impact that the Chinese National Sword decision has had on the prices of recycled goods that were previously exported. It has become difficult to export co-mingled recycling and in some cases, the costs of export are greater than landfills. Green Gorilla has passed some of this additional cost to their customers however, it has not passed on the full price to ensure it remains competitive and continues to promote diversion from landfills.

Green Gorilla believe that waste to energy should be looked at carefully before it comes to New Zealand. Overseas experience indicates that once the capital is committed there is a financial necessity to divert material to incineration and this has a negative impact on the level of recycling and recovery and reuse of resources.

10 What can the government do?

WtE can be beneficial to dealing with New Zealand's waste concerns, however given New Zealand's electricity is almost all generated from renewable resources the energy benefits will be lower than in countries that have a higher reliance on fossil fuels for electricity and heating.

The EC have identified that WtE processes can play a role in the transition to a circular economy provided that the waste hierarchy is used as a guiding principle, and that the choices made do not prevent higher levels of waste prevention, reuse and recycling. Given New Zealand has no central control over the waste stream these conditions will be difficult to meet.

The government should not rule out all forms of WtE in the New Zealand waste industry as it provides a possible alternative solution to tackling New Zealand's waste disposal. However, the government should put in place standards to enable it to evaluate WtE proposals on their individual merits.

Given the nature of the New Zealand waste industry each WtE facility will have a number of unique characteristics that will be determined by the type of facility, location and feedstock. This includes variables such as the supplier(s) of feedstock, the type and volume of feedstock, both available and consumed. This will affect both the economic and environmental outcomes.

Experiences in the EU and in India show the risks of stranded assets, either WtE facilities where feedstock has not been sufficient or recycling facilities where the waste that would have been recycled is instead set to a WtE facility as feedstock.

The government should also pay particular attention to the technology that is used by any proposed WtE facility. The EC recommendations are that states should ensure the use of state of the art energy-efficient technologies and consider the size and location of the plant. The EC recommend this to ensure that over capacities are avoided and to ensure the supply of heat and electricity to local industries where possible.

To ensure that efforts to reduce waste consumption and encourage recycling continue, we make the following recommendations for Government when considering how to legislate and regulate for WtE facilities.

10.1 Investigate WtE technologies and set minimum standards

MfE should investigate the developments of WtE facilities internationally and set minimum standards for emissions and feedstock. These standards should be set at the top end of available technologies to ensure that the facility maximises the possible reduction in emissions and encourages waste minimisation.

If WtE is to become an alternative solution to landfills the government should carry out further investigation into which WtE solution is the most appropriate for New Zealand. The consideration should include how each WtE solution fits with the waste hierarchy and the circular economy. As noted by the EC disposal, in landfills or through incineration with little or no energy recovery, is usually the least favourable option for reducing greenhouse gas (GHG) emissions.

As the EC communication recommends where waste-to-energy processes are opted for, there is a need to ensure that the most efficient techniques are used. The government should focus on the technologies identified by the EC. The EC study found that the best-proven techniques to increase energy efficiency processes were as follows:

- Co-incineration in combustion plants

- Co-incineration in cement and lime production
- Waste incineration in dedicated facilities
- Anaerobic digestion.

Based on the findings of further investigations and international evidence, standards should be set for all WtE facility applications to meet. Minimum standards should include a requirement to show how the proposed facility will affect efforts to reduce, reuse, recycle or reprocess waste.

10.2 Data collection on New Zealand waste should be increased

MfE should do more to understand the New Zealand waste sector and the volumes of materials that are in the waste stream. It is clear that outside of class one landfills little data is available on the volumes of waste and recycling in New Zealand.

One of the difficulties faced during this study was accurately quantifying the total volume of waste produced in New Zealand. Data on the total volume of waste generated in New Zealand is not known outside of the levy volumes provided by class one landfill owners and operators and the data supplied by local authorities. MfE should expand its data collection on the waste in New Zealand to gain a better understanding of the quantity and composition of waste across the county and by region.

Collecting more information will enable MfE to better monitor the effectiveness of its interventions to reduce the total amount of waste generated and the volumes that are re-used or recycled.

10.3 MfE should forecast future waste volumes and capacity

After expanding its data collection, MfE should model and forecast New Zealand's future waste flows and disposal capacity. One of the difficulties that exists when assessing the potential of WtE and the impact on the waste sector was understanding future disposal volumes and needs. With a growing population and a focus on waste reduction there is no clear picture of what future waste volumes and disposal needs and what disposal capacities will be.

One of the major concerns surrounding WtE was the ability to meet the feedstock volumes required by the facilities and the potential that additional fuel stock would be required to meet the waste volumes for the facility to remain profitable. There was no data available forecasting future waste volumes and the capacity of landfills and other waste disposal methods to handle this waste.

If this information was available it would allow for better planning for disposal facilities to ensure they can be operational for the full expected life span, while accounting for a reduction to the volume of waste as the transition to a circular economy occurs. This would help to address fears that there waste will be directed to "feed the beast" rather than to recycling or alternative uses.

This data would enable MfE to be confident that when approving a WtE facility that the feedstock available will meet the needs of the facility without impacting on the circular economy.

Forecasting future waste volumes would also enable MfE to monitor the impact that other waste minimisation and reduction activities have. Understanding future supply and demand for waste and disposal could allow the government to use an adjustable levy rate as a tool for incentivising a reduction of waste.

10.4 Only build WtE close to energy generation and demand

The average annual volumes of waste required by a WtE facility are between 200,000 and 400,000 tonnes per annum. Outside of Auckland there are very few New Zealand cities that could that could

supply this volume of waste. One of the EC recommendations is to build WtE facilities close to where the waste is generated and the energy, heat or electricity, is consumed.

The EC noted that superior energy efficiency levels are attainable by installations that provide both heat and power, compared to plants merely producing either heat or electricity. To maximise the energy captured from the waste any WtE facility in New Zealand should be co-located with other businesses or developed alongside a wider development. By co-locating or building WtE into the design of a surrounding development will make use of the heat energy produced by the WtE facility. This is the model that has been successful in Europe and has seen industrial development around the WtE facility.

WtE facilities should be required to show that there is sufficient feedstock available from the areas surrounding the facility and that there is demand for the energy that is being generated.

10.5 WtE should not displace renewable energy sources

One of the attractions of WtE in many countries is the ability to move away from fossil fuels in electricity production. This is unlikely to be the case in New Zealand. 85 percent of our electricity is from renewable sources.

Approval for a WtE facility should only be allowed when the facility can show that there is demand for the electricity or heat generated. WtE should not replace renewable sources of energy such as hydro and wind.

When considering WtE, MfE should work with the Electricity Authority to understand the demand for non-renewable sources of electricity and clearly establish that there is the demand for the electricity generated, and that the electricity will replace fossil fuels such as coal.

As New Zealand has minimal use of fossil fuels for electricity generation outside of low lake level periods MfE could also consider further investigation onto the possibility and viability of WtE facilities that only operate when there is demand for additional energy from non-renewable sources.

WtE may be able to replace coal use in industrial heat applications similar to the example of Golden Bay Cement. This type of co-generation application is likely to have a net environmental benefit, particularly if the waste used as feedstock is difficult to recycle or reprocess.

10.6 Impose the waste levy on WtE with some exceptions

The government should impose a waste levy on WtE facilities where the primary purpose is to generate energy that displaces renewable energy sources. For example this would include a WtE facility burning waste to send electricity to the natural grid, or is producing heat that could have been generated by renewable sources. This would exclude the levy being applied to facilities such as Golden Bay Cement where waste replaces coal.

The purpose of the levy is to encourage New Zealanders to start taking responsibility for the waste they produce and to find more effective and efficient ways to reduce, reuse, recycle or reprocess waste. It also creates funding opportunities for waste minimisation initiatives.

If the waste levy was set at the same level for WtE and landfills then there should be no change in the price driven behaviour by consumers and the impact on recycling should not be affected.

WtE does not address efficient ways to reduce, reuse, recycle or reprocess waste or promote the circular economy. At its core the purpose of WtE is as an alternative disposal method to landfills.

For many in the industry WtE is seen as a direct replacement for landfills, and both should be considered a last resort for disposal.

To promote innovation, exceptions should be allowed. The levy should not be applied in cases where waste replaces fossil fuels. As the EC noted co-incineration of waste in cement and lime production is one of the main WtE processes. In examples such as Golden Bay Cement coal has been replaced with wood and tyre chips that would have otherwise been landfilled. If the levy was applied to this waste it would increase the cost to GBC and has the potential to limit innovation for alternative waste disposal.

10.7 Regulation, reporting and penalties

If WtE is to become a solution for New Zealand's waste disposal MfE should put restrictions on the feedstock and require regular reporting. Although the company promoting New Zealand's first major WtE facility assured us it only intended to incinerate residual waste there is the possibility that other recyclable and compostable materials could be burnt by future WtE facilities.

Restrictions and regulations should be put in place to discourage WtE facilities from consuming recoverable materials. If WtE facilities fail to meet these regulations then penalty provisions should be put in place to support accurate sorting to ensure that materials that could be recycled are not consumed.

Regular reporting should require each WtE facility to report on the level of emissions, the volume of ash landfilled, the volume of ash that is reused and the volumes of feedstock by material type that are used in the facility.

Failure to comply with restrictions and regulations and reporting requirements should be supported by appropriate penalty provisions.

10.8 Promote incentives to increase recycling

The EC has stated "the transition to the circular economy requires striking the right balance when it comes to waste to energy capacity for the treatment of non-recyclable waste."[23] The EC believes this is critical to avoid the potential economic losses or the creation of infrastructural barriers to the achievement of higher recycling rates.

The EC also recommends that in countries with low or non-existent dedicated incineration capacity, such as New Zealand, priority should be given to further development of separate collection schemes and recycling infrastructure. The gradual diversion of waste from landfills or WtE should go hand in hand with the creation of greater recycling capacity and facilities.

If WtE is to become an alternative to landfills in New Zealand government should promote other alternatives to encourage recycling. Schemes suggested have been bottle deposit schemes, or similar that provide a return to individuals and businesses that encourages them to recycle. As Wellington City Council currently does, revenue from the incineration or landfilling of waste could be used to pay for some of the recycling initiatives. This could include product stewardship schemes.

10.9 Promote domestic recycling infrastructure

The Chinese National Sword has had an impact on export prices for recycled goods and these are now less profitable, if there is any value at all. Prices paid for some recycled materials have fallen so

[23] European Commission (2017) The role of waste-to-energy in the circular economy

far that some local authorities are considering reducing recycling collection. These local authorities are considering only providing collection services or collection facilities for those materials that can be sold for a reasonable return.

As noted above by the EC, states with low or non-existent dedicated incineration capacity, like New Zealand, should give priority to further development of separate collection schemes and recycling infrastructure.

The government should look to support the development of local industries for the re use of recycled materials. Flight Plastics has shown that domestic re use of recycled materials can be successful and can reduce the volume of these materials that goes into landfill. By creating a domestic market for recycled materials this will encourage local authorities to continue to collect and sort recyclable and re-usable materials rather than diverting them to landfills or WtE.

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