



Waste Policy Taskforce
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The Corky's Group (Corky's) welcomes the opportunity to comment on the Draft National Waste Policy Framework. The Corky's Group is an Australian owned, group of research and consulting companies operating out of Newcastle, NSW.

We have an alternative perspective to the use and potential use of waste material. This view has evolved through research and more importantly, from the construction, operation and production testing of two demonstration plants. As Corky's is not part of the traditional waste management industry, we have approached the problems from our background in an integrated steelworks where the waste of one department was the feedstock for another department. Corky's is interested in waste utilisation as a source of demand-energy, bio-char, nitrogen and pot ash and not waste management as such.

Corky's, are in alignment with the draft framework, in that we share the intent that all Australian should:

- Reduce the amount of waste for disposal
- Utilise waste as a resource for better environmental, economic and community outcomes
- Apply stewardship approaches to enhance resource recovery
- Drive innovation in waste minimisation
- Dispose of necessary waste in a safe and environmentally sound manner
- Be aware of the environmental consequences of their consumption choices.

The difficulty is not in the intent but rather in how to achieve these aims. In particular, there is a significant lack of affordable options available in regional and remote communities. This leads to inferior waste management practices in many areas and distorted economics. The concept of **waste miles**; the distance the waste travels to be processed and the distance the recyclables travel to find a market, is needed to improve the true benefit or cost of proposed waste utilisation schemes.

Figure 1; shows a typical waste hierarchy, which has been modified from Zero Waste South Australia's published hierarchy¹. The poor interpretation of this rational hierarchy can lead to the wrong conclusions. The facts are:

- The hierarchy is to be interpreted with regards to economics and the location of the waste and local climate. Each town and city will need to fit the waste hierarchy to their own waste resource, available recycling markets and to what they can afford. This concept is captured in the framework and will not be discussed further.
- Waste to energy schemes are not in competition with recycling and composting infrastructure, rather they are complementary technologies. Corky's were surprised to see such a low emphasis on waste to energy schemes in the proposed framework.

¹ The Government of South Australia, Zero Waste SA, Alternative Waste Technologies Position Paper Jan 2006.



- Only the green waste, paper and food scraps that have a market should be composted.
- There are more wastes to energy technologies than mentioned in figure 1. Gasification is distinct to incineration and bio-digestion in landfill. Energy can generated in multiple forms; eg as electricity, and as hot water.

Lastly Corky's would like to challenge the comment in the draft framework that "The carbon pollution reduction scheme imposes an unfair burden on communities by including landfill legacy emissions (They) do not necessarily support recycling and re-use".

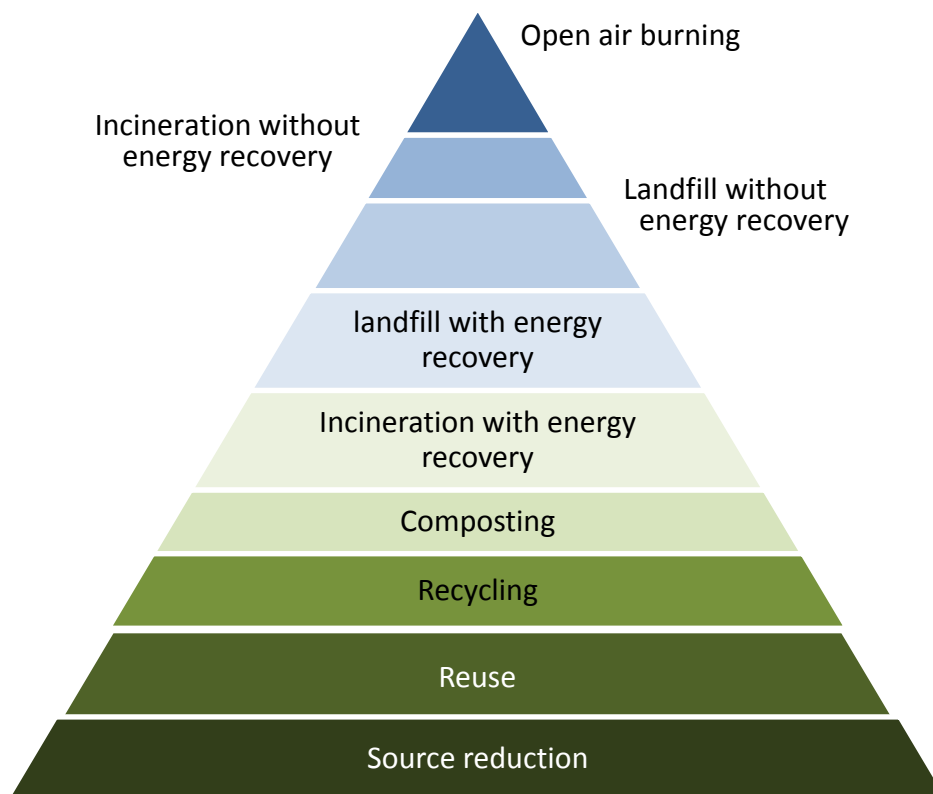


Figure 1: Typical Waste Hierarchy

Waste to Energy Schemes do not necessarily Compete with Recycling and Destroy Value

It should be noted that methods of waste disposal on the hierarchy are not necessarily mutually exclusive. For example both Denmark and Holland have one of the highest rates of recycling and waste disposal via incineration in the world². That is they recycle what they can and combust the remainder. The drivers for high rates of recycling appear to be high population density, strong community interest and a healthy recycling market. Like Denmark and Holland, South Australia has a bottle and can deposit system. Therefore the hierarchy is not a simple linear process; one that operates independent of other factors such as population density, government policy and community awareness.

² In 2001 Denmark sent 8% of its waste to landfill, 29% was recycled and 61% was incinerated and supplied 4.8% of their power grid. Eurostat, 2003. In 2006 (Eurostat 2008) Denmark had 6.7% of their grid powered by waste and Holland was at 2.8% with similar waste to landfill and recycling figures.



Only the unwanted, therefore by definition low value, mixed plastics, paper and food scraps are destroyed by thermal treatment. However, these same wastes are also destroyed (or at least made unavailable) by landfill. What is more, the paper and food stuff in landfills is turned into more undesirable products like leachate and methane. Leachates and methane production are avoided when the waste is thermally treated.

Leachate and methane can be economically managed on the larger landfill sites in a mechanical-biological treatment plant (MBT) also known as a digester.

Those items that can be **economically** recycled, considering **waste miles**, should be removed from the waste stream and reused or recycled. Corky's believes that where there is enough population for a MBT to be economically viable there should be a MBT (generally in cities). Typically MBTs end up with 40% of the waste being only suitable for landfill and this is what happens if there is no thermal treatment available. Refer to Figure 2.³

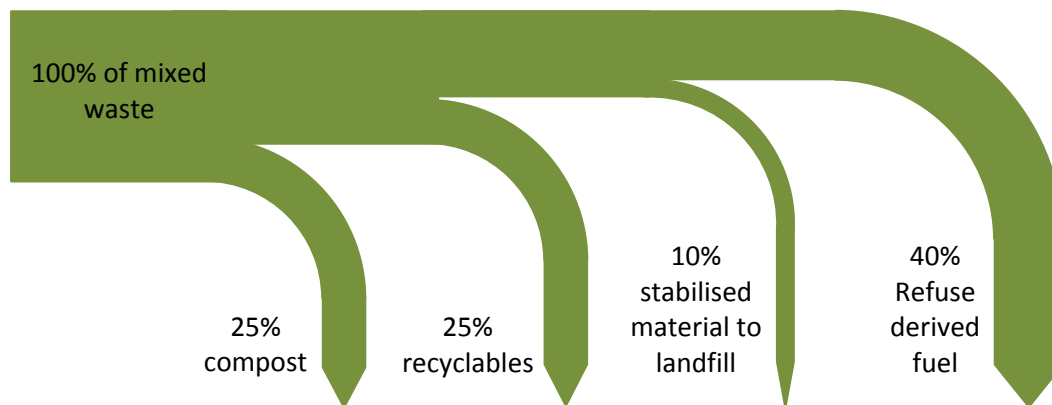


Figure 2: Typical Waste Partition with a MBT

The market for mixed plastic is also very weak and not available to small remote communities when transport costs are considered. Most clean plastics can be recycled into oil or other plastic products. Nevertheless the cost of separating and cleaning the plastic in many remote areas makes this option difficult on a small scale. Therefore unwanted plastics would be processed as a fuel in the proposed plant and used to generate electricity, rather than buried as landfill.

Corky's rejects the assertion by some campaigners that waste to energy plants that use incineration, destroy the valuable resources of a community. In fact we see that waste to energy schemes encourage increased recycling and separation of waste, as well as providing many other benefits that cannot be realised with the current methods of waste processing and energy generation.

³ Dr M. Stambach, WME, vol 19, No 6 July 2008



All Composts are not the Same and not all Waste Should be Composted

To complicate the hierarchy further, some forms of waste disposal operate very differently between source and communal processing. For example, a household making compost for itself would be careful to not contaminate their compost with broken glass or dead vegetation killed by herbicides. Yet up to 90% of the compost made in Melbourne is reportedly ultimately land filled due to lack of demand and contamination⁴. Perhaps this is an old comment and does not reflect current practice. However, there is little doubt that some compost is being made which has no market and this appears to be making a waste from another waste.

Biomass is matter derived from plants and animals. Biomasses contain mostly carbon, oxygen, hydrogen with smaller amounts of nitrogen, sulphur and phosphorous. Biomass can be used to generate sustainable electricity if:

1. The biomass would have rotted or composted (slow thermal oxidation) within a few years if not used for power, or
2. The biomass would have been buried and putrefied (slow anaerobic digestion) if not used for power, and
3. The biomass was collected at a rate equal or less than it can regrow

Biomass is stored solar energy and concentrated plant nutrients. Biomass has traditionally been used for heating, lighting and fertiliser from pre-history. Corky's are not trying to stop these traditional uses of biomass but rather to make these uses highly efficient, safe, and more environmentally sustainable.

Corky's believe that green waste, paper and food scraps should be composted at home or on the farm before mixing with MSW whenever possible. MSW derived compost should only be made up to the point where the market demands MSW based compost. The balance of green waste, paper and food scraps should be bio-digested or thermally treated. If thermally treated, then green waste ash (also referred to as 'bio-char'), which contains all the original nutrients, can be used as fertiliser. Bio-char should be a more marketable product than compost in some instances, as the unwanted seeds have been sterilised and any carried through glass fragments in the waste stream have been de-burred (sharp edges dulled) by the heat of the process. Finally, any entrained plastics have been thermally destroyed and hence been removed.

Waste to energy plants do not discourage composting or recycling, nor do they deny their cost benefits. Corky's highlight that these activities need to occur before the waste is mixed and treated communally and should only be processed to a point that matches the market need for these composts.

Municipal solid waste typically contains between 60 to 80% biomass, after the recyclables have been recovered. This number is expected to fall as more councils trial a three bin system. Nevertheless green waste can often add up to a significant proportion of total landfill.

⁴ Remark made at Cleantech Australia, Melbourne conference March 2008



There are Alternative Waste Treatment to Incineration and Multiple Energies Available

The United Nations Environment Programme, Division of Technology, Industry, and Economics have written a guideline booklet titled "International Source Book on Environmentally Sound Technologies (ESTs) for Municipal Solid Waste Management (MSWM)"⁵ The following discussion is lifted directly from this document. Direct quotes are printed in green.

"Sound technical options:

- Mass-burn
- Modular
- Fluidized-bed
- Refuse-derived fuel

The following quotes come from Cardiff University's Waste Research Station⁶.

- "When comparing to mass burn, there are several clear advantages (for pyrolysis and gasification systems). It can be a more efficient technology - one studied biomass gasifier has a 36% efficiency ... compared (to) 21% for mass burn.
- "The major environmental benefit of these processes is that they retain pollutants (the sulphur, heavy metals etc.) in the ash instead of them being moved to the gas phase and discharged to the atmosphere. Therefore the emissions from this technology are much lower than produced by conventional incineration and will require less flue gas treatment. In fact, there is often no need for a smoke stack as the emissions only come from the burning combustible gases in a turbine or boiler.
- "The major drawback to these systems is with getting past the planning stage. Advanced thermal technologies like these are still categorised as incineration when it comes to planning. The public generally have misconceptions as to the word "Incineration" as most expect huge visual intrusion and dangerous smoky emissions. This is the reason why the granting of planning permission is often resisted by the local community. The absence of a smoke stack, however should help with planning permission applications.
- "The major public concern of recent times has been with Dioxins. The group of chemical compounds 'Polychlorinated dibenzo-paradioxins' and 'Polychlorinated dibenzofurans' are grouped and given the abbreviation dioxins. A presence of chlorine and temperatures in the system of between 200 and 400°C are conducive to dioxin formation. They may also be formed at lower concentrations in system temperatures of between 800 and 1200°C, but higher temperatures will destroy them. They can either be deposited on fruit and vegetables which go directly into human food chain or on plants which are eaten by farm animals intended for human consumption; otherwise they can enter the food chain through dairy products. Dioxins are fat soluble and retained for long periods. Excessive exposure to dioxins can cause weight loss, liver problems, or chloracne (a severe skin condition).
- "Presently in the UK an average dietary intake is estimated to be about 0.19ng TEQ/day/kg body weight. This compares satisfactorily with the tolerable daily intake of 100ng TEQ/day/kg body weight. The toxins have not been shown to be a notable risk to human health, and emissions from energy-from-waste plants produce minimal amounts compared to other sources (other

⁵ <http://www.unep.or.jp/ietc/estdir/pub/msw/>

⁶ <http://www.wasteresearch.co.uk/frontpage.htm>



industry, traffic and cigarettes). Future plants will however be required to periodically monitor for dioxins.

- “It should also be easier to develop these technologies on a smaller scale than that which is demanded by a mass burn incinerator as capital costs are smaller and individual gasification/pyrolysis units generally deal with only between 25,000 and 40,000 tonnes per annum. More than one unit would likely operate together to make best use of the necessary pre-screening and to boost output. It might only be economic for a plant to incinerate by mass burn a minimum of 150,000 tonnes per year. The difference is it could prove practical to gasify just 50,000 tonnes per year. There is, therefore, greater scope for application of this technology in smaller communities than the large cities which typically support incinerators today. Likewise, there is less need to keep the gasifier running 100% of the time as start-up periods are less than for mass burn incinerators which allows for possible plant closing at nights or weekends. These systems are also able to operate at less than 100% of capacity so there is flexibility when there is a decline in waste availability.

Corky's have developed a waste to energy plant based on gasification. The measured emission results were equal to world's best practice and cleaner than a large scale coal fired power station. The distinctive features of the Corky's approach are:

1. Pyrolysis / Gasification,
2. Small distributed plants,
3. Hot water available as a co-energy product, and
4. The ability to operate in tandem with solar and wind as a hybrid power station.

More emission results will be available after August 2009.

Energy Generation and Green house Gas Emissions

Lastly Corky's would like to challenge the comment that a carbon pollution reduction scheme imposes an unfair burden on communities by including landfill legacy emissions and this does not necessarily support recycling and re-use.

A carbon pollution reduction scheme should encourage investment in small towns and regional areas where recycling is not as widespread as in the cities and energy recovery and methane abatement is non existent because:

1. Waste to energy schemes share infrastructure with a municipal recycling facility thus encouraging recycling in these smaller towns
2. Waste to energy schemes will be prioritised towards landfills with no methane capture and use.

Four reasons why waste to energy projects are green house gas friendly:

1. Typically they contain 40% to 80% biomass which is short cycle carbon and this is renewable if the food, paper, and garden clipping were harvested sustainably. Garden clippings are not expected from very dry communities and therefore the biomass portion may fall substantially. Refer to the Table 1 overleaf:



Table 1: Percentage (assay) of variations in typical waste streams

	Wet tropical	Coastal temperate	Inland dry Not desert	
Wooden Matter	34.0	22.8	7.0	} biomass } combustible
Vegetable, grass leaves	33.0	21.0	6.5	
Food scraps	11.9	20.2	31.1	
Paper packaging	7.5	12.8	19.6	
Clothes and fabric	2.4	4.1	6.3	
Plastic packaging	3.4	5.8	8.9	
Dirt stones and sand	5.1	8.6	13.3	
metals	1.6	2.8	4.2	
glass	1.2	2.1	3.2	
Biomass by energy	83.2	72.1	58.5	
Biomass by mass	86.4	76.7	64.2	
Combustible by mass	92.3	86.6	79.4	
ash	7.7	13.6	20.6	

On an energy basis, inland waste is likely to be 58.5% renewable.

$(58.5\% = 64.2\%(\text{biomass fraction}) \times 10(\text{CV of biomass}) / (64.2\% \times 10 + 15.2\%(\text{combustible but not biodegradable fraction}) \times 30(\text{CV of combustible but not biodegradable fraction}))$

2. They avoid the formation of the methane (CH₄) that results from the anaerobic bio-digestion of the biodegradable fraction of the MSW. Methane is approximately 21 to 23 times more powerful green house gas compared to carbon dioxide (CO₂).

Typically, 25% to 65% of the biodegradable fraction forms CH₄ and the balance forming CO₂ and humic acid. Therefore one can estimated the net benefit of MSW combustion as 3.52 kg of CO₂ saved in green house gas emissions per kg of MSW burnt, rather than sent to landfill. This is dependent on the MSW assay and assuming 50% of the biomass is removed for composting leaving only 32.1% of the waste being biomass.

$3.52 = 64.2\%(\text{original biomass fraction}) \times 50\%(\text{biomass fraction remaining}) \times 50\%(\text{methane forming fraction}) \times 22(\text{CO}_2 \text{ equivalence})$

It is often argued that if all the biomass was removed from the MSW then there would be no green house gas advantage for thermal processes, nor could they claim any renewable energy. In the above example 50% of the biomass was removed to make compost. However, there is a limit to which biomass can be economically removed from MSW. As compost generated from MSW is contaminated with glass, herbicides, insecticides, unwanted seeds and other non compatible organics, as well as undesirable bacteria; there is a clear limit when using MSW compost. As a result Australians landfill the extra MSW compost that cannot be sold; this volume can be anywhere between 0% and 90% of the total compost volume. Whilst composting does reduce the toxicity of the biomass; wasting a resource like the un-wanted compost is not best practice when a cost-effective alternative is available.



Therefore waste to energy projects, are able to claim a green house gas credit. Even with higher levels of recycling and comparing to modern landfills with methane collection the net saving is greater than 1.25 kg of CO₂ equivalent per kg of MSW burnt; assuming 50% methane recovery and no carbon in the ash. Corky's can produce ash with a high carbon content to further increase green house gas abatement.

3. Small distributed waste to energy plants reduce waste miles. By producing in the community where the waste is generated there is a feedback mechanism for both good and bad recycling and pre-sorting practice in that community. They can generate hot water which can be used for heating or cooling to displace conventional energy usage. For example: heat green houses in winter, provide cooling water in summer via an absorption chiller.
4. Waste is effectively stored low grade energy. Therefore waste can be used when the sun does not shine or when the wind does not blow. Therefore Corky's imagine that small power stations in rural areas that hybrid solar, wind and waste to form virtual power stations.⁷

Therefore, the waste industry has the potential to greatly benefit from a considered carbon pollution reduction scheme. Waste is truly a resource. A carbon trading system will help modernise the waste industry and help drive change. To not change leaves a legacy to our children which is unacceptable in our minds.

Conclusion

There are legitimate alternative ways of looking at waste and considering it as a resource.

Municipal solid waste typically contains between 40 to 80% biomass after the recyclables have been recovered. In some places this residual waste is composted but due to contamination typically between 0 to 90% of the compost is given away and the remainder land filled. Green waste can often add up to a significant proportion of total landfill. This seems like a wasted resource to Corky's. In our opinion the waste hierarchy should be:

1. Reduce waste
2. Recycle where economically possible
3. Encourage local biomass composting, as required, before mixing biomass and MSW
4. Residual waste, which is still mostly biomass, is converted to energy
5. No biomass to landfill as it forms methane
6. Process waste in the community which generates those wastes

The amount of biomass produced annually is small compared to the total power needs of the planet. Therefore biomass should only play a small part in the world's power mix. Nevertheless, the part biomass can play is very important as biomass can produce both base-load and demand power to support other renewable energies. These other renewable energies like solar thermal, solar PV, wind, wave and tidal are less able to produce base-load and demand power.

⁷ http://www.solarserver.de/solarmagazin/anlagejanuar2008_e.htm

provides an independent assessment of the importance of biomass to support other renewable energies.



The government should consider:

- Waste miles and climate as valid reasons for one town adopting a strategy difference to another town.
- Certifying waste to energy producers as renewable provided they met certain emission thresholds.
- Certifying hot water as renewable from waste to energy projects as it can displace coal powered electricity .
- Facilitating and promoting small scale distributed power generation by removing the barriers to connect to the grid for energy produces generating less than 15 MWe.
- Recognising that in remote areas, biomass derived electricity has large environmental and socio-economic benefits; by producing local employment; reducing methane emissions from biomass which has been gasified rather than sent to landfill and by replacing coal-fired electricity and in some cases diesel generated electricity with electricity derived from a renewable and hence carbon-neutral source. Finally, in remote regions, 1 kW of electricity used at the home can be equivalent to 1.2kW produced and sent to that source (losses via transmission over long distances). Therefore, remote communities also benefit the environment by reducing their demand of coal-derived electricity.