AUSTRALIAN INDUSTRIAL ECOLOGY NETWORK

Submission to the South Australian EPA Enhancing resource recovery and discussing the place of energy recovery from waste

January 2018

Australian Industrial Ecology Network Pty Ltd
PO Box 5523, West Chatswood NSW 1515 • ABN 44 601 455 743
t 1300 446 303 • f 02 8624 4779 • info@aien.com.au • www.aien.com.au

The AIEN

The Australian Industrial Ecology Network (AIEN) is a vibrant network of like-minded individuals, companies and institutions with a common interest in sustainable development through the study and practice of industrial ecology. We advocate the principles and concepts of industrial ecology in policy formation and business practice. The AIEN actively engages with organisations to facilitate improved performance and environmental benefits.

The AIEN is also a forum in which people can discuss ideas, seek advice from one another, connect with resources associated with the practice and study of industrial ecology or simply keep in touch through the network with developments and best practice in their areas of interest.

The AIEN was established as a proprietary limited company in October 2014 to promote and facilitate industrial sustainability through the application of industrial ecology. The company aims to provide a 'window on the world' of industrial ecology by relaying news, canvasing new ideas, producing 'position papers' on topics, such as energy from waste, organising events and alerting people to developments in academia and in practice. In effect, AIEN aspires to become the 'go-to' organisation for all things to do with industrial ecology, including collaboration on the design, planning and implementation of IE projects.

In February 2016, AIEN held its inaugural conference on energy from waste (EfW) in Ballarat Victoria. It was followed by a similar event in February 2017 and a third conference will be held in Ballarat in February 2018. In July 2017, the AIEN also hosted a one-day event on EfW in Adelaide (SA - Unpacking EfW Conference), which focused specifically on related issues in South Australia. These events and submissions made to other inquiries on EfW have established the AIEN as a major contributor to the national discussion on EfW.

The primary motivation for this and all other submissions made by the AIEN is to promote future world best practice in sustainable development based on the principles of industrial ecology. Its contributing members have no particular commercial or political positions that influence their collective views and so from this unique perspective, the AIEN offers observations and comments on the options and opportunities for EfW presented in this submission.

Structure of this Submission

This submission has been structured around:

a) Some initial discussion around the generic topics of:
   - Justifiable demand;
   - The actual demand for any subsidised "black" energy that might be generated; and
   - The conditions necessary to achieve a freely granted "Community Licence to Operate" (CLO) since ultimately such projects are developed for and on behalf of the serviced community, and at their ultimate expense and in their name.

b) Two essential and existing documents: -
   i. The "Sustainability Guide for EfW Projects and Proposals" (SG/EfW2004) Attachment A; and
   ii. Western Sydney Sub-Regional Resource Recovery – Options Analysis (WSRR2014), attachment B

Attachment A

In our opinion, this continues to be the most authoritative document published, on the subject. It was sponsored by Australian Greenhouse Office, to address the following fundamental issues and questions: -

a) Recovering energy from residual wastes, including the very significant question of what constitutes a residual waste? What is the sustainable market for the energy? Under what circumstances is such a binary approach (either/or - nothing in between) justifiable economically, environmentally and socially?

   How can all legitimate concerns of the community who are the ultimate customer for such facilities and in whose name such projects are promoted, be sufficiently addressed so that a 'Community Licence to Operate' is granted, even conditionally? NB: Attachment A was drafted specifically to address all such issues, concerns and outcomes with the ultimate granting of a fully informed "Community Licensee to Operate presenting as the primary criterial for success".

Background to the SG/EfW – Summarised

The SG/EfW is an entirely self-explanatory document, in that:

- The circumstances of its initiation (very similar to the current situation in SA and Western Sydney);

- The methodology applied in the production of the SG/EfW including the comprehensive national community consultations undertaken to record and collate issues and concerns (including in Adelaide 29 Oct'2003);

- The synthesis of the relevant issues into the final Six Project Scoping Principles adopted;
- The broad representation on the project editorial committee is recorded;
- The broad representation of the project reference group is recorded; and
- The full list and cross section of the project sponsors are recorded.

This document is now in the public domain and the AIEN seeks only to draw attention to the systematic approach and subsequent outcomes

Attachment B

If the SG/EfW2004 document seeks to systematically define when an EfW approach for residual urban waste streams are likely to achieve a CLO, from a fully informed community, freely given, the later document (WWRR 2014 Attachment B) provides a fully worked options analysis for how a similarly sized community (880 population) could achieve the higher order, optimised resource recovery outcomes without needing to resort to traditional EfW, and at a lower net cost to the community.

Since these two supporting documents had the advantage of being developed in the entire context of the briefs for both projects, this submission will refer to them, as relevant, in response to the 28 specific questions that follow.

Other Adopted Generic Topics or Concepts in this AIEN Submission

And finally, we seek to differentiate between EfW approaches to Urban Waste streams, as the main focus of this submission, rather than EfW approaches to agricultural and forestry wastes and residues, in regional and rural situations.

Where agricultural and forestry (sustainably sourced biomass) is concerned, the principles and justifications in rural and regional areas can produce entirely different outcomes. If this topic is of interest to SA EPA, AIEN would be pleased to make a quite separate submission on the subject.

Discussion of certain generic topics for reference as required in subsequent responses to specific questions.

<u>GT1 – Justifiable Demand</u>

This criteria is often adopted by planning and approval agencies, requiring that a project is actually needed or strategically beneficial in pursuit of the common good, as a precondition to subsequently evaluating the proposed impacts and consequences of a proposal. This submission looks to provide a fully integrated decision-making framework to such Justification of Demand assessments to be made for a truly objective outcome.

GT2 – What is a "Residual?"

EfW proponents will preface the justification for facilities, such as currently being promoted in Western Sydney, by asserting that they only intend to combust 'RESIDUAL' waste. Wastes, that have previously had recyclables removed and that therefore present as having ''no higher resource value''. Such waste is to be terminally converted to at least realise inherent Calorific Value (CV). This 'justification' requires a description, if not a definition of what is meant by 'RESIDUAL' waste.

Before the advent of Comingled Kerbside Recycling (CKR), residual waste was considered to be everything the community needed to discard, save only for those materials of interest to the 'rag and bone' sector.

Today 'recycling options' have expanded to include not only the CKR standard packaging items but also those materials that are the subject of an ever-expanding list of Producer Responsibility items. This trend represents a concerted attempt to reclaim as much of the biomass i.e. organic content of waste streams (usually >60% wet waste) as possible.

In this scenario alone, ''residual waste'' is not a static, universally understood term and, in fact, the evidence is that with every passing year, more and more of these materials are being transferred from the ''residual'' list to the recyclable/recoverable list. With the right policy settings, developed to truly reflect the community's desire for optimised and systematic resource recovery, the ''residual'' waste category is destined to represent an ever-decreasing volume of a region's urban waste stream. See Attachment B for a truly integrated plan to actually achieve such an outcome).

This trend stands in stark contrast to the outcomes that will arise if very complex and expensive EfW plants are established to process what today is considered 'residual', as less and less material will logically fall into this category over time. The AIEN contends that the commercial drivers for and demands of such plants will directly impede, if not entirely prevent the development of future programs to maximise resource recovery, which are at the core of a successful circular economy.

In summary, the AIEN view is that in striving to achieve accurate criteria for assessing the best use of materials (SG/EfW PSP1 Section 3.3 pp33) 'residual waste' does not have a fixed definition. It is a rapidly diminishing category of a general waste stream, which yields a corresponding decline in calorific and hence economic value when used to generate thermal energy. The future status of EfW must be questionable in a market characterised by a rapidly falling demand for any resultant 'black' energy.

GT3 – The actual demand for heavily subsidized "black" energy from such urban waste processing EfW plants.

The issue of the market for the 'black' energy that will be produced by an EfW plant is a crucial criteria for justifying the demand for any particular EfW proposal. It would be operating in a national energy market where the overwhelming focus is on closing coal fired, black energy plants in favour of clean or renewable power sources. It is noted, for example, that five coal fired power stations in Australia have been closed in the last 3 years.

EfW plants that combust plastics or all other 'fossil' based materials are considered only marginally less 'black' than pure coal fired facilities. It is only the biomass fraction in 'residual' waste that is assumed to improve the sustainability status of any energy derived from such plants. However, this is exactly the very fraction of waste streams that is receiving the most impetus to transfer them from a 'residual' to a 'recyclable' status. As Fig. 1 clearly demonstrates, in a sustainable resource paradigm, biomass will be 'too valuable to just burn'.

And Biomass is so much more than firewood!

Biomass – the Sustainable Competitive Advantage

Table 1: Comparison of benefits and properties of non fossil sources

Low carbon energy sources	Features/Properties								
	A	B	C	D	E	F	G	H	I
	Renewable	On demand supply	Heat	Power	Gas	Oil	Char	PetroChem industry manufacturing precursors	Potential to be Carbon negative
Fossil fuels with sequestration		✓	✓	✓					
Hydro	✓	✓		✓					
Wind	✓			✓					
Solar – thermal	✓		✓	✓					
Solar – PV	✓			✓					
Geothermal	✓	✓	✓	✓					
Wave/Tidal	✓			✓					
Nuclear		✓	✓	✓					
Biomass	✓	✓	✓	✓	✓	✓	✓	✓	✓

Whilst <100yrs biomass can be converted to fulfil all the roles currently provided by fossil resources – there is nowhere near enough – so should be applied to highest and best uses – bioenergy as a by-product.

Figure 1: – Biomass is so much more than just firewood

To extend this logic further, in a fast approaching paradigm, where the vast majority of biomass has been removed from residual waste, to support the manufacture of direct replacements/ supplements for all products and services currently sourced from 'fossil' raw materials, only the oil based plastics will feature in 'residual' wastes and in that situation, such materials will also be much too valuable to burn since they can so readily be processed back into petro/chemical sector platform or precursor materials, such as methanol, naphtha and the like. Materials that average a commercial value currently of approx. $1,000/t as compared to only $30-$50/t if converted for CV alone in an EfW plant.GT4 – Demonstrating a freely obtained "Community Licence to Operate (CLO)

<u>GT4 – Demonstrating a freely obtained "Community Licence to Operate (CLO).</u>

Attachment A is focused specifically on adopting a project development process that:

a) Can fully consult and inform the host community to eventually obtain,

b) A fully informed and freely granted CLO.

Assumptions in the Terms of Reference

The Terms of Reference seems to assume the EfW is an accepted term referring to the combustion or Biological treatment of residual wastes such that:

a) The volume of waste for subsequent disposal to landfill is significantly reduced (perhaps by 80-90%);

b) The physio/chemical reactivity of such residuals (ash) is reduced;

c) The energy recovered is a product with a fair and recognisable market or demand; and

d) The recoverable materials in the wastes to be so processed have been removed prior to the final binary process of recovering a varying proportion of the inherent Calorific Value (CV)

Often, the international facilities, designed and operated to achieve these outcomes are cited as the benchmarks of such EfW strategies.

With reference to the SG/EfW, in this submission we challenge the ideas of: What a residual waste is.

- What the actual market and/or demand is for energy produced from such wastes.
- What alternative waste processing options are available to a community facing this choice.
- What the Justifiable Demand is for a 'traditional' EfW proposal.
- The conditions necessary to achieve a 'Community Licence to Operate' a facility, which is being proposed to service the community's clearly articulated needs and which is to be built and operated in their name, at their expense.
    - We address the various issues on the premise that EFW is not derived solely from a thermal process. Energy certainly can be derived from thermal means, typically: Incineration
    - Gasification &
    - Pyrolysis

But it can also be derived from biological processes, such as:

- Dry anaerobic digestion
- Liquid or wet anaerobic digestion
- Aerobic fermentation
- Landfill Gas (LFG)

Response to the white paper - Enhancing resource recovery and discussing the place of energy recovery

1. *Is there an opportunity to expand EfW in SA? If so, with what source material (waste feedstock) and technologies?*

The opportunity to expand

The primary purpose of SA Waste levies is to increase the cost of simple (landfill) disposal to the point where systematic resource recovery is a more cost-effective outcome. This submission proposes that such a 'tipping point' by 2019-2020 will be reached, and that systematic resource recovery will be the most cost-effective process option for the urban waste streams of the Metropolitan Adelaide Area.

The implementation of the W2R EPP in 2010 introduced a general waste management obligation in South Australia that with some limited exceptions that it would be illegal to dispose of waste unless it had been through a pre-treatment process; Division 2 – Waste to be treated prior to landfill.

In our submission, the AIEN recommends that this same approach be applied to any materials that are delivered to a facility for the purpose of creating energy from the waste, particularly in the event of a thermal treatment facility. See Attachment A

Wherever possible, the AIEN will always encourage optimal source separation of materials prior to waste or commodity collection. The AIEN has identified a weakness in regulatory guidelines that require significant and potentially redundant recovery from waste streams that have already undertaken source separation prior to the subsequent processing of residual materials for EfW.

Waste Feedstocks - LGA

Most council's in Metropolitan Adelaide have a mandatory two bin system; comingled recycling and residual general waste and further either a mandatory or optional green waste bin.

In the opinion of the AIEN the green waste bin should become mandatory and councils would be encouraged to implement the diversion of food waste into the green waste bins for the purpose of the optimised recovery of the inherent nutrients carbon and energy.

With the implementation of co-mingled recycling bins and the implementation of a green waste (FOGO) collection the residual waste can potentially be considered (subject to Attachment A) in a thermal treatment process.

Waste – Feedstocks - C&I

In SA there is a very mature and sophisticated collection option for commercial food waste. This option if further implemented would allow for the residual commercial dry mixed waste to be processed through one of the already available resource recovery facilities with the residual from these sites being made available for processing into PEF or use in an EfW application.

Waste Feedstocks - Mixed C&D

South Australia already has very mature markets for processing what is often referred to as the combustible fraction of construction and demolition industry. They will also separate the inert fraction at source so when the material is transferred to a disposal facility it has already been reduced by 80% or more. Further the AIEN believes that as the levy approaches $103 in 2019-2020 that the success of this industry in SA can be readily built upon.

Technologies

The AIEN is agnostic about the technology selected for a particular application. However, as discussed earlier, our position is that the chosen EfW solution is determined to ensure the highest and best practical, technical, economic and environmental viability, and that will complement existing resource recovery systems within the context of the highest best use hierarchy. Generally, the AIEN approach to technologies is as "servants" rather than "masters", is that the project should determine the most appropriate technology to achieve the required results, rather than vice versa.

Anaerobic Digestion (utilising biomass material)

The AIEN believe that in the first instance in the South Australian environment an anaerobic digester process would be a sound addition to the existing waste treatment processes, due to the potential end-user market for the Digestate. We recommend that a thorough process be undertaken to ensure that any technology implemented realises an end product that has a re-purpose or marketable commodity rather than a landfill rehabilitation material. (See comments related to Urban Waste processing vs regional/rural opportunities above)

Thermal Treatment

If a fully recovered waste stream process is implemented, and the resulting residual waste stream, or portions thereof, has suitable characteristics as feedstock (including woody biomass material) for use in a thermal treatment process for energy recovery, then the AIEN would encourage the installation, however we would strongly recommend that South Australia guard against over-sizing so as to potentially cannibalise existing higher end uses and stifle innovation toward the implementation of higher end uses for the materials.

Landfill Gas

It is important to recognise that the two largest landfills in the northern metropolitan area do not generate energy from their LFG and are only flaring this gas as a minimum to meet their environmental requirements. The AIEN view is that, as things stand in 2018 and beyond, squandering this energy is totally unacceptable and recommends that the EPA implement a policy to rectify this as a matter of urgency. The recovery of FOGO (a biomass material) prior to disposal will significantly reduce the LFG produced and wasted at these facilities and will in turn, through AD, be able to produce renewable energy reducing the reliance on fossil fuels and producing a high-quality soil enhancer.

And Biomass is so much more than firewood!

Biomass – the Sustainable Competitive Advantage

Table 1: Comparison of benefits and properties of non fossil sources

Low carbon energy sources	Features/Properties								
	A	B	C	D	E	F	G	H	I
	Renewable	On demand supply	Heat	Power	Gas	Oil	Char	PetroChem industry manufacturing precursors	Potential to be Carbon negative
Fossil fuels with sequestration		✓	✓	✓					
Hydro	✓	✓		✓					
Wind	✓			✓					
Solar – thermal	✓		✓	✓					
Solar – PV	✓			✓					
Geothermal	✓	✓	✓	✓					
Wave/Tidal	✓			✓					
Nuclear		✓	✓	✓					
Biomass	✓	✓	✓	✓	✓	✓	✓	✓	✓

Whilst <100yrs biomass can be converted to fulfil all the roles currently provided by fossil resources – there is nowhere near enough – so should be applied to highest and best uses – bioenergy as a by-product.

Figure 1: – Biomass is so much more than just firewood

2. *Could the EfW sector be further developed through public or private investment and ownership or as a partnership?*

The AIEN does not have a position in regard to this issue. Suffice to say that given the population of Adelaide there may not be sufficient feedstock for more than one type of technology, so a public private partnership may be one way of ensuring fair and reasonable pricing. Although, where recovery of homes from Urban Waste Streams could be beneficially value added in conjunction with agriculture/forestry residues in the hinterland, then collaboration with such projects could be very cost effective and sustainable.

3. *Is EfW Technology best applied at a site specific or district level, or at a larger scale?*

The AIEN considers that, depending upon the feedstock type, volume and frequency of availability, there may be opportunities for onsite and microgrid as well as district and large-scale applications.

To address the heterogeneity of urban waste sources in relation to the tight quality control of end products – including energy, integrated facilities are often the most viable.

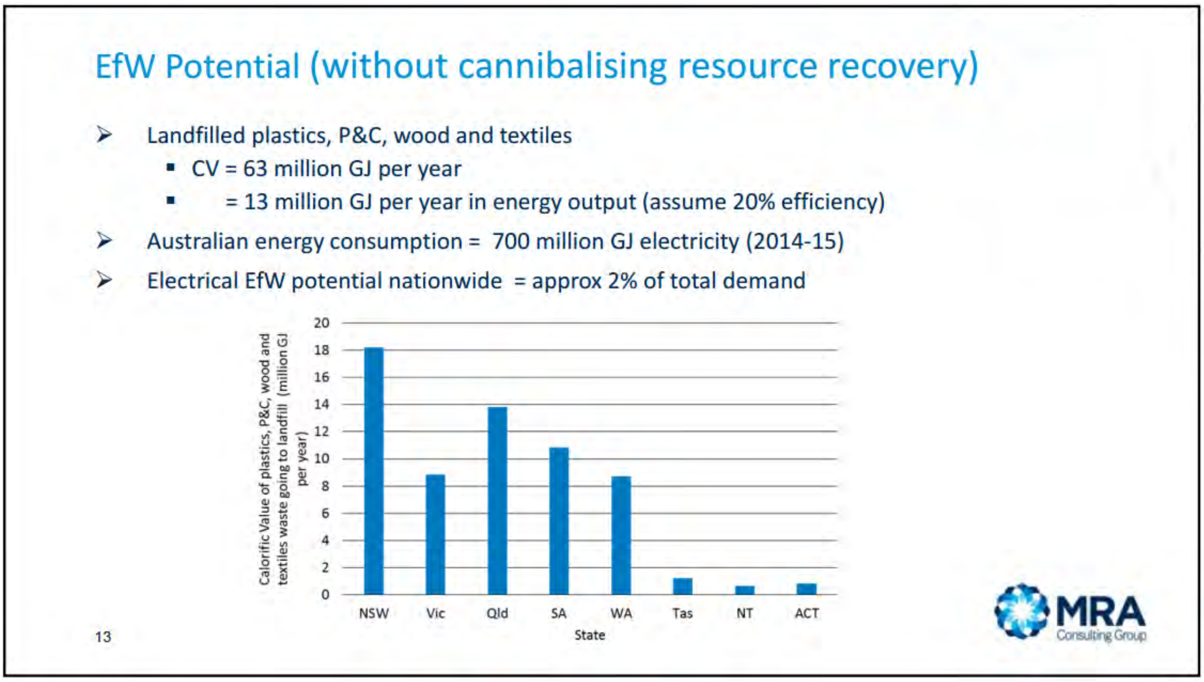
Site Specific & District Level

The feedback we received from the delegates from the regional communities at the SA unpacking EfW conference was that regional communities wanted to explore the opportunities available to them however most of the discussion is towards large scale operations. The AIEN believe that there is an opportunity for small scale projects for regional areas especially with Anaerobic Digestion technologies and projects such as the ones proposed by the City of Salisbury and the Adelaide Airports Corporation once implemented and commercialised will assist with the case studies for Regional Areas.

The AIEN recognises that within the Adelaide metropolitan area there are several opportunities for developing EfW projects including thermal treatment depending on the chosen technology. Once again, the AIEN warns against over sizing the thermal technology option. Reviewing the white paper there is only 890,000 tph of material landfilled in the whole of South Australia, the AIEN estimates that by recovering the green waste and organics, glass, metals and bringing the moisture content to 15% the total material with a calorific value could be less than 200,000 tonnes per annum, it may be that small scale close to market options may be the most economical in a South Australian context.

4. *Could EfW make a significant contribution to the baseload energy grid and the national energy market going forward.*

The following slide presented at a recent Keep NSW Beautiful event provides context for this issue



This 2% of total demand figure would be further reduced in a metropolitan Adelaide context by: -

i. Allowing for the continual redefinition of Residual MSW (GT2 above) and (SG/EfW2004);

ii. That no typical EfW process plant would consider attracting more than, say, 60% of the available material for simple supply risk issues; and

iii. Basing the project on an "unsubsidised" cost basis (as a precondition for the achievement of GT4).

Under these circumstances it seems that net power produced may well be <1% of total demand, and that when benchmarked against the full range of emerging clean energy sources, the Justification for Demand may not be achievable.

5. *Could the uptake of EfW assist in the reduction of the use of high greenhouse gas emissions intensity fuel contributing to a low carbon future? What are the factors that could assist with displacing high intensity fuels? What are the factors that could lead to EfW displacing renewables? What regulatory mechanisms or policy could be applied to EfW to reduce the extent of any displacement of renewables?*

The issue for the EfW industry is the market for the 'black' energy that will be produced by an EfW plant. It would be operating in a national energy market where the overwhelming focus is on closing coal fired, black energy plants in favour of clean or renewable power sources. It is noted, for example, that five coal fired power stations in Australia have been closed in the last 3 years.

EfW plants that combust plastics or all other 'fossil' based materials are considered only marginally less 'black' than pure coal fired facilities. It is only the biomass fraction in 'residual' waste that is assumed to improve the sustainability status of any energy derived from such plants. However, this is exactly the very fraction of waste streams that is receiving the most impetus to transfer them from a 'residual' to a 'recyclable' status. As Fig. 1 clearly demonstrates, in a sustainable resource paradigm, biomass will be 'too valuable to just burn'.

To extend this logic further, in a fast approaching paradigm, where the vast majority of biomass has been removed from residual waste, to support the manufacture of direct replacements/supplements for all products and services currently sourced from 'fossil' raw materials, only the oil based plastics will feature in 'residual' wastes and in that situation, such materials will also be much too valuable to burn since they can so readily be processed back into petro/chemical sector platform or precursor materials, such as methanol, naphtha and the like. Materials that average a commercial value currently of approx. $300-$1,000/t as compared to only $30-$50/t if converted for CV alone in an EfW plant.

The AIEN do not recommend a regulatory frame work that will ban the use of thermal treatment for residual waste only that in the assessment of the project an evaluation of the net energy recovery value is assessed against the higher end commodity use and the risk of stifling the introduction of innovative higher end recovery technologies, for which much current evidence is emerging for the realisation of these higher net resource value outcomes.

6. ***What is the EPA's role in safeguarding the waste hierarchy with regard to EfW e.g. ensuring that wastes with high calorific value such as plastics are not diverted to thermal EfW potentially undermining higher order recycling, reuse and reduction activities?***

Before the advent of kerbside recycling, residual waste was considered to be everything the community needed to discard, save only for those materials of interest to the 'rag and bone' sector

Today 'recycling options' have expanded to include not only the kerbside recycling bins standard packaging items but also those materials that are the subject of an ever-expanding list of Producer Responsibility items (CDL and potential for expanded packaging).

This trend away from landfill represents a concerted attempt to reclaim as much of the biomass i.e. organic content of waste streams (usually >60% wet waste) as possible.

In this scenario alone, ''residual waste'' is not a static, universally understood term and, in fact, the evidence is that with every passing year, more and more of these materials are being transferred from the ''residual'' list to the recyclable/recoverable list. With the right policy settings, developed to truly reflect the community's desire for optimised and systematic resource recovery, the ''residual'' waste category is destined to represent an ever-decreasing volume of a region's urban waste stream. See *Attachment B* for a truly integrated plan to actually achieve such an outcome).

This trend stands in stark contrast to the outcomes that will arise if very complex and expensive EfW plants are established to process what today is considered 'urban waste residuals', as less and less material will logically fall into this category over time. The AIEN contends that the commercial drivers for and demands of such plants will directly impede, if not entirely prevent the development of future programs to maximise resource recovery, which are at the core of a successful circular economy.

In summary, the responses to Q5 & 6 above, the AIEN view is that in striving to achieve accurate criteria for assessing the best use of materials (SG/EfW PSP1 Section 3.3 pp33) 'residual waste' does not have a fixed definition. It is a rapidly diminishing category of a general waste stream, which yields a corresponding decline in calorific and hence economic value when used to generate thermal energy. The future status of EfW must be questionable in a market characterised by a rapidly falling demand for any resultant 'black' energy.

7. *Could EfW as an alternative to landfill deliver net environmental benefits to SA in the form of greenhouse gas emission reductions, management of fugitive air emissions, and ensuring the environmental quality of waters? What regulations and policy could reduce the extent of any net cost in one or more of these factors?*

Attachment B provides the most comprehensive and integrated answer to the question. At question 4 we demonstrate that the actual energy product from such EfW facilities will be minimal, therefore such facilities serve only one strategic function, to reduce volume and reactivity of the material under management. Certainly, all putrescible landfills should be required to install and operate B.AT landfill gas extraction and reuse, but ultimately Attachment B is a relevant example of a full integrated system that will ensure maximum resource recovery at highest net resource value and with the minimum emissions or detrimental environmental effects. AIEN would be pleased to work with the SA Government to accurately adapt Attachment B concepts to include the precise SA circumstance if requested.

8. *If an EfW proposal is to be grid-connected what opportunities and challenges might lie ahead with regard to EfW energy end-user agreements, i.e. with regard to securing agreements and feedstock material, accessing infrastructure and the cost of bringing this energy to the market?*

This AIEN submission supports the view that this circumstance would not be economically viable in SA and therefore would not be applicable. Due to the factors available to energy producers that export through the grid network EfW in SA would be confined to uses of the energy at the back of the meter applications.

9. *Is it feasible and necessary for proponents of EfW to demonstrate the greenhouse gas emissions intensity and lifecycle emissions of their proposal? What range of data and what level of evidence should be required? How would it be validated?*

The Australian Government regulates Greenhouse emissions visa vie the National Greenhouse Inventory – Kyoto Protocol, SA EPA should adapt their reporting criteria to accommodate the Accounting practises of this office.

Most projects will be attempting to gain some form of carbon credits that are sealable the Clean Energy Regulator there are protocols in place that SA EPA can easily adopt.

10. *Should proponents of EfW be required to demonstrate that the greenhouse gas emissions intensity is less than that of currently utilised baseload and peaking energy fuels while the state transitions to its target of zero net greenhouse gas emissions by 2050?*

This AIEN submission supports the view that these circumstances will not and should not every apply refer Q8

11. *Is there a role for the further development of some EfW technologies or processes vs others? Why, and under what circumstances?*

We refer to the initial comments in this submission that seeks to differentiate between urban waste processing approaches and technologies, and those adopted in a regional/rural contest, processing agricultural and forestry residues and by-products.

Whilst continual and iterative improvements in technologies will occur, access to tailored MSW processing technologies is readily available today; but AIEN would always recommend approaching technologies as the "servants" not the "masters" in such discussions. The process technologies should be tailored to the required process and strategic outcomes, and not vice versa. The AIEN recognise that with innovation comes additional risk however that should not necessarily be the catalyst to stifle that innovation.

The fact is that the AIEN recognises that in a well-defined circumstance the development of technologies in Australian States and Territories would bring with it the potential for increased wealth.

The risks from this can easily be managed with the use of a flexible licence system that will allow for the design and commissioning of a technology where an actual operational licence would not be issued until the equipment was fully operational, commissioned and was meeting all of the emissions standards as required by the SA EPA emissions protocols.

12. *Considering the waste management hierarchy and the role of the waste levy, should a levy apply to an EfW activity? Would any such levy be higher, lower or equal to that associated with landfill disposal?*

The AIEN do not believe that a gate fee levy on genuine EfW projects would be in any way beneficial and would have the potential to destroy projects. In order to clarify if the levy is applicable the following process should be considered.

In assuming a self-sustaining environmentally sustainable project, rather than a material destruction project, is intended, the gate fee should only be required to the extent that sufficient revenue, is gained to cover cost of the operation plus profit of the enterprise for example:

- The cost of the technology, interest & depreciation
- Processing of feedstock to specification
- Operating Expenses including Management, administration and labour
- Profit/ROI

Simple energy cost balance equation should be similar.

(CE + EC) – PE must be ≤ SE

Key to Equation

CE = Cost of Energy in (fuel and/ or electricity)

EC = Cost of Feedstock Energy Content

PE = Value of Parasitic Energy

SE = Value of Saleable Energy

For example	EfW[1]	Material Destruction[2]
Total gate fee revenue-	$100	$100
Energy production gross margin-	$10	($10)[3]
Operations cost -	($60)	($60)
Profit -	$50	$30

Notes - 1 Levy is not applicable at gate

2 Levy is payable at the gate

3 Gross margin is negative when cost of goods sold (cost of energy input & or cost of feedstock & value of parasitic energy) exceeds energy sales revenue.

Furthermore, as with any project an energy cost balance equation specific to each project to support the claim to EfW should be developed and implemented so as to ensure that the project is an EfW project and not a material destruction project.

The residuals from an EfW project that do not meet any suitable end use criteria and therefore require landfilling would be required to pay the applicable metropolitan landfill levy.

13. What other fiscal considerations could be applied to EfW in SA?

The AIEN believe as with any project of these types that the market itself should determine if a project is fiscally viable. The AIEN recognise that as with landfills and other projects of this nature that a bond or bank guarantees would be considered, based on the size and nature of the project, this bond or bank guarantee could be reduced as the project is commercialised and is shown to meet all of the EPA operational requirements.

14. Given the complexity of EfW proposals and the nature of regulatory assessment that would be required, what methods of cost recovery could be used by government when responding to EfW development and ongoing operations?

Attachment A established some basic proposal assessment criteria, which if adopted could bench mark these proposals which comply, or not. SAEPA could then introduce a fee-for-service project assessment framework for non-complying proposals.

AIEN would be pleased to work with SA EPA to update and streamline Attachment A to achieve this outcome.

The AIEN recognises the significant cost to the EPA and the State for the assessment and implementation of an EfW project and therefore during the assessment stage we recommend a percentage of the cost of the proposal i.e. 0.2%-0.5% management fee depending on the size and nature of the project and once commissioned a licence fee similar to any landfill operations.

15. Is a three-bin kerbside collection system a sufficient method of resource recovery prior to undertaking EfW on the residual component?

As discussed earlier if the green waste bin becomes mandatory on kerbside collection systems including food organics, along with a community education program The AIEN believe that this should be sufficient. The AIEN believe that in some Council jurisdictions in metropolitan Adelaide green waste bins are an opt in system. In order to further encourage a take up the organics and Kerbside could become weekly with the residual predominantly none put material collected fortnightly.

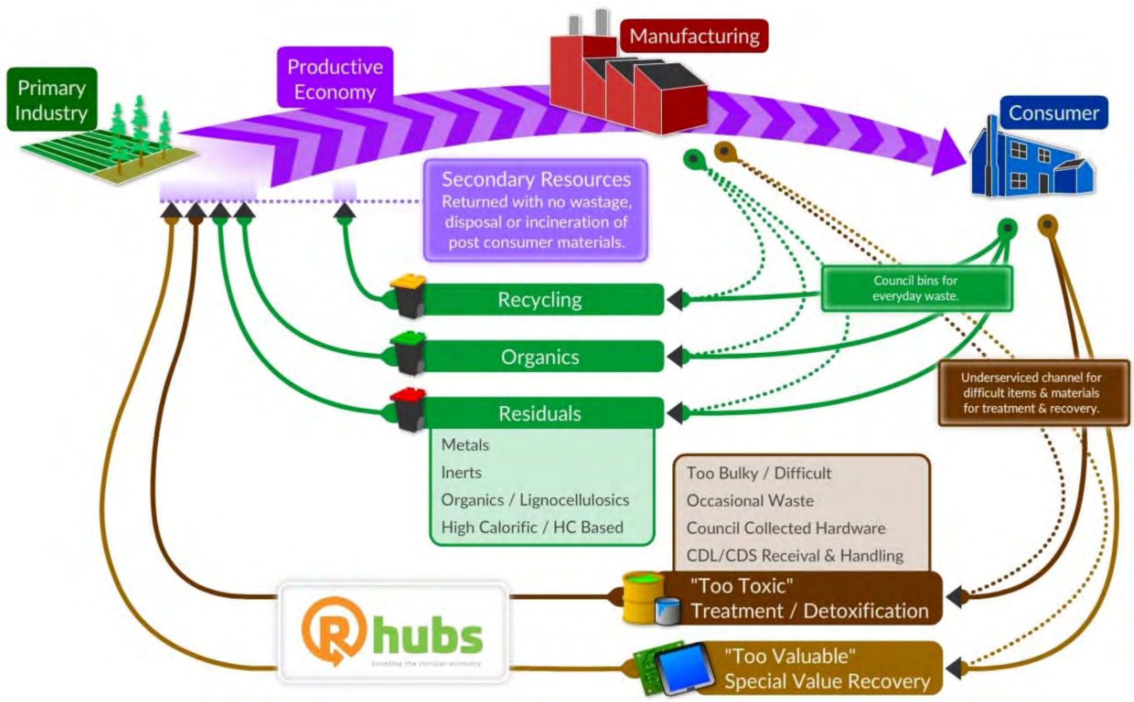


Figure 2: Optimised Post-Consumer Resource Recovery Framework

Fig 2 is the provided as conceptual response to this question, were the discard options for the community is limited to just Reb, Yellow and Green lidded bins, for all mainstream discarding of household wastes and spent materials/items.

All other discards (especially PS type materials and items) would be received at specialist “Bring”, “Drop off”, prelim sort, aggregate and forward facilities referred to in Fig 2 as RHubs, but in the SA context these facilities would be extensions/adaptions of the existing CDC facilities in the state, brought under a common performance specification.

16. *Would it be necessary to require mandatory resource recovery criteria to be met for residual kerbside waste prior to EfW?*

The AIEN recommend a benchmark approach based on best practise minimum recovery protocols.

17. *In a similar manner to the existing requirement of the Environment Protection (Waste to Resources) Policy 2010 to treat waste in order to recover resources prior to the disposal of waste to landfill, should the EPA consider mandating that resource recovery is undertaken prior to an EfW process?*

Attachments A & B provide a detailed and fully integrated response to this question.

The AIEN would fully support the same or similar mechanism to the W2R EPP 2010 with the addition of the implementation of a weekly FOGO collection.

18. *Should a mechanism be considered requiring minimum resource recovery criteria to be met by local government before they can be eligible to put residual waste to EfW (i.e. criteria that are consistent with the future SA Waste Strategy landfill diversion targets)?*

The implementation of the W2R EPP in 2010 introduced a general waste management obligation in South Australia that with some limited exceptions that it would be illegal to dispose of waste unless it had been through a pre-treatment process; Division 2 – Waste to be treated prior to landfill.

In our submission The AIEN recommends that this same approach be applied to any materials that are delivered to a facility for the purpose of creating energy from the waste, particularly in the event of a thermal treatment facility.

Wherever possible, The AIEN will always encourage optimal source separation of materials prior to waste or commodity collection. The AIEN members have identified a weakness in regulatory guidelines that require significant and potentially redundant recovery from waste streams that have already undertaken source separation prior to the subsequent processing of residual materials for EfW.

See Attachment A which provides an integrated framework to address this issue

19. *What level of resource recovery should be required e.g., a blanket minimum standard vs waste-stream-specific targets and would this change depending upon the source and/or type of any particular waste stream?*

Attachments B and GT-2 provide a fully integrated response to this question

Wherever possible, The AIEN will always encourage optimal source separation of materials prior to waste or commodity collection. The AIEN members have identified a weakness in regulatory guidelines that require significant and potentially redundant recovery from waste streams that have already undertaken source separation prior to the subsequent processing of residual materials for EfW.

The AIEN do not support the blanket minimum standards as they tend not to account for the already source separated materials, some demolition companies are better than others at source separation however most already due to the significant cost savings separate the inert fractions from the combustible fraction. Within the C&I collections industry there is already well-advanced source separation of cardboard, paper, metals, timber and hard & soft plastics (usually single polymer) added to this in SA we have the extremely successful CDL system.

The kerbside system has a two-bin system with some form of a third green waste bin so The AIEN believe that the continual increase in levies will be sufficient to continually improve the existing diversion targets.

20. *How prescriptive should the EPA be in pursuing resource recovery criteria applying to EfW, how could market forces assist or not assist in determining resource recovery outcomes for EfW?*

Refer GT- 1,2,3 and 4 and the clearly demonstrated achievement of a CLO via the adaption of Attachment A.

If performance outcomes and orderly articulated “Criteria for Success” are readily available and adopted, market forces will self-regulate for the preferred outcome.

As discussed above The AIEN do not support a prescriptive resource recovery criteria, however we recommend that the EPA are reasonably prescriptive in relation to the outcomes of the EfW processes chosen. The recent introduction of mass balance reporting if properly implemented and managed will encourage suitable and environmental outcomes for these materials that will move towards EfW projects.

21. *Should SA look to adopt an energy efficiency criteria (such as the EU R1 indicator) as a means of assessing energy recovery vs disposal for thermal EfW proposals?*

The AIEN supports the EU R1 indicator as one of the assessment tools, it is important to recognise that EfW is an energy recovery process and not a materials destruction process, see comments in Q12.

22. How far into the future should we consider new recycling and reuse technologies improving to the extent that EfW is no longer economically viable and the likelihood of stranded assets becomes a significant risk?

The AIEN believe that the effective life of an EfW plant is 30 years, the question is what technological advances may be developed and commercialised within those 30 years. The real question to be thought through as part of this discussion is would an LGA be prepared to sign a 30-year supply agreement for their residual waste streams?

23. Do EfW facilities have the potential to hamper ongoing innovation in resource recovery?

The AIEN will point to Europe where several facilities are struggling to find volume and in some cases the residual form the waste stream is transported for country to country as a product that they are referring to as PEF, The AIEN do not see this as a good outcome in an Australian context as we deal with the tyranny of distance therefore the hampering of innovation would become more paramount to a large scale EfW facilities survival.

24. How might a 'social licence' be applied to a proposal for an EfW facility? What would the process be for proponents in securing a 'social license'?

See Attachment A

Apart from addressing the direct economic, social and environmental impacts of such proposed facilities, the Community Licence to Operate must be given primacy, since such facilities are developed to service these same communities and doing so in their name and at their expense.

It has been shown that while many proponents of EfW and even communities that would like to see EfW developed will often not want to see it in their own community, again looking towards Europe they are "hiding or disguising" direct burn facilities in extremely modern buildings and in some cases in "play parks" the reality is that they are still direct burn incinerators.

The AIEN recommend that in order to attempt to gain the social licence to build and operate a facility the proponent would need to engage all stakeholders very early and bring them along with the process, trying to ensure that they have had some ownership of the process to implementation and just as important transparency will preclude the vacuum of knowledge that allows for the propagation of false information.

25. What role will air quality modelling data play in securing a social license?

The AIEN believe that real time emissions monitoring should be mandatory and built into the emissions management of any thermal treatment project, particularly when there is a stack emission and the production of ash.

26. Should the EPA develop and publish minimum evaluation distances specific to different groups or types of EfW facilities which would be used to decide how to proceed with scientific investigations into potential environmental impacts during the planning process?

The AIEN believe that separation distances should be relative to the proposed technology for example a well-run AD plan can be with in close proximity to sensitive receptors whereas a large thermal treatment plant should be situated sufficiently distant from sensitive receptors.

27. WA, VIC, and NSW all require proposals for EfW to demonstrate proof-of-concept through direct comparison of the proposal to a suitable reference facility already in operation within Australia or overseas. Should this requirement also be considered in SA?

The AIEN suggest that this has the potential to stifle local innovation and often only allows for technologies to be implemented that are several years old in fact some of the biggest selling points is that they have been around for years and are proven.

While on the surface this may seem attractive to a regulator The AIEN are not totally convinced that you get the best outcome. The AIEN believe that as long as any technological innovation will meet the base line emissions of proven technologies and the SA EPA guidelines for emissions control from EfW facilities.

28. With a view to achieving a net environmental benefit, are there opportunities for coordinating the cross-jurisdictional movement of waste feedstock for EfW facilities?

At this time given the response to the attempt by the NSW EPA to introduce the proximity principle into their jurisdiction The AIEN do not believe that SA EPA would be able within the current climate to affect the cross-jurisdictional movement of materials, that would be a function of the market. A way that we might be able to resolve this issue may be a variation in the Waste to Resources EPP to allow for the levy to be collected if materials that are transported across-jurisdictions meet a required PEF specification.

The AIEN would be pleased to make a personal presentation to the committee to expand on this written submission.

Australian Industrial Ecology Network Pty Ltd
PO Box 5523, West Chatswood NSW 1515 • ABN 44 601 455 743
t 1300 446 303 • f 02 8624 4779 • info@aien.com.au • www.aien.com.au

Attachment A:

Sustainability Guide for EfW Projects & Proposals

Sustainability Guide

for

Energy from Waste (EfW) Projects and Proposals

Completed with significant sponsorship from

Australian Government

Australian Greenhouse Office

First Draft	For Review by Reference Group	1/07/03
Discussion Draft	For Review by Reference Group	3/07/03
Final (AGO) Draft	For Review by Reference Group	10/11/03
Plain English Draft 1	For Submission to AGO	10/12/03
Plain English Draft 2	For Submission to AGO	19/12/03
Edition 1	For Publication	29/02/04
Edition 1a	For Publication	30/09/04

Preface

The Sustainability Guide for Energy from Waste (EfW) Projects and Proposals is an initiative of the EfW Division of the Waste Management Association of Australia (WMAA). The EfW Division has also developed a Code of Practice for the EfW Sector in Australia to support the Sustainability Guide.

These two documents form the first and second parts of the WMAA Energy from Waste Sustainability Project. Together they provide the fledgling EfW industry with a widely accepted protocol, process and strategic framework for assessing EfW projects and proposals.

The vision of the Energy from Waste Sustainability Project is for a sustainable Australia with our systems, facilities and infrastructure working to avoid and minimise waste, recover valuable resources and energy and close the loop on urban resource consumption.

The Sustainability Guide is intended to help the community, government and industry stakeholders know when it is best to conserve materials presenting as urban "wastes" in something close to their original form and when it is appropriate to convert them to energy through a variety of processes.

The Sustainability Guide recognises the crucial role played by the community in any EfW project or proposal. In effect, the community, represented by Government, or special interest groups or as individuals, act as arbiters of sustainability on behalf of current and future generations. The Sustainability Guide acknowledges that without broad community agreement to an EfW project, or a "community' licence to operate," an EfW project cannot go ahead. The document is framed to keep the community actively involved, fully informed and engaged regularly and transparently in order to facilitate an outcome that provides for sustainable resource use in the interests of current and future generations.

Although the Sustainability Guide does discuss some EfW technologies, a deliberate decision has been made to focus on outcomes rather than being prescriptive in terms of technology, process or methodology. The document presents a number of project scoping principles stakeholders can use to assess whether a project or proposal falls within the principles of ecologically sustainable development.

The Code of Practice supporting the Sustainability Guide is intended to demonstrate the EfW industry's commitment to operating within the framework of sustainable development. By signing up to the Code members of the EfW industry are publicly stating their commitment to act for the recovery of the highest resource value from secondary resource materials, ensure transparency in their decision-making processes, meet all legislative requirements and continuously improve in all the aspects of their operation over which they have control.

The Sustainability Guide and Code of Practice are living documents that derive their functionality and credibility from their inclusiveness, continual improvement and interaction with stakeholder requirements, as accommodated against a founding philosophy of sustainable resource use.

They were developed over three years from November 2000 to December 2003 and involved extensive consultation with a wide range of stakeholders (see Appendixes A, B, C and D). The Australian Greenhouse Office provided significant sponsorship for the project, as did a wide range of government and industry parties (see Appendix C).

Signatories to the Code and their current compliance status will be kept on the WMAA EfW Division website at http://www.wmaa.asn.au/efw/home.html

The EfW Division of the WMAA and its state-based Working Groups will regularly produce updated editions of the Sustainability Guide and Code of Practice in a culture of continuous improvement and in the face of changing circumstances and needs. Edition 2 of the Sustainability Guide is due for completion at the end of 2005.

Structure of the Sustainability Guide

Section 1 of the Sustainability Guide is intended for first-time readers only. It provides a broad overview of the issues involved and the rationale for the Sustainability Guide and Code of Practice. It also outlines how the document was developed and gives guidance on how it is to be applied.

Section 2 gives a consolidated summary of the issues and drivers as a context and rationale to many of the principles and outcomes adopted in the Sustainability Guide. Much of this material originated from early discussion groups, the deliberations of the Working Group and the matters raised during the stakeholder consultation. This section will be useful where the interpretation of related, collateral or contingent issues arise in any future project assessment.

Section 3 provides a set of project scoping principles (PSPs). These are the principles that have been developed to best address the complex issues surrounding sustainable energy recovery from urban wastes. The section will be particularly useful in the qualitative assessment of proposed or actual projects.

Section 4 is the assessment roadmap tool. This consists of a process that is recommended to analyse and evaluate the impacts of a project in the context of ESD.

Contents

List of Tables

List of Figures

Section 1: Introduction

This section provides an overview of the main issues that relate to the complex topic of energy recovery from society's urban waste streams. It introduces the structure of the Sustainability Guide and outlines the process of its development.

(Many of the issues touched on in the introduction are explored in more detail elsewhere in the document and referenced accordingly. The section may only be of value to first-time readers of the Sustainability Guide.)

1.1 The Initial Conditions and Context

1.1.1 One unintended consequence of the rapid economic development in OECD countries is the unsustainable use and consumption of natural resources, both renewable and finite (non renewable).

1.1.2 Sustainability in this context, or ecologically sustainable development (ESD) in general, refers to the concept of managing the use of resources in a way that improves our quality of life today and allows future generations to improve their own quality of life, with an underlying focus on maintaining the ecological processes upon which life on Earth depends. Within this concept, sustainability can also be described in terms of the ability of the natural environment to sustain impact (see 2.1.5)[1].

The wastes in question

1.1.3 This Sustainability Guide focuses on the sustainable use of the resources that currently present as the **three main urban waste streams,** comprising:

i) the spent, surplus and discarded materials that originate from households that are usually managed by local government, called municipal solid waste (MSW) (see 2.2.1 i)

ii) the spent, surplus and discarded materials that originate from commercial, industrial and manufacturing operations that are usually managed by private waste contractors, called commercial and industrial (C&I) waste (see 2.2.1 ii)

iii) the discarded or waste materials that originate from the construction, engineering and building demolition sectors that are generally managed by private contractors, called construction and demolition (C&D) waste (see 2.2.1 iii).

1.1.4 In addressing society's urban waste streams from a perspective of sustainability, a number of strategies can be adopted:

i) efforts can be made to **avoid** the materials being initially produced, consumed or managed in such a way that they never present as wastes

ii) strategies can be employed to limit or **minimise** the amounts of materials that are employed in the production of goods and services and that will eventually present as wastes

[1] This application of sustainability requires the proactive implementation of the precautionary principle Appendix D ii).

iii) spent, surplus or secondary materials can be managed as by-products for future **reuse** or **recycling** in their original form or in a degraded form, or they can be **reprocessed** for some equally valid re-application of their resource potential.

One potential but irreversible reprocessing option for these materials may be to recover the energy or "calorific" value of the waste through an Energy from Waste (EfW) project.

1.1.5 This Sustainability Guide seeks to address and define those elements in the urban waste streams that are suitable for EfW projects and to present protocols for their conversion from waste to energy.

1.1.6 These potential sources of energy could be described as materials that satisfy the following two conditions:

i) they have no further practical value or market for reuse, recycling or reprocessing to recover their inherent resource value

ii) they have a net calorific value that could be recovered and would otherwise be lost through disposal to landfill.

1.1.7 In terms of ecologically sustainable resource application, the crucial issue is to know when to conserve materials in something close to their original form and when to convert them for their calorific value.

This Sustainability Guide has been developed to help determine:

i) whether the materials in question are suitable for conversion to energy

ii) whether the immediate impacts of the conversion activity are acceptable: i.e. will the benefits be optimised and the disbenefits minimised or eliminated?

1.1.8 Urban waste is an important community issue and concern. The Sustainability Guide provides a structure for the community to regain more ownership of the issues and the potential solutions.

1.1.9 Currently, fractions of urban wastes that present as potentially sustainable sources of energy as described in 1.1.6 above are being lost to landfill disposal because:

i) there are few, if any, facilities available to recover the energy in Australia

ii) energy recovery facilities are not being developed in Australia because there are no generally accepted standards, protocols or strategic planning frameworks that could support the necessary investment decisions.

1.1.10 This Sustainability Guide provides the strategic framework needed to evaluate EfW projects and their social, environmental and economic impacts.

1.2 Energy Recovery: A Binary Decision

1.2.1 Because the EfW process is irreversible, the decision to reprocess urban wastes for the primary purpose of energy recovery has implications for sustainable resource use.

1.2.2 On the one hand, the recovery of the calorific value of the waste and its corresponding benefits may be preferable to losing the potential for energy recovery to landfill disposal.

1.2.3 On the other hand, the irreversible consumption of a resource for energy alone may not fully acknowledge the more sustainable resource use of that material, by reuse, recycling or reprocessing for the inherent material recovery and the greater embodied energy value (see 2.1.7).

1.2.4 Such resource decisions are of vital interest to the broader community as we consider our collective responsibility to future generations. This highlights the need for community consent for projects that seek to recover energy value from urban waste. In order to gain this consent it is important for the potential impacts, both positive and negative, to be properly identified and understood in order to determine the suitability of an EfW project.

1.3 The Potential Impacts of Energy Recovery from Urban Wastes

The potential benefits

1.3.1 The **benefits** of energy recovery from urban wastes can include the following:

i) a higher value resource management outcome than to lose the same materials through landfill disposal

ii) the biomass or lignocellulosic content of urban wastes can present as a renewable source of energy

iii) the hydrocarbon-based content (high calorific plastic-, textile- and fossil-fuel-based fraction) of urban wastes can present as a source of alternative or supplementary energy

iv) use of certain urban wastes for energy recovery can deliver a reduced greenhouse gas impact when compared to directly applied fossil fuels or the landfill alternative where organic material is not collected separately and diverted (see 1.3.5)

v) a reduction in volume of the solid waste that is consigned to landfill

vi) appropriate conversion of certain urban wastes for energy recovery close to the potential markets for this energy can demonstrate significant transport and transmission advantages

vii) processing urban wastes for energy recovery can demonstrate significant public health, hygiene and public amenity advantages over many alternative applications such as landfill disposal[2].

The potential disadvantages

1.3.2 Like any waste management option, inappropriate energy recovery from urban wastes can produce significant **disadvantages** such as:

i) wasted resource value from a once-off application for energy from materials that had ongoing or higher resource value applications available

ii) direct impacts of polluting emissions (including health impacts), odours, dust and noise

iii) maintaining a demand for the creation of waste, rather than avoiding waste, simply to satisfy the needs of the EfW facility.

Better information exchange is needed to promote community confidence in EfW projects

1.3.3 An objective of sustainable development is to ensure optimum benefits within a framework that eliminates or minimises the potential disadvantages.

[2] Landfill disposal itself has a range of problems including leachate and the generation of methane, a potent greenhouse gas. These impacts can be difficult to manage because of the indeterminate boundaries of landfill impact. Furthermore, landfilling the materials is unlikely to recover the highest resource value for the material so employed.

1.3.4 Some EfW projects have had a chequered history; too often realising many of the disadvantages with too few of the benefits. The lack of a commonly adopted standard or strategic planning framework has led to the current situation where the development of sustainable and well conceived projects are often prevented due to the difficulty of obtaining a licence to operate from the community. This has stemmed from poor information exchange between stakeholders and a lack of community confidence in EfW projects.

1.3.5 The potential greenhouse impacts and advantages of using fuels made from selected urban wastes include, but are not limited to:-

i) reducing demand for fossil fuel extraction to produce a given amount of energy. In particular -

   a) biomass based materials (wood, plant matter, paper, cardboard etc.) can represent a renewable source of energy in that any CO_2 released can be reabsorbed at the same rate as it is released

   b) hydrocarbon based materials (plastics, textiles etc.) converted to energy at the end of their useful life can represent a net advantage in terms of overall greenhouse gas release over the direct application of such materials (coal, oil, gas) to energy, in that such materials have served one or more useful purposes before being converted to energy.

ii) reducing demand for the materials conserved or reused before being presented for energy recovery such that less mining, manufacturing, transporting, treating, reprocessing or even disposal activities are necessary with the resultant energy and transport fuel savings and their related emissions.

iii) the promotion of high order material reuse where appropriate, with the resultant savings of embodied energy in certain applications.

1.4 Origins of the Sustainability Guide

A National strategic planning framework was needed

1.4.1 In November 2000 the EfW Division of the Waste Management Association of Australia (WMAA) was initiated by a group of experienced practitioners in the area of waste management and sustainable resource use. The group identified the need to develop a nationally accepted approach and strategic planning framework for EfW projects.

1.4.2 The EfW Division developed a discussion paper to conceptualise the group's ideas and launched the project to develop this Sustainability Guide and its supporting Code of Practice. The project attracted major sponsorship from the Australian Greenhouse Office and significant additional sponsorship and support from a wide range of government and industry parties (see Appendix C).

1.4.3 This Sustainability Guide and its supporting Code of Practice are the outcomes of this project.

1.5 Development of the Sustainability Guide and Code of Practice

1.5.1 The key steps in the development of this Sustainability Guide and Code of Practice have featured an ever-broadening involvement of stakeholders so that the final product can be adopted with confidence.

i) Following the formation of the WMAA EfW Division an initial discussion paper was prepared.

ii) Increasing membership of the EfW Division led to the preparation of a revised and refined discussion paper and to the identification of the need for a Sustainability Guide and Code of Practice.

iii) A project proposal was developed to produce the Sustainability Guide and Code of Practice. This proposal received funding from the Commonwealth through the Australian Greenhouse Office, the environmental agencies in most states and private sector contributors (see Appendix C).

iv) An expert Working Group was established to manage the project and maintain editorial control (see Appendix A).

v) Workshops were advertised and conducted in all state capitals and many regional centres to address the complexities of the debate and to inform the production of subsequent documents[3].

vi) The first drafts of the Sustainability Guide and Code of Practice were prepared from the workshop outputs and reviewed by the Working Group. They were then put out to a much wider Reference Group for peer review (see Appendix B).

vii) First Editions of the Sustainability Guide and Code of Practice were then developed for distribution. A structure of state-based Working Groups (including non-industry representatives) reporting to the National EfW Division was established for the regular and ongoing updating and maintenance of the documents.

1.5.2 The Sustainability Guide and Code of Practice are living documents that derive their functionality and credibility from their inclusiveness, continual improvement and interaction with stakeholder requirements, as accommodated against a founding philosophy of sustainable resource use and the agreed principles outlined in Section 3.

[3] See http://www.wmaa.asn.au/efw/Final%20Summary.pdf for more information

1.6 The Purpose of the Sustainability Guide and Code of Practice

Why do we need an EfW sustainability guide and code of practice?

1.6.1 The Sustainability Guide has been produced to provide a widely accepted protocol, process and strategic framework that will:

i) help potential EfW projects to be conceived, scoped and structured to optimise the potential of sustainable energy recovery from the appropriate fractions of urban waste, whilst ensuring that the potential environmental, social, health and economic impacts are rigorously evaluated in a transparent and publicly accountable manner

ii) provide a common reference for the evaluation of potential projects and for projects that are evaluated positively

iii) provide a pathway toward the granting of a "licence to operate" from the community and assistance for regulators in granting project approvals

iv) provide an integrated and structured reference for the ongoing assessment and monitoring of a project or facility that does acquire a "community licence to operate".

1.6.2 Whilst the Sustainability Guide has been developed to inform and facilitate the scoping and initiation of sustainable EfW projects, the companion Code of Practice has been produced to evidence stakeholders' long-term and ongoing commitment to the principles and philosophies of the Sustainability Guide. This enshrines a platform of continuous improvement for all stakeholders directly involved in a potential project.

1.6.3 It is hoped that the Sustainability Guide will assist sustainable EfW projects to emerge that gain consent, approval and the confidence of all stakeholders.

1.6.4 The Sustainability Guide in no way seeks to provide guarantees or assurances of success during a formal consent or approval process. However, it can help both applicants and consent authorities understand the complex issues surrounding EfW projects.

1.6.5 Since a formal application may well require the expenditure of considerable time and money, some project profiling and screening techniques have been provided that are designed to limit expenses for projects and proposals that appear to be unsustainable rather than attempting to justify them.

1.7 Key Stakeholder Groups

Wide consultation improves an EfW project's chances of success

1.7.1 There is a wide range of individual stakeholder and special interest groups with whom consultation is an important factor in gaining acceptance and approval for a development. These groups can be loosely categorised as community, government and industry and encompass the following stakeholders:

i) community

a) neighbouring residents, workers, businesses and sensitive landuses such as schools, community centres and aged care facilities

b) the electorate (local, state, federal)

c) environmental NGOs

d) special interest groups

ii) government

a) local government

b) state governments and their individual agencies

c) federal government and its individual agencies

iii) industry

a) project developers and proponents

b) waste generators, suppliers and collectors

c) technology developers and vendors

d) energy wholesalers and retailers

e) energy consumers

f) specialist consultants and advisors

g) ancillary suppliers.

1.8 Applicability to Individual Stakeholder Requirements

The Sustainability Guide helps the community, government and industry decide which projects are acceptable

1.8.1 The Sustainability Guide and Code of Practice have been developed for both the general community and the specialist stakeholder groups involved to promote informed decision-making processes and sustainable resource use.

i) **Community groups** can use the Sustainability Guide to become better informed about the issues related to EfW and to understand the complexities and inter-relationships between the various issues and outcomes. In the face of specific proposals, community groups can use the Sustainability Guide to evaluate, critique and, if appropriate, approve certain projects or initiatives, confident that the documents have been developed in an informed, impartial and inclusive manner.

ii) **Government** politicians and their bureaucracies can use the Sustainability Guide for evaluating and approving projects, drafting consent conditions and developing public policy and strategy. For example, it will assist local government to make waste management decisions where alternative technologies are being considered.

iii) **Industry** can apply the principles, philosophies and project assessment framework in the Sustainability Guide for scoping and developing projects that are more likely to receive a community licence to operate and the regulatory consents and approvals that are required.

1.8.2 The Sustainability Guide and Code of Practice are designed to be beneficially adopted by community representatives, government and project proponents in equal measure.

1.9 Editorial Focus and Sustainability Guide Formats

1.9.1 The issues of resolving the interests of both current and future generations within the field of sustainable resource use and the appropriate role for energy recovery from selected urban wastes have generated different opinions and defined some individual objectives. In the first editions of the Sustainability Guide and Code of Practice certain issues have been agreed and/or acknowledged, including:

i) the community's involvement in and acceptance of EfW projects is essential. The core focus during the development of the Sustainability Guide and Code of Practice was to facilitate not only a greater level of understanding of the issues by all stakeholders, but to provide a transparent and practical framework for appropriate and sustainable EfW projects to achieve the broad community licence to operate. However, it must be recognised that the framework itself may be limited and should not exclude consideration of other sustainability issues raised by stakeholders

ii) whilst this project was developed under the supportive umbrella of the WMAA and its principles and constitution, it has also been a public policy development activity for the broadest possible adoption. A wide range of stakeholders have been actively involved in the project to this point including those listed in Appendixes A, B and C and all those who attended the consultative workshops[4]. This active involvement provides the credibility for widespread application of the outcomes

iii) the WMAA will have an important role in providing a structured forum for ongoing input, review and comment through the Working Groups in each state and feeding into the National EfW Division. The EfW Division of the WMAA will regularly produce updated editions of the Sustainability Guide and Code of Practice in a culture of continuous improvement in the face of changing circumstances and needs

iv) the Sustainability Guide will be published in the following forms to accommodate different requirements:

a) the Complete Sustainability Guide with all sections as the background reference document

b) a Concise Sustainability Guide with little background and context and more emphasis on the project scoping principles (PSPs) and the assessment tool

c) a Condensed Sustainability Guide with only core principles and a graphic of the assessment process.

1.9.2 All documents will be developed and issued by the National EfW Division of WMAA.

1.9.3 The Sustainability Guide and Code of Practice will be updated every few years or more frequently if events require it.

1.9.4 The EfW Division of the WMAA is the peak national body, with Working Groups in most states of Australia. These Working Groups will submit editorial suggestions or factual modifications to the national body for assessment in the regular updating and review process.

[4] See http://www.wmaa.asn.au/efw/Final%20Summary.pdf for more information.

Section 2: Background and Context

This section gives more detail and background to the issues and drivers that must be addressed and resolved in the evaluation of sustainable energy from waste (EfW) projects. It is designed as a reference guide for the evaluation and assessment of related, collateral or contingent issues or projects.

2.1 Ecologically Sustainable Development (ESD) as the Primary Determinant

2.1.1 The management of urban wastes is an issue that goes to the heart of the social, environmental and commercial debate over the impact modern civilisation is having on the biosphere and its natural systems.

Establishing the benchmark

2.1.2 The framework adopted by the Working Group for the assessment and prioritisation of options is derived from Australia's National Strategy for Ecologically Sustainable Development (see Appendix D).

2.1.3 The definition of ecologically sustainable development (ESD)[5] adopted in this strategy is:

A pattern of development that improves the total quality of life both now and in the future, in a way that maintains the ecological processes on which life depends.

2.1.4 The overarching concept adopted in the Sustainability Guide is as follows:

Society's resources are to be managed in a way that improves our quality of life today without compromising the ability of future generations to improve their own quality of life.

What is sustainability?

2.1.5 This concept of sustainability accepts that all human and natural activity has an impact, but advocates that the biosphere must be capable of sustaining or absorbing these impacts[1]. Human activity that causes impacts which natural systems cannot repair is unsustainable. This unsustainability can be assessed by intensity and rate.

The Sustainability Guide looks to avoiding, minimising, reusing, recycling and reprocessing waste before considering the potential of EfW projects kicks in.

2.1.6 The Sustainability Guide has been developed to support and complement higher order strategies of avoidance, minimisation, reuse, recycling and reprocessing (facilitated through source separation) for inherent material recovery. It seeks to promote these outcomes before the step is taken to recover the calorific value through EfW projects (see 1.1.6).

---

[1] This application of sustainability requires the proactive implementation of the precautionary principle Appendix D ii).

[5] Note that the terms "ecologically sustainable development" and "sustainable development" are used interchangeably.

2.1.7 The destruction of finite resources for energy recovery alone can have lasting impacts on future resource availability and is not encouraged by this Sustainability Guide. The impacts of this are exacerbated when these materials still have the practical ability to furnish other higher value societal needs in substantially their current form or slightly degraded form.

Embodied energy needs to be considered

2.1.8 The importance of embodied energy needs to be considered at this point.

i) The embodied energy in an item or material is the energy expended to create the item or material and the energy that will need to be expended again if the material is to be replaced. This energy value is seldom reflected in the single calorific value that would be recovered by a traditional thermal energy recovery process (see 2.5.1 iv). For example, a textile made with a standard plastic will represent only a basic calorific value in a traditional thermal EfW process. However, this outcome will not reflect the energy expended to form the basic polymers or compounds from the original hydrocarbon source, nor will the energy expended in designing, manufacturing, marketing and distributing the product be recovered or recognised by the simple EfW end-of-life fate.

ii) The overarching interests of sustainable resource use place considerable importance on measuring and conserving embodied energy values. This is reflected in the preference given in the Sustainability Guide to higher order outcomes such as reuse, recycling and reprocessing for inherent resource value recovery (see 2.1.6).

iii) The balancing factor for the retention of embodied energy recovery is the effort, energy or resources required to actually reuse, recycle or reprocess the particular item that is presenting in an urban waste stream.

2.1.9 The principles of ESD have been adopted as a primary determinant for issues and options during the development of the Sustainability Guide since they establish a framework to balance social, environmental and commercial issues with the needs of both current and future generations.

2.1.10 These issues discussed in 2.1.1-2.1.9 above have been addressed in the preparation of PSP1 (see3.1).

2.2 The Nature of the Waste Considered

The Sustainability Guide deals with the residuals of three urban waste streams

2.2.1 The urban waste streams that are the focus of the Sustainability Guide originate from the following three main sources:

i) **municipal solid waste (MSW)** — the material generated by individual households and some small businesses. It represents the post-consumer spent and surplus materials that have traditionally been disposed of or discarded

ii) **commercial and industrial (C&I) waste** — the spent, surplus or unwanted materials that arise in the course of the primary productive activity. For the purposes of the Sustainability Guide this waste stream does **not** include by-products that also emanate from these productive enterprises. These will be applied as process inputs into some other activity since it is assumed that they will be channelled to some higher order application before presenting as a potential fuel

iii) **construction and demolition (C&D) waste** — the products of building demolition or alterations and the spent or surplus materials generated by building and engineering activity.

2.2.2 By their nature, the materials from these three waste streams present as **mixed** or **heterogeneous**. This is a direct product of the circumstances of their discard and will greatly affect how the materials might later be used if they are not to be simply discarded for landfill disposal.

2.2.3 Where the materials can be presented in **defined** or **homogeneous** streams, their ability to be reused or recycled is much enhanced, as is the case with kerbside recycling of domestic containers and paper, source-separated garden waste or source-separated wood, metals, glass and plastics from C&I or C&D waste.

2.2.4 The focus of this Sustainability Guide is the flow of **residual urban wastes** after higher order options have been thoroughly explored or those materials that, although homogeneous in nature, can be most sustainably used for energy recovery.

2.2.5 The Sustainability Guide has been developed as an assessment tool for urban wastes presenting for appropriate energy recovery as an option of last resort for materials that otherwise would be disposed to landfill.

2.3 Broad Characteristics of Residual Urban Wastes

The viability of an EfW project depends on the properties of the materials, their location and the energy recovery pathway or infrastructure

2.3.1 Although the materials in residual urban wastes are by definition indeterminate, in aggregate they demonstrate some broad characteristics. Generally these wastes will contain:

i) a moist organic fraction — this material comes from food residuals, soiled paper and garden organics and is predominantly lignocellulosic biomass in origin (renewable)

ii) a biologically slow or inactive high calorific fraction — this material consists of plastics, textiles, footwear and some wood, cardboard and paper and is predominantly hydrocarbon material of crude oil origin with some carry-over of lignocellulosic material

iii) metals — this consists of ferrous (iron and steel) and non ferrous (aluminium, copper and lead) materials. Metals can be extracted from the original waste material

iv) an inert fraction — this includes materials such as ceramics, dirt, grit, broken glass and rubble. These materials can be readily separated from the original waste material.

2.3.2 It is anticipated that a level of cross-contamination will occur between the four fractions identified.

2.3.3 Carry-over cross-contamination is addressed by the principles and protocols contained in the Sustainability Guide.

2.3.4 The location or geography of a potential source of urban waste is an important characteristic in assessing the potential for an appropriate energy recovery pathway. Issues of transport for aggregation to create viable volumes and the transmission of any electricity to be generated are both characteristics to be evaluated in determining the ultimate viability and sustainability of the EfW project.

2.3.5 The Sustainability Guide focuses on three urban waste streams: municipal solid waste (MSW), commercial and industrial (C&I) waste and construction and demolition (C&D) waste.

2.4 Community Perceptions of Energy Recovery Projects

2.4.1 Incinerating urban wastes as an alternative to landfill disposal has been practised widely for many years around the world, and still is. Increasingly incineration operations are retrofitting energy recovery capabilities and flue gas treatment systems to their facilities or replacing old plants with new facilities that seek to optimise the energy recovery in the form of heat or power as a valuable by-product of the primary operation. For ease of description we term these facilities "waste to energy" or "WtE."

2.4.2 Modern WtE facilities are one possible approach to the sustainable energy recovery from urban waste streams, especially in the light of recent technology improvements and the effort that is being directed to engineering out their potential negative impacts. However, the limits to these technological solutions must be recognised and considered in a transparent manner.

The Sustainability Guide promotes EfW when all other resource recovery options have been exhausted, not WtE as a by-product of incineration

2.4.3 The current community perceptions of this form of energy recovery from urban wastes could be coloured by past events and impacts. The business profile for these facilities tends to feature the following:

i) the core business is based on the disposal of the community's wastes. Energy recovery is an option or by-product of the core activity

ii) the efficiency and cost-effectiveness of the facility is closely dependent on waste volume and constant levels of throughput which have a tendency to require a large and dedicated catchment to provide supply for such a significant investment

iii) the wastes provided as feed to the facility are by definition indeterminate and of no fixed or certain origin or quality, even though they tend to demonstrate certain broad generic characteristics (see 2.2.2, 2.3.1). This lack of consistency could reflect a commensurate lack of control of the emission and ash quality from the facility and even certain operational impacts. Whilst many of these issues can now be managed by improved technology and engineering, these controls come at a cost.

2.4.4 The term "energy from waste" or "EfW" used in this Sustainability Guide is a simple terminology intended to promote projects and facilities that demonstrate a markedly different business profile from the WtE facilities outlined above. The business profile for EfW projects tends to feature the following:

i) the core business is the efficient recovery of energy from those fractions of the urban waste stream that have been identified as having no higher resource value other than energy recovery

ii) EfW provides the systems, facilities and infrastructure to recover energy efficiently without creating an incentive to generate waste or disrupt the flow of waste materials to their highest net resource value

iii) the immediate environmental consequences of EfW must demonstrate assured levels of control and management of impacts such as noise, pollutants, air and ash quality, as well as odour and traffic (see 3.5). **Given the indeterminate nature of the original urban wastes, if fuel preparation is not to be the primary strategy for controlling environmental impacts, the project would need to demonstrate post-conversion engineering and technological solutions that give the same or higher levels of confidence.**

2.4.5 Whilst WtE and EfW facilities may deliver substantially similar results and outcomes most of the time, it is perception and confidence issues that so concern the community.

2.4.6 Once urban wastes have been determined to have no higher resource value than energy recovery[6] the circumstances of their availability should inform the selection of the most appropriate conversion pathway.

[6] Note that the Sustainability Guide does not preclude the use of monofill as a long-term storage option. This would simply become one of the technology options to assess when considering highest resource value.

2.5 Energy Recovery Systems and Technologies

2.5.1 Detail on each technology is provided in Appendix H.

*Generic approaches for **unsorted** urban wastes*

Generic systems and technologies to recover energy from non-source separated or unsorted urban wastes include:

i) **conventional landfill with methane recovery** — the biogas that is recovered from landfill can be converted to heat, steam or electricity. The conventional landfilling of unsorted urban wastes generates methane or "biogas" through anaerobic degradation. Biogas is a significant, potentially explosive pollutant and greenhouse gas with a global warming potential 21 times that of carbon dioxide. Its recovery or extraction from traditional landfills is as much a pollution protection and safety measure as an energy recovery objective. However, even with today's best landfill practices, there are potential inefficiencies in biogas recovery including incomplete gas capture and greenhouse gas emission[7]

ii) **landfill designed to optimise biogas recovery** — the recovered biogas that is recovered from landfill can be converted to heat, steam or electricity. The landfill design and filling process can be done to optimise

a) the anaerobic, biogas generating activity

b) the systematic recovery of the biogas. Less gas is likely to escape to atmosphere over time, minimising the risk of a significant greenhouse emission impact from the biogas[5]

iii) **in-vessel anaerobic digestion (AD)** — the recovered biogas can be converted to heat, steam or electricity. Rather than rely on the relatively indeterminate boundary limits of a landfill, the same anaerobic digestion can be better controlled in a dedicated vessel or container. This allows the process to be conducted "wet" in a fully aqueous (added water) environment or "dry" using the inherent moisture in the material itself (perhaps 55% moisture). In either case, gas control can be absolute and gas generation rates optimised. The digestate will present for future treatment, beneficiation or processing to produce secondary products if required[4]

iv) **mass burn** — the heat evolved can be used directly or converted to steam or electricity. This approach can use a range of hearth configurations but the similar conditions of intense thermal oxidation aim to achieve complete "burn out" of the organic molecules to achieve complete mineralisation of the urban wastes which will present as heat evolved, ash and resultant gases. The gases that result must then be cleaned up or controlled before emission to the locally prevailing limits or standards. The ash must be similarly managed for reuse, recycling or disposal in accordance with local circumstances.

[7] In the three generic systems and technologies set out in i, ii and iii above it is only the organic biomass fraction of the urban wastes that is altered or converted by the process. The metals and inert materials remain substantially unchanged. A biologically stable organic fraction will result from the digestion for future processing, application or disposal. The primary outcomes of these systems or technologies are volume reduction, biochemical stabilisation and some calorific energy recovery.

v) **advanced thermal processes** — these include pyrolysis, gasification and plasma arc (see Annexure H for more detail).

In general these advanced thermal processes and technologies are unsuitable for **unsorted** or **non pre-treated** urban wastes (see 2.5.2 iii below).

*Generic approaches for **selected** urban wastes*

2.5.2 Generic systems and technologies to recover energy from selected or source-separated fractions of urban waste are set out below.

By definition, the following systems or technologies require and assume that the preferred fraction has been selected from the mixed and indeterminate urban waste feedstocks and pre-treated, screened or selected:

i) **in-vessel anaerobic digestion (AD)** — as for 2.5.1 iii above. However, where the moist organic fraction referred to in 2.3.1 iii above is processed without the other fractions of urban waste, a greater level of gas generation efficiency is possible. In this case the digestate is much more likely to be reprocessed into secondary products rather than directed for conventional disposal as a stabilised material

ii) **process engineered fuel (PEF)** — this approach to systematic energy recovery from mixed urban wastes usually focuses on the high calorific fraction (see 2.3.1 ii), but may also include carry-over components from the moist organic fraction (see 2.3.1 i). These materials most typically are processed at a specialised facility by sorting, screening, blending, drying and particle size control to produce quality-assured **alternative** or **supplementary fuels** for use by existing or dedicated conversion facilities (see 2.5.3). A feature of these facilities is the production of a supplementary or alternative fuel product that has defined, specified and assured qualities and characteristics. This allows the converter to establish their own product, process and emission quality criteria, with confidence that the fuel will have known and acceptable impacts.

This generic approach presents the maximum quantity of available high calorific fraction (HCF) for conversion to energy and retains the primary control of environmental impacts in the fuel preparation process rather than relying solely on gas clean-up and complex ash management techniques.

Another feature of the approach is that high calorific materials can be received and processed into fuel products as they are needed. Their future conversion can then occur as required to meet secondary market demand. Where existing facilities such as kilns and power stations act as the converter the capital cost of dedicated conversion facilities is avoided.

Process engineered fuel facilities play a convenient and cost-effective first point of receival role for waste collection vehicles similar to that currently played by transfer stations.

The alternative and supplementary fuel products that result can be forwarded to the dedicated conversion facilities as value-added products rather than as negatively valued wastes

iii) **advanced thermal processes** — these include:

a) **gasification** — thermal conversion of feedstock to a combustible gas in an oxygen-reduced atmosphere. The gas may be used as a fuel or chemical feedstock after clean-up

b) **pyrolysis** — the application of an external heat source in the absence of oxygen to produce reduced gas, oil and char products for immediate or future use

c) **plasma arc** — the application of an extreme heat source to convert the fuels into hot ionised gas for synthesis into the desired products.

These are sophisticated processes that can deliver significant advantages in terms of efficiency and control of process and product quality. They are invariably sensitive to feedstock quality and consistency and therefore most likely to be used for converting PEFs.

2.5.3 Secondary conversion facilities for selected or pre-prepared fuel products can present in many forms:

i) **existing facilities** — a range of industrial or power generation facilities currently exist that have been established on traditional fossil fuels (coal, oil, gas) and can be adapted to accept a proportion of alternative or supplementary fuels prepared from urban wastes.

Similarly, these PEFs can be “manufactured” to meet the precise requirements of existing industrial applications to ensure there is no detriment to the primary product quality or emission profile of the existing facilities (see 2.5.2 ii).

The potential facilities include:

a) cement and lime kilns
b) brick or masonry works
c) metal smelting and reduction plants
d) thermal power generation plants
e) miscellaneous facilities that generate industrial heat and steam.

As alternative fuels, the PEFs are manufactured to completely replace the existing fuel source.

As supplementary fuels, the PEFs are manufactured and supplied to co-fire with the existing fuel source in the desired or practical proportion

ii) **special purpose facilities** — in this scenario PEFs might be produced to a specification to exactly suit a new special purpose conversion facility such as:

a) an advanced thermal process (see 2.5.2 iii)

b) a dedicated power generation facility with a wide range of hearth configurations

iii) **embedded facilities** — these are usually smaller but very localised energy recovery facilities, even to the scale of the single facility converting its own waste material. An example of this is a sawmill converting offcuts and sawdust to produce heat, steam and/or power for its own use, perhaps with an excess to export from time-to-time or perhaps converting bagasse on-site to provide heat and power for sugar distillation. These facilities are increasingly adopting cogeneration techniques for optimum efficiency and cost-effectiveness.

The main features of embedded facilities with regard to the conversion of urban wastes are:

a) they are usually small-scale, for example up to 10 MW
b) they are localised and generally centred on one plant or industry for base demand
c) they are located to minimise transport and transmission costs
d) they often feature cogeneration for local heat and steam use, with excess power exported.

2.6 Interaction with the Community

A focus for the Sustainability Guide and Code of Practice is to facilitate the granting of a broad-based community licence to operate for appropriate and sustainable EfW projects. This involves providing information and facilitating active involvement so that the community can exercise its ultimate responsibility through an informed, transparent and accountable process or framework.

2.6.1 Whilst the term "community" includes every party potentially involved in evaluating a particular project or issue, the main stakeholders have been defined as community, government and industry (see 1.7.1). As such, government represents the statutory authorities that are charged with interpreting the community will and common good. Community in this instance seeks to reflect:

i) neighbouring residents, workers, businesses and sensitive landuses such as schools, community centres and aged care facilities

ii) the electorate (local, state, federal)

iii) environmental NGOs

iv) special interest groups.

By this definition the community is a powerful force that could organise and act to influence government and industry on significant issues.

2.6.2 Given the benchmark of sustainability as the primary determinant of appropriate projects and the requirement for a broad-based community licence to operate as a basic necessity for an appropriate project to proceed, the community has a crucial role to play (see 2.1, 1.10.2 i).

2.6.3 The community role is to interpret the sustainability issues on behalf of current and future generations. This requires active interaction between the stakeholders to assist them to carry out their tasks and responsibilities.

2.6.4 The community needs to be actively involved, fully informed and engaged regularly and transparently in order to make its decision responsibly. The Sustainability Guide provides a structure or framework to facilitate this outcome.

2.6.5 To facilitate this interaction between the stakeholders the Sustainability Guide outlines a process and framework for:

i) **providing information** — the information provided must be topical, of an appropriate quality and readily accessible. It needs to cover the following topics as a minimum:

a) the issues and context

b) the details of the specific proposal

c) the outcomes, impacts and benefits

d) the determining factors

e) the process for project assessment and determination

ii) **stimulating involvement** — the rights of and necessity for the community to be intimately involved in the decision-making process is matched by a responsibility to undertake the task thoroughly. Action and involvement are essential for this to occur and can be stimulated if required by:

a) an iterative and interactive approach that matches involvement, information and interaction as suits the status of the proposal

b) an "early and often" approach that encourages active involvement whenever new information or material advances on a proposal occur

c) a consultative approach that provides transparent and accountable feedback mechanisms

iii) **maintaining a transparent and accountable process** — for all the stakeholder groups to be able to act and interact with confidence and goodwill, the process must be fair and transparent and the parties must be accountable for their actions and the decisions they make on behalf of their respective constituencies. The adoption of a transparent and accountable process is the best insurance that projects will be thoroughly evaluated and critiqued and the final decision to approve, amend or reject a proposal delivered in an environment that can be substantiated.

2.7 Issues to be Evaluated and Assessed for a Successful Project

As outlined in this section and reinforced during the extensive consultation and workshop process[8], a number of key issues emerge that must be addressed and resolved for a project or proposal to:

i) receive a widely endorsed licence to operate from the community

ii) optimise the sustainability of the project or proposal.

2.7.1 Best Use of the Available Resources

The evaluation of best resource use goes to the heart of the sustainability issue. This issue is of paramount importance because of the irreversibility or binary nature of the decision to recover the calorific value of the materials concerned (see 1.2). If it can be shown that potentially available urban wastes can be directed for higher value reuse, recycling or reprocessing in substantially their current form, then it is immediately apparent that EfW is not the correct action. In those circumstances all other issues of efficiency, environmental and social impact and economic consequence will not require assessment or evaluation.

2.7.2 Assessment of Consequences, Impacts and Commitment

Once potentially available fractions have been identified as being suitable for appropriate conversion to energy, then the circumstances of their arising and presentation can inform the most effective conversion pathway. This can be decided after considering:

i) the net efficiency of their conversion. Inefficient conversion results in wasted resource value (see PSP2 and Section 3 for a description of the PSPs)

ii) whether there is adequate control of the environmental impacts that will occur. In all circumstances this is a critical factor in receiving consent to operate. It will be demonstrated by control of the fuel preparation and conversion processes (see PSP3)

iii) adequate assessment, evaluation and control of the social consequences of a potential project. These issues are of significant consequence to neighbours, the electorate and traditional or special purpose NGOs (see PSP4)

iv) the importance of demonstrating the ability to deliver on the long-term commitments made at the time of initial consent. This amounts to a proven ability to make good on commitments and control measures over the life of a project — perhaps 20–30 years — and not just at the consent and approval stages (see PSP5)

v) the potential commercial impacts on higher order reuse, recycling or reprocessing options. Before the project is operational, it is crucial to document that no higher resource value programs will be negatively impacted (see PSP6).

Throughout the evaluation process for i-v above there is a need to ensure that the full suite of environmental externalities has been systematically evaluated and included in any final assessment or decision.

[8] See http://www.wmaa.asn.au/efw/Final%20Summary.pdf for more information.

2.7.3 Throughout the project evaluation phase the community needs to be consulted proactively and the actions and decisions of all stakeholders continually monitored and reviewed in a fully transparent and accountable framework. The Sustainability Guide has been designed to provide this framework.

Section 3: Project Scoping Principles for EfW Projects

This section summarises and resolves the outcomes of the national consultative workshops and the issues reviewed in the two previous sections. It presents a series of key project scoping principles (PSPs) that can be used to assess the sustainability of any energy from waste (EfW) project or proposal. The PSPs are fundamental to the use of this Sustainability Guide.

3.1 Introduction to the PSPs

Project scoping principles or PSPs take the guesswork out of assessing the sustainability of an EfW project

3.1.1 The following PSPs have been developed from the national consultative workshops to provide a recognisable structure for assessing the sustainability of an EfW project. The PSPs aim to:

i) help potential EfW projects be conceived, scoped and structured to optimise the potential of sustainable energy recovery from the appropriate fractions of urban waste whilst minimising or eliminating the potential disadvantages (see 1.3)

ii) provide a common reference for the evaluation of potential projects as they seek to “justify their demand” or acquire their basic “licence to operate” from the community and its duly authorised consent and approval authorities

iii) provide an integrated and structured reference for the ongoing assessment and monitoring of a project or facility that does acquire a community licence to operate.

3.1.2 The process of profiling a project and assessing sustainability has the following features, which are also shown graphically in Figure 3-1:

i) **satisfaction of PSP1** — if it cannot be demonstrated that conversion to recover the calorific value of the materials in question is the most sustainable use of the materials, no further project assessment needs to be undertaken. Whilst this initial assessment may be undertaken by any stakeholder, it is most appropriate if undertaken by the current owner or generator of the waste

ii) **assessment of optimum conversion pathway** — for the materials or resources presenting for recovery of calorific value an iterative framework is proposed that includes evaluation against PSP2–6 within a process that advocates:

a) proactive consultation with the community (see 2.6.3)

b) continuous monitoring of the likely impacts of a proposal and the incorporation of environmental and social externalities at each stage.

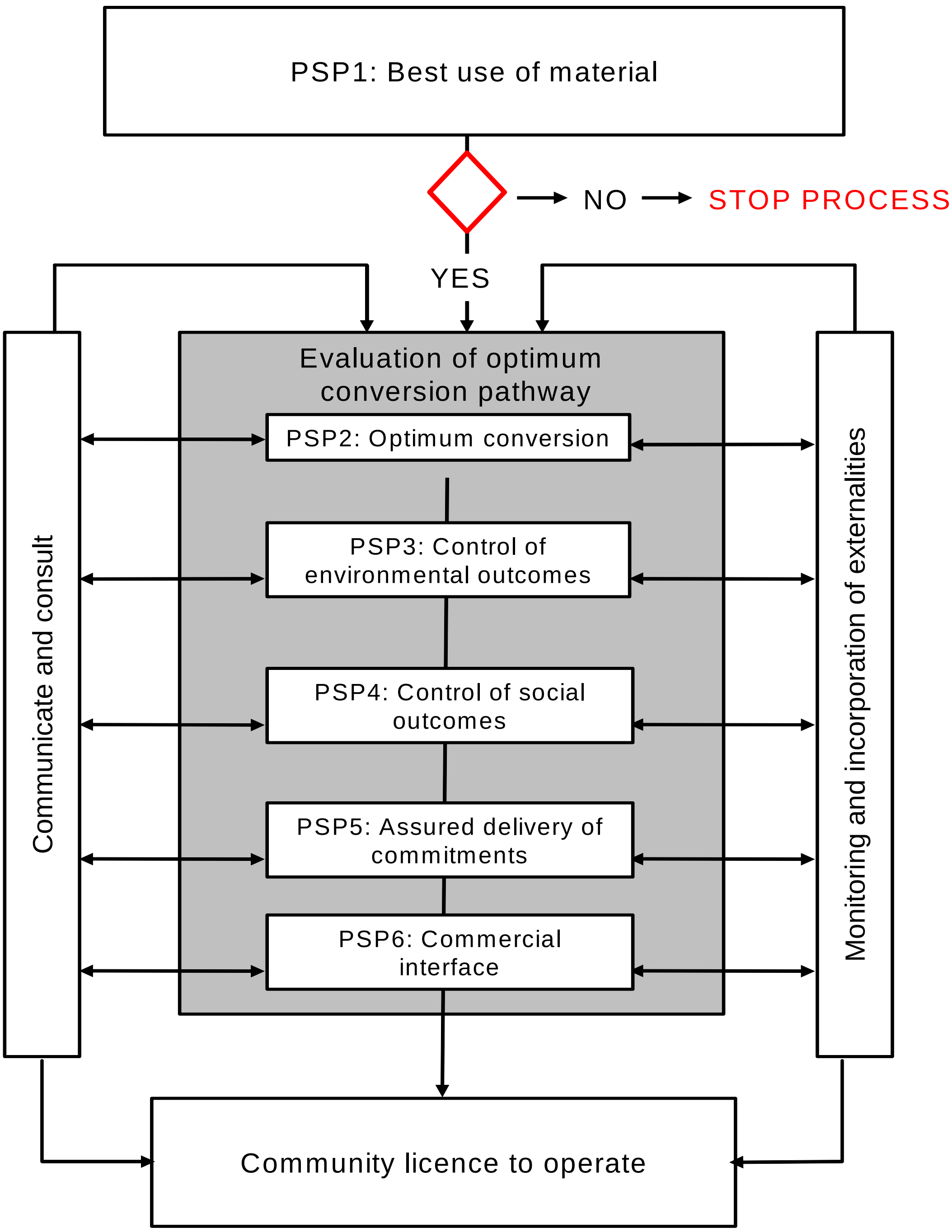
The PSPs are designed to streamline the assessment process

The Sustainability Guide proposes that the current waste owner, generator or project developer be responsible for demonstrating the optimum conversion pathway

iii) **application for formal consents and approvals** — this stage should be greatly simplified for both applicant and consent authority through the demonstration of a general licence to operate from the community.

3.1.3 The proactive and conscientious application of the project profiling and assessment process shown in Figure 3-1 can reduce the potential for misunderstandings between stakeholders and avoid potential delays due to objections since these may not be raised if the PSPs are used. The process also identifies projects at an early stage which do not demonstrate sustainable resource use. This avoids the considerable time and expense that would be incurred by both applicants and consent authorities if a formal consent or approval process were to be undertaken (see 1.5). In this case the community would be justified in withholding a licence to operate.

Figure 3-1: Assessment Roadmap of Project Scoping Principles



3.2 Profiling EfW Projects and Proposals

The following PSPs and the corresponding assessment process outlined in Figure 3-1 above allows the potential of an actual EfW project to be profiled to provide a qualitative and widely recognised assessment. If this is positive, it can provide a firm basis for a more quantitative assessment as part of any future formal consent, approval and licensing procedure.

3.2.1 The profiling process is based on assessing a project or proposal against the six PSPs that have been identified as accurately representing the issues of ESD and community interest.

3.2.2 The commercial assessment that might occur after a project has achieved a positive assessment against these sustainability criteria is assumed to be an independent process for a project proponent[9].

3.2.3 Each of the following PSPs is addressed as follows:

i) PSP title

ii) PSP statement of purpose or objective

iii) explanatory notes to assist assessment

iv) some suggested compliance criteria or approaches

v) qualitative assessment matrix.

3.2.4 The qualitative assessment matrix provides a framework for comparative evaluation. It is designed to give the stakeholders confidence that the quantitative assessments that will be required during the formal consent or approval processes are appropriate.

[9] However, a project that demonstrated a positive sustainability assessment and therefore an important role in delivering a sustainable resource outcome for the community's urban wastes but failed a standard commercial viability assessment by the project proponent might be a candidate for public support or subsidy as a tangible internalisation of certain ESD externalities.

3.3 PSP1: Best Use of the Available Materials

This assessment is best done by the waste owner or generator

3.3.1 The purpose or objective of PSP1 is:

to demonstrate that the application of the urban wastes being considered for conversion for their calorific value represents the most sustainable application of the resources.

3.3.2 Explanatory Notes to Assist Assessment

It is proposed that the following assessment is to be completed for the urban wastes under consideration by their owner or generator. This approach is aimed at both facilitating the acquisition of data and information that will most accurately describe the circumstances of their arising and presentation in their current form, and most directly informing the development of alternative strategies should they emerge as possible or beneficial. An audit and assessment of the materials in question should allow the following profile to be systematically addressed:

i) did the particular urban wastes need to be generated in the first place and is the primary activity or product design justified or could the activity have been altered or amended to avoid generating the waste?

Responses to this very fundamental initial question could have considerable impact on many of the future values and assessment criteria, especially where a point source or specific activity can be identified. For materials such as mixed residual MSW the assessment may be more subjective and could include:

a) justification of demand for the generic product or service

b) attention to sustainability and resource use issues at the point of design or product initiation to achieve the optimum post-consumer fate for the product or service

c) the clean production disciplines

ii) if the production of the wastes was unavoidable and justified, could the volume, toxicity or heterogeneity have been reduced at or before the point of generation?

iii) once a particular urban waste is confirmed and identified, could all or any fraction of the materials have been beneficially directed for some form of reuse, perhaps as a supplement to the original raw materials or related to the original purpose or function?

iv) could all or any of the materials presenting in the confirmed and identified urban waste stream be beneficially directed for recycling into substantially the same originating material (for example, paper-to-paper, glass-to-glass, plastic-polymer-to-plastic-polymer, metal-to-metal)?

v) having reviewed the possibilities in i–iv above, could all or some of the materials in the urban waste be beneficially reprocessed into some other raw material stream or product?

Responses to ii–v above will be much assisted if the research for i above has been thorough and systematic and properly addressed under the headings of clean production and post-consumer planning.

If questions i–v above are answered in the negative, then the calorific value potential needs to be assessed, evaluated and considered before determining the materials' fate of last resort such as the need for stabilisation or treatment to make them suitable for landfill. The following issues and all future decisions will be materially affected by the circumstances of their arising and the rate of availability of the urban wastes in question:

a) geography — where the materials initially arise will materially influence all issues of critical mass, transport and aggregation

b) rate of arising — the materials may arise sporadically, regularly or seasonally or in variable or reliable rates of presentation

c) reliability of presentation — the materials may present as short-, medium- or long-term opportunities

d) quality and content — the auditable quality characteristics of the materials will inform the selection of future processes.

These issues will be vital determinants of the options, scale or viability in the assessment of PSPs 2–6 below.

The consideration of existing or potential markets for resource streams and their availability or saturation must also be included in the assessment in PSP1. However, it should be noted that EfW projects will not prevent other markets for recoverable resource streams developing.

3.3.3 Some Suggested Compliance Criteria or Approaches

The assessment and evaluation of performance against these criteria may never be an exact science, but the ultimate granting or declining of a community licence to operate may never be able to be objectively determined either. The task is to demonstrate that the key issues and criteria have been systematically and conscientiously addressed and that practical, commonsense, fair and equitable conclusions can and have been drawn.

There are emerging assessment tools that might be adopted in whole or in part to provide greater levels of assurance and certainly in certain circumstances. These include:

- life cycle assessment (LCA)
- materials flux analysis (MFA)
- environmental accounting
- risk assessment
- general research and best practice benchmarking.

However, the adoption of these tools will still require value judgements and artificial boundary or process parameter determinations. As such, they need to be used with careful consideration of their effects on the more intuitive and subjective opinions of the general community.

This Sustainability Guide suggests that the current waste generator be responsible for the structured responses to these criteria, since they are best placed to influence the outcomes. This is especially valid in an EPR context[10].

3.3.4 Qualitative Assessment Matrix

Because of the importance of granting a community licence to operate, the responses to these criteria must be sufficiently well developed and communicated to allow reasonable assessment.

Table 3-1: PSP1 Qualitative Assessment Matrix

Issue	Assessment		
	Yes or not applicable (N/A)	**No**	**Provisional**
i) Is there justification for the generic product or service that generated the urban wastes in question?			
ii) Has sustainable resource management been adequately addressed at the point of product initiation or design?			
iii) Have the clean production disciplines been conscientiously observed and implemented up to the point of consumption?			
iv) Has resource value been optimised throughout the supply chain to create the opportunity for optimal reuse, recycling and reprocessing?			
v) Are the resultant wastes unavoidable?			

- *A **yes** or **N/A** response to each question should facilitate a simple response to the next stage (see Table 3-2).*
- *Any **no** response would suggest a review of the circumstances that drew that response since if they are left unaltered these issues are likely to feature prominently in any future consent or approval process.*
- *Any **provisional** responses may also draw attention during a formal consent or approval process but may be offset by positive responses to all other criteria.*

---

[10] Assessment at this fundamental and initial stage highlights the important link between design intent at the product initiation stage with the range and serviceability of systematically available options for both the by-products from the production process and the post-consumer fate of the products or packaging themselves.

The urban wastes that are the subject of this Sustainability Guide arise as by-products of the productive processes as well as post-consumer discards. The interface between designing products and services sustainably and sensitively for a secondary resource or post-consumer fate that cannot be provided is as wasteful as providing secondary resource recovery services that are sub-optimised by inconsiderately designed products or packaging (eg. making a "recyclable" soap container that although made of cardboard, has a metal spout, a plastic handle and non-recyclable coating). The concepts of extended producer responsibility (EPR) and/or product stewardship (PS) have a direct and causal relationship with the (usually government) role of waste management planning or secondary resource recovery, reaggregation and systematic value recovery.

The provision of EfW options and facilities should be seen as providing for the recovery of the most sustainable inherent energy values from materials that were specifically designed or made available for such a fate.

Table 3-2: PSP1 Evaluation Matrix

Issue	Assessment		
	Yes	No	Provisional
In light of the quality of the information provided and the above responses, on balance has the case been sustained that the materials in question have no higher resource value than to be converted for their calorific value?			

- *A **yes** response would suggest that a move to PSPs 2–6 was appropriate.*
- *A **no** response would indicate that a move to PSPs 2–6 was unlikely to be worthwhile.*
- *A **provisional** response would indicate that a move to PSPs 2–6 might be appropriate, especially if very positive results could be expected from future assessments. However, a systematic review of the suitability of the apparently available materials for conversion to energy might be more rewarding.*

3.4 PSP2: Selection of the Optimum Conversion Pathway

3.4.1 The purpose or objective of PSP2 is:

to demonstrate that the selected process and pathway for the conversion of the urban wastes for their calorific value are the optimum ones for the available materials.

3.4.2 Explanatory Notes to Assist Assessment

i) A sub-optimal or inefficient conversion process and pathway represents wasted resource value. Wasted resource value represents unsustainability and is to be avoided on both environmental and economic grounds.

ii) The concept of the conversion pathway reflects the geography of the initial arising of the wastes in question and requires consideration of the costs and impacts of any future transport or aggregation to attain critical mass or access to a suitable conversion process (see 3.3.2 a). Where conversion to electric power is being considered, future power transmission issues have an impact on the final determination of the optimum result.

iii) Urban wastes usually present as a mixture of different materials which individually have quite different conversion characteristics such as different flash points, ash content and optimum combustion and burn-out properties. There will even be differing moisture levels and inert contaminants within each of the constituent materials. In these circumstances the selection of the conversion process will need to reflect these complexities.

iv) Optimal conversion efficiency may be best demonstrated where both heat and power recovery are achieved (cogeneration). Conversion efficiency may be expressed simply as operational efficiency; that is, the useful output of energy divided by the total energy input. At a more complex level, issues such as fuel processing and pathway and transport activities need to be considered and compared with locally available energy sources or alternatives.

v) Feedstock preparation can play a role in:

a) narrowing the range of optimisation for the selected process

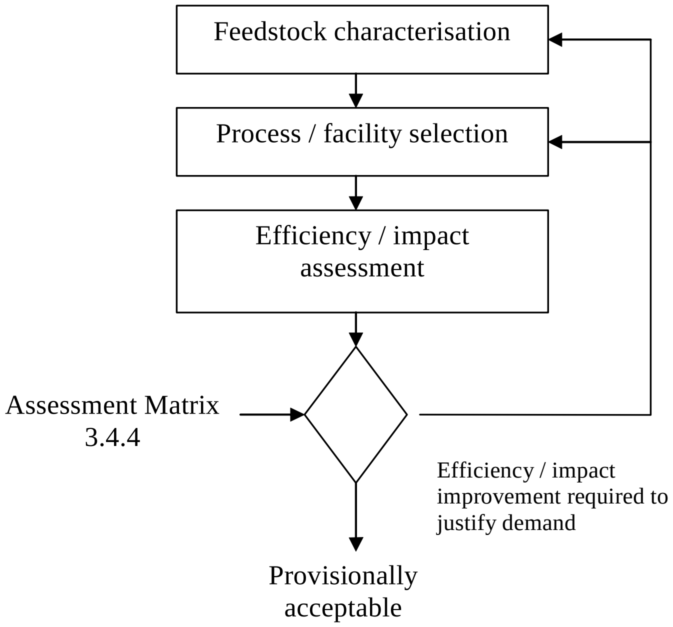
b) demonstrating control of impurities and contaminants

c) providing evidence that any higher value materials have been identified and recovered

d) providing first order value-adding to materials that are identified for future transport and aggregation to larger scale and more efficient facilities.

3.4.3 A three-stage iterative review process is proposed as shown in Figure 3-2:

Figure 3-2: PSP2 – Iterative review process



i) **feedstock characterisation** — the initial supply of urban waste has been identified in PSP1. The characteristics of this material need to be recorded as to:

a) geography — where the materials initially arise or present as an opportunity for assessment and potential resource recovery

b) rate of arising — the volume or quantity of the urban wastes available for assessment

c) reliability of presentation — the seasonability or fluctuations in the availability of the materials including a review of the short-, medium- and long-term prospects for the continued generation of the urban wastes

d) quality and content — a physical and biochemical analysis of the materials including a review of potential changes over time (see c above).

A review of these characteristics will enable an initial needs analysis to be completed that will describe the development of an optimum process specification to accommodate the conversion of the available materials for their calorific value

ii) **conversion pathway, process, facility and site selection** — a range of issues will need to be assessed and reassessed to identify the best fit with the needs analysis and process specification developed in i above including, but not limited to:

a) **on-site, local and embedded facilities** — these facilities or processes would include either new or existing facilities that are suitable to convert the specific materials in question and could include systems mentioned in Section 2.5 (see 2.5.3 iii)

b) **regional facilities** — these facilities, also outlined in Section 2.5, will require a transport or transmission factor to be considered, and may represent an opportunity to aggregate the materials to improve economies of scale or improve the profile of all or any of the factors set out in 3.4.3 i a, b, c and d above

c) **site selection** — the selection of a specific site for the project is an important consideration and, in particular, its proximity to resource supply and the community

d) **sole, alternative or supplementary feed** — the materials might be converted as a sole feed to a new or existing process, as an alternative to some existing feed or as a supplement to an existing feed into a new or existing conversion process

e) **process track record and reliability** — any conversion pathway or specific process in any of the above combinations needs to be assessed for innovation, its track record in similar service, its reliability and general ability to deliver proven and acceptable outcomes

iii) **efficiency and impact assessment** — this process may be conducted iteratively as different combinations of i and ii above are considered. Both qualitative and quantitative items will need to be included.

Eventually the **efficiency** of the proposed process compared with alternative sources of energy locally and the **impacts** (PSPs 3, 4, 5 and 6) will need to be presented in a format and with a level of community credibility which allows reasonable and informed members of the community sufficient justification for granting a community licence to operate. The presentation of an audit trail of the research and assessment undertaken to establish the efficiency and impact values is therefore recommended

iv) **iterative development of options** — after an initial assessment as described in i and ii above, the results at iii may appear sub-optimal, in which case other options may be considered to improve the outcomes, such as:

a) aggregation with other urban wastes — in this situation other sources of materials that can pass the evaluation criteria for PSP1 might be identified that improve the rate and reliability of arising issues and/or quality and content characteristics. Aggregation might involve the original materials being transported to a regional facility or regionally sourced materials being aggregated at the original location

b) transport and transmission issues — aggregation involves net process efficiency and impact criteria to reflect the transport costs and impacts and, in the case of energy generators, future transmission costs and losses

c) review of conversion pathway and process options — following a needs analysis and process specification revised by research into ii) a & b above, the amended situation will require a review of the conversion pathway and process options before a revised efficiency and impact assessment is undertaken

d) assessment of impacts in relation to the receiving environment — this should be done bearing in mind the specific conditions and characteristics of the local or receiving environment since impacts such as emissions to air, water or land, traffic, noise, job creation and local commerce will all be regionally specific.

3.4.4 Qualitative Assessment Matrix

This proposed assessment process assumes that sufficient iterations of the review of 3.4.3 i, ii and iii have occurred independently to provide the basis for the following assessment.

Table 3-3: PSP2 Qualitative Assessment Matrix

Issue	Assessment		
	Yes or not applicable (N/A)	**No**	**Provisional**
i) Has the potential feedstock characterisation occurred to a level of certainty sufficient to objectively scope future conversion pathway and process options?			
ii) Have issues of potential feedstock aggregation been considered to a level that is sufficient to objectively scope future conversion pathway and process options and consider additional transport and transmission issues?			
iii) Has feedstock preparation and pre-treatment been thoroughly evaluated in the development of the proposed conversion pathway and process especially in regard to improving logistics, efficiency and impacts?			
iv) Does the selection of the proposed conversion pathway, process or facility demonstrate a thorough evaluation of all the options within the context of the specific feedstocks available?			

- *A **yes** or **N/A** response to each question should facilitate a simple response to the next stage (see Table 3.4).*
- *A **no** response to any of the questions would suggest that a review of the particular issue was advisable. **No** responses are likely to feature prominently in any future formal consent or approval process.*
- *A **provisional** response to any of the above questions may also draw attention during a formal consent or approval process but may be offset by positive responses to all other criteria.*

Table 3-4: PSP2 Evaluation Matrix

Issue	Assessment		
	Yes	**No**	**Provisional**
In light of the responses and information provided, can a position be sustained that, on balance, the selected conversion pathway and process is the most efficient for the urban wastes in question?			
Note The issue of the resultant impacts of the project will be evaluated in PSP3 below.			

- *A **yes** response would suggest that a move to PSPs 3–6 was appropriate and that preliminary community consultation could proceed on the basis of the information that had been generated from PSPs 1 and 2.*
- *A **no** response would suggest that further review of the options was required before continuing or that the proposal should proceed no further.*
- *A **provisional** response would indicate that positive results from PSPs 3–6 could improve the project's sustainability profile but that the project was unlikely to satisfy a formal consent or approval process in its current form.*

3.5 PSP3: Control of Environmental Impacts and Outcomes

3.5.1 The purpose or objective of PSP3 is:

to demonstrate that the selected conversion pathway and process and management systems will provide control of all environmental impacts and outcomes.

3.5.2 Explanatory Notes to Assist Assessment

i) Unless they are separated at their source, urban wastes almost by definition present as mixed and indeterminate.

ii) Conversion pathways and processes may be adjustable but will tend to be optimised at certain preset process conditions.

iii) Where materials of indeterminate consistency are processed via a consistent process, the outcomes may well be as variable and indeterminate as the original feedstocks.

iv) This variability may be managed by tertiary processes broadly scoped to treat any unacceptable impacts or outcomes as and when they occur. These techniques can be employed in such areas as gas clean-up, water treatment or ash management. However, there is an inherent inefficiency in this approach since it requires a process to be designed and operated at all times, regardless of whether or not the particular impact is present or evident at any particular time. An alternative approach is to pre-treat or pre-process the feedstocks to remove the indeterminate nature of the material before processing or converting them (see 2.5.2 ii and 2.4.4 iii).

v) **This Sustainability Guide advocates the pre-treatment or fuel preparation route since it has the greatest potential to provide the greatest level of impact control or certainty of outcomes (see 2.4.4 iii).** Fuel preparation by mechanical, manual or automated systems to produce a product to a defined specification that can be made available for direct conversion will not only demonstrate the greatest level of assurance to the community but will allow for a more targeted conversion process design that incorporates management systems to deal with any tertiary impacts.

vi) Fuel preparation can occur at the point of generation as part of the aggregation or logistics network or at the conversion plant itself.

vii) Site availability and selection will be an important factor requiring consideration. Factors to be considered include size, transport access, proximity to the resource, market, community and any sensitive natural surroundings.

viii) The demonstration of appropriate quality assurance/quality control (QA/QC) systems is essential for satisfaction of this PSP. Some of the poor public perception of energy recovery from wastes originates from environmental impact issues.

Historically incineration was adopted as a disposal-based technology that sought to destroy or reduce the volume and toxicity of urban wastes by intense thermal oxidation, with any energy recovery as a by-product of the main activity (see 2.4). The process accommodated the heterogeneous and indeterminate nature of the wastes. If environmental impacts were recognised as an issue they were dealt with by ever-more complex gas clean-up, water treatment, ash management and OH&S techniques.

ix) The EfW approach in this Sustainability Guide does not advocate the destruction or disposal of urban wastes for their own sake. Rather, it seeks to recover the calorific value from those materials that have no higher resource value than to be managed in this way. A fundamental difference between the two approaches is reflected in the QA/QC procedures adopted. An example of this is the pre-treatment or preparation of available wastes into specified fuel products.

x) EfW projects must adhere to the environmental standards in the state where they operate. These require the management of by-products from EfW projects including ash, char and digestate to comply with relevant standards.

xi) Approaches in this PSP are typical of those that need to be addressed in formal approvals from permitting authorities, facilitating formal interactions when required.

3.5.3 Some Suggested Compliance Criteria or Approaches

i) In the first instance the potential impacts from a particular conversion pathway or process will have been defined in evaluation of PSP2 (see 3.4.3 iii).

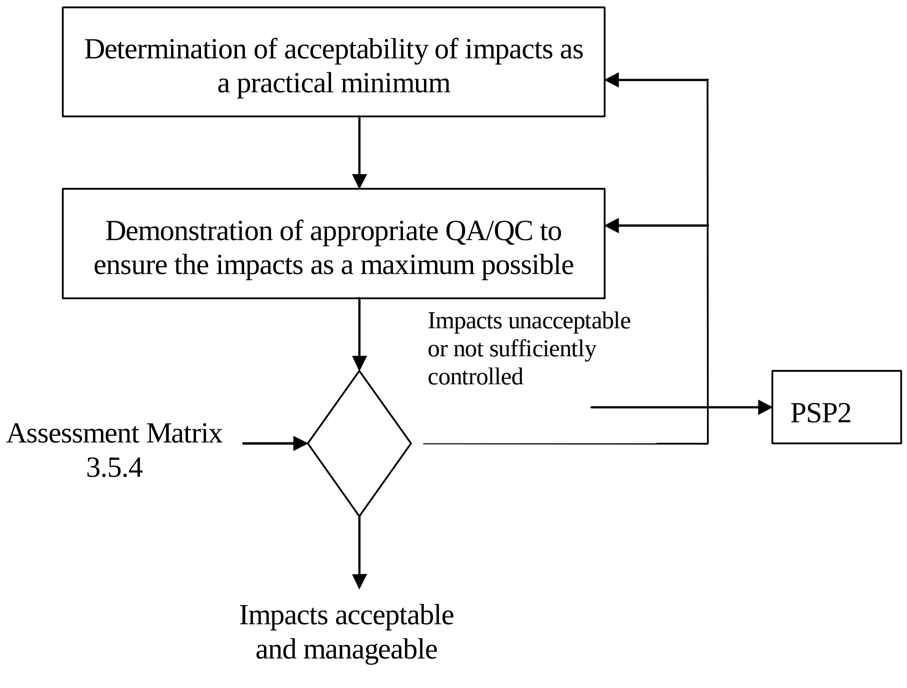
ii) To demonstrate compliance with this PSP proponents need to:

   a) determine that these impacts are acceptable and of a minimum that will sustain project viability

   b) demonstrate that if any environmental impacts are accepted as reasonable and in proportion to the benefits that they can be systematically controlled throughout the entire life of the project.

This gives rise to a proposed two-stage iterative review process to satisfy this PSP as shown in Figure 3.3: PSP3 - Iterative review process.

Figure 3-3: PSP3 – Iterative review process



iii) The basis for demonstrated QA/QC may be:

a) strategic

b) mechanical

c) systematic

d) a combination of all three.

In any case, evidence would need to be presented that would lead to the conclusion by a suitably informed party carrying out a reasonable assessment that these issues had been thoroughly and conscientiously addressed.

3.5.4 Qualitative Assessment Matrix

This assessment process assumes that sufficient iterations have occurred between 3.5.3 ii a, b and PSP2, if necessary, to provide the basis for the following assessment.

Table 3-5: PSP3 Qualitative Assessment Matrix

Issue	**Assessment**		
	Yes or not applicable (N/A)	**No**	**Provisional**
Are the projected impacts such as emissions and residuals management acceptable as a practical minimum in proportion to the potential benefits and in light of the local, regional or national circumstances?			
Has a sufficient level of control of the impacts been demonstrated to ensure that they will be the maximum experienced for the duration of the project?			

- *A **yes** or **N/A** response to each question should facilitate a simple response to the next stage (see Table3.6).*
- *A **no** response to either question would suggest that a review of the particular issue was advisable. **No** responses are likely to feature prominently in any future consent or approval process.*
- *A **provisional** response to either question may also draw attention during a formal consent or approval process but may be offset by positive responses to all other criteria.*

Table 3-6: PSP3 Evaluation Matrix

Issue	**Assessment**		
	Yes	**No**	**Provisional**
In light of the responses and information provided, can a position be sustained that control of the potential impacts can be maintained for the duration of the project?			

- *A **yes** response would suggest that a move to PSPs 4–6 was appropriate and that preliminary community consultation could proceed on the basis of the information that had been generated from PSPs 1, 2 and 3.*
- *A **no** response would suggest that a further review of the control mechanisms was required or that the proposal should proceed no further.*
- *A **provisional** response would indicate that positive responses to previous or future criteria would be required to provide the level of confidence necessary in a formal consent or approval process.*

3.6 PSP4: Control of Social Impacts and Outcomes

3.6.1 The purpose or objective of PSP4 is:

to demonstrate that measures are in place to adequately manage social and economic impacts for the duration of the project.

3.6.2 Explanatory Notes to Assist Assessment

i) The establishment of an EfW project, whether embedded, local or regional in scale and whether adopting new or existing conversion facilities, can have social and/or economic impacts on the community. These impacts might include:

a) concern over direct environmental impacts such as:
- emissions to air
- emissions to water
- emissions to land
- biodiversity and ecotoxicity concerns
- traffic issues
- increased noise profile
- greenhouse issues
- odour
- dust
- vermin and vectors (see 3.5)

b) employment and training issues

c) OH&S issues

d) local amenity issues and aesthetics

e) commercial effects locally, regionally and nationally

f) pricing signals, effects on other programs (e.g. recycling)

g) delivery of genuinely sustainable resource management outcomes

h) offsets and community infrastructure.

ii) Many of these issues and impacts will be weighted differently in different locations and circumstances and depend on site availability and selection. Different views or perspectives can arise from local, regional and larger scale community interests. For example, a remote rural application may value the employment and commercial benefits more highly but consider impacts of traffic and amenity more negatively. The measurement of net environmental impacts will also be a direct result of considering the totality of the effects within the context of the receiving environment.

iii) Many of these impacts such as b, d, e, f and g above may be observed positively as well as negatively and a community licence to operate may be granted as a result of various representations or understandings on these issues. The objective of this PSP is to ensure that the project is structured so that it can demonstrate an ability to manage and deliver the anticipated social outcomes.

3.6.3 Some Suggested Compliance Criteria or Approaches

i) The direct anticipated environmental impacts will have been established in PSP3. However, the concern will be best managed by a structured program of communication, education and engagement conducted in a participatory, accountable and transparent manner.

This dialogue must be genuinely informative since the objective of sustainable resource use requires responsible decision-making by all stakeholders (see 2.6).

ii) Where a new project has the potential to influence local employment or training opportunities, some measure of assurance needs to be provided that these expectations are realistic.

iii) A monitorable OH&S plan needs to be presented to give confidence that the projected OH&S outcomes will be achieved.

iv) Similarly, an environmental monitoring program needs to be presented to demonstrate commitment to responsible environmental management throughout the life of the project.

v) Process pathway and conversion facility designs need to be sufficiently advanced to allow the community to make fully informed decisions as to local amenity and aesthetics.

vi) Pricing signals for the maintenance and promotion of sustainable resource use are addressed in PSP6. However, new developments will have effects, especially in the local area. These impacts need to be sufficiently defined to allow objective assessment.

vii) The social issues and impacts can be the most subjective or difficult to define or satisfy and yet they may be the very issues that most materially affect the granting of the community licence to operate. For this reason, proactive, informed and sensitive consultation is recommended to ensure the greatest level of common understanding before decisions are made.

viii) In the case of compensatory offers such as the provision of sporting or recreational facilities donations or ongoing royalties, transparency and accountability are vital, as is confirmation of the ability to deliver on behalf of the party making the offer[11].

ix) The objective of this PSP is to demonstrate that the social and economic impacts:

a) have been adequately described and quantified

b) are acceptable to the community

c) can be controlled or delivered in substantially the form described for the life of the project.

3.6.4 Qualitative Assessment Matrix

This simple assessment process assumes that sufficient iterations have occurred between 3.6.3 ix a, b, c and other PSPs as required.

[11] Generally, compensatory offers should be considered as unsatisfactory if their primary purpose is to seek to justify what would otherwise have been considered as genuinely unsustainable impacts.

Figure 3-4: PSP4 – Iterative review process

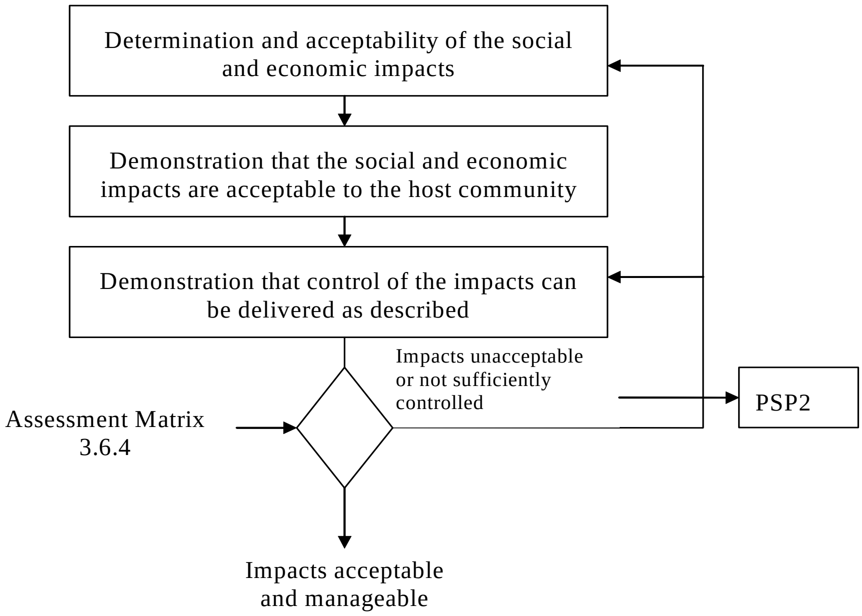


Table 3-7: PSP4 Qualitative Assessment Matrix

Issue		Assessment		
		Yes or not applicable (N/A)	**No**	**Provisional**
i)	Have the social and economic impacts been adequately determined and identified?			
ii)	Is there evidence that the anticipated social and economic impacts are acceptable to the determining community?			
iii)	Can it be demonstrated that control exists to deliver the impacts as described or better?			

- *A **yes** or **N/A** response to each question should facilitate a simple response to the next stage (see Table 3-8).*
- *A **no** response to either question would suggest that a review of the particular issue was advisable. **No** responses are likely to feature prominently in any future consent or approval process.*
- *A **provisional** response to either question may also draw attention during a formal consent or approval process but may be offset by positive responses to all other criteria.*

Table 3-8: PSP4 Evaluation Matrix

Issue	Assessment		
	Yes	**No**	**Provisional**
In light of the above responses and the quality of the information provided, can a position be sustained that acceptability and control of the social and economic impacts can be maintained for the duration of the project?			

- *A **yes** response would suggest that a move to PSPs 5–6 was appropriate and that preliminary community consultation could proceed on the basis of the information that had been generated from PSPs 1, 2, 3 and 4.*
- *A **no** response would suggest that a further review of the control mechanisms was required or that the proposal should proceed no further.*
- *A **provisional** response would indicate that positive responses to previous or future criteria would be required to provide the level of confidence necessary in a formal consent or approval process.*

3.7 PSP5: Assurance of Project Commitments

3.7.1 The purpose or objective of PSP5 is:

to demonstrate that the environmental, social and economic commitments defined at the initiation of the project are understood and delivered over the life of the project.

3.7.2 Explanatory Notes to Assist Assessment

i) One major community concern identified has been the monitoring of the project after the consent to operate has been given. Under the spotlight of a formal consultation, consent or approval process, adequate undertakings or assurances may have been provided but a concern may remain as to whether these undertakings or assurances would be maintained for the life of the project once the initial focus was dissipated and over time. In the absence of these confirmations, the community may be likely to withhold the community licence to operate, forgoing the immediate benefits because of the prospect of medium- to long-term disadvantages. There is therefore a need for the project proponent or formal consent authority to provide or insist on safeguards for the life of the project.

ii) Commitments for the life of the project need to include an eventual closure and site remediation plan so that in the event of circumstances that cause the closure of the project the physical remnants would not be orphaned or left as an unfunded public liability. The proponent's commitments also need to include an undertaking to respond to complaints promptly (e.g. within 24 hours), hold open days and publish community information newsletters and so on.

iii) In the event that a project produces unexpected and unacceptable consequences or that the initial undertakings in regard to foreseen impacts have not been managed appropriately, there is a need for transparent mechanisms by which the situation can be redressed.

3.7.3 Some Suggested Compliance Criteria or Approaches

i) The proponent needs to demonstrate that they are a respected corporate citizen with sufficient means to deliver the project within anticipated timelines.

ii) The formal consent authorities need to note all legitimate community concerns and ensure that the terms and conditions of consent contain mechanisms that will provide the level of monitoring and control appropriate for the circumstances.

iii) The proposed strategies, programs and actions that are developed to demonstrate compliance with this PSP need to be transparent and monitorable during the life of the project and might include:

a) by the proponent:
- International Standards Organisation (ISO) 14000 accreditation
- public reporting through
  - o Public Environmental Reporting (PER) (Environment Australia website)
  - o Global Reporting Initiative (GRI)
  - o Triple Bottom Line (TBL)

    - National Pollution Inventory (NPI)
- information dissemination by:
    - website
    - newsletters
    - annual reports
    - regular open days

b) by the formal consent authority:
- compliance audits of consent conditions
- contractual commitments.

Note: Where any specific environmental impact internalisation mechanisms such as renewable energy certificates (RECs) or carbon credits exist, the auditing and verification process by the issuer of the tradable certificate should provide one more level of assurance in this regard.

3.7.4 Qualitative Assessment Matrix

Given that the environmental, social and economic impacts will have been identified in PSPs 3 and 4, compliance with PSP5 can be assessed by applying Table 3-9.

Table 3-9: PSP5 Qualitative Assessment Matrix

Issue	**Assessment**		
	Yes or not applicable (N/A)	**No**	**Provisional**
i) Is the proponent a respected corporate citizen with sufficient means to undertake the proposed project?			
ii) Have strategies, programs or actions been proposed that if fully and transparently implemented would provide the level of assurance required for the granting of a licence to operate by the community?			
iii) Have the formal consent authorities shown sufficient regard to these long-term issues in the development and imposition of the consent conditions for the project?			
iv) Does the proponent have sufficient financial resources or the ability to obtain these resources in order to provide financial assurance for closure and remediation if necessary?			

- *A **yes** or **N/A** response to each question should facilitate a simple response to the next stage (see Table 3-10).*
- *A **no** response to any question would suggest that a review of the particular issue was advisable. **No** responses are likely to feature prominently in any future consent or approval process.*
- *A **provisional** response to any question may also draw attention during a formal consent or approval process but may be offset by positive responses to all other criteria.*

Table 3-10: PSP5 Evaluation Matrix

Issue	Assessment		
	Yes	No	Provisional
In light of the above responses and the quality of the information provided, can it be reasonably determined that the level of environmental, social and economic impacts, positive and negative, deemed both desirable and acceptable at the commencement of the project will be delivered and monitored over the life of the project?			

- *A **yes** response would support the continued development of the project.*
- *A **no** response would suggest that a further review of the proposed assurance mechanisms was required or that the proposal should proceed no further.*
- *A **provisional** response would indicate that positive responses to previous or future criteria would be required to provide the level of confidence necessary in a formal consent or approval process.*

3.8 PSP6: Management of the Commercial Interface

3.8.1 The purpose or objective of PSP6 is:

to demonstrate that the structuring of the project to achieve commercial viability does not compromise the inherent sustainability achieved by observance of the other PSPs.

3.8.2 Explanatory Notes to Assist Assessment

This PSP addresses many of the issues that normally would be part of the continuous and iterative monitoring and incorporation of the sustainability externalities shown in Figure 4.1. However, certain key issues can be identified as needing particular attention.

i) The commercial and financial realities for a project must achieve the prescribed returns and outcomes within the risk profile acceptable to the proponent. However, the achievement of these commercial and financial outcomes should not be at the expense of the strategic and sustainable resource use requirements that created the potential for the project in the first instance.

ii) Supply issues — a facility that can efficiently and safely recover the calorific value from selected urban waste streams may be complex and capital-intensive and the commercial viability of a project is likely to depend on a reliable supply of waste to justify the capital investment for the project (see PSPs 2, 3 and 4). However, the paradox is that sustainable resource use aims to reduce these waste streams to zero wherever possible or practical. Therefore, an EfW facility needs to have the flexibility to take these materials as and when they become available as residuals after all other higher value outcomes have been reviewed (see PSP1). On the other hand, the facility owner, operator or converter may require a fixed and contracted minimum to be provided to justify the project. This can be problematic and needs to be resolved in a manner that is consistent with the philosophies of the Sustainability Guide while simultaneously considering the commercial underpinning of the project.

iii) Energy availability issues — energy (heat or power) generated from urban wastes, even as a minor fraction of the total fuel consumed has the potential to fail the “improved valuation and pricing of environmental resources” test for sustainability (see Annexure F (d)). If the energy value is not fully appreciated, there is a danger that unsustainable pricing signals could present downstream. For example:

a) electricity could be generated at a lower cost than by the alternative or sustainable options and could lead to unsustainable power consumption (because of the low cost)

b) fuel could be supplied for process heat at a significant discount to the existing alternative (e.g. coal) to the extent that either marginal or inefficient operations could be retained or product costs could be “artificially” lowered to promote excessive use of energy or negatively impact on demand management programs.

While these issues may not feature strongly in the evaluation and assessment of a project or proposal, they are important considerations for demonstrating attention to detail when seeking a community licence to operate.

iv) Miscellaneous issues and commercial signals — within the broad context of the feedstock and energy supply issues discussed in ii and iii above, the following lesser issues could impact on the sustainability outcomes if they are handled inappropriately during the development of a commercial framework for a project or proposal.

a) The volume and content of urban wastes that satisfy PSP1 will alter continuously and need to be addressed in proposals. It may be necessary for conversion pathways and facilities to avoid levels of specialisation that cannot accommodate this sort of variability.

b) Long-term commitments of, say, up to 25 years need to be considered carefully by potential suppliers because these sorts of commitments could eventually have the effect of absorbing materials with a higher resource value. Where long-term commitments are not provided the supplier must recognise the offsetting increases in processing costs that need to be borne in order to allow the developer to make a reasonable risk-weighted rate of return.

c) The provision of or access to suitable EfW conversion pathways and facilities need to be part of an integrated suite of options to support optimum resource use outcomes in general, especially as support for whole-of-life planning programs at the point of product initiation and design (this relates to the parallel issues of EPR, lightweighting, post-consumer planning and by-product optimisation).

d) Putrescible urban wastes that could satisfy PSP1 might require immediate processing as a treatment or stabilisation function. This could trouble the orderly observance of this PSP.

3.8.3 Some Suggested Compliance Criteria or Approaches

i) Some waste supply, fuel demand and energy need issues can be addressed logistically by the fuel preparation approach. By this method urban wastes that satisfy PSP1 are received at a process engineered fuel (PEF) facility as and when they are available and converted into specified and stabilised fuel or energy products immediately. These fuel or energy products would be produced to the specifications required by future energy converters and could be supplied to them as and when required to meet their quite independent, future market demands. This approach would enable the PEF manufacturer to access a range of sources as the basis of production and still provide supply certainty to the end user.

ii) It is important to avoid an overly dependent relationship between the supplier and converter. The converter might manage supply assurance issues by having a range of PEF supplies and/or suppliers. Furthermore, by having a backup supply of fossil fuels, the PEFs are supplementary. This places the PEF product as supplementary or alternative fuel, for conversion as available, as opposed to threatening compliance with this PSP.

iii) Other approaches could involve:

a) modularity

b) process flexibility or turndown capacity

c) a fixed or variable component in the supply agreement. The balancing of base demand versus spot prices.

3.8.4 Qualitative Assessment Matrix

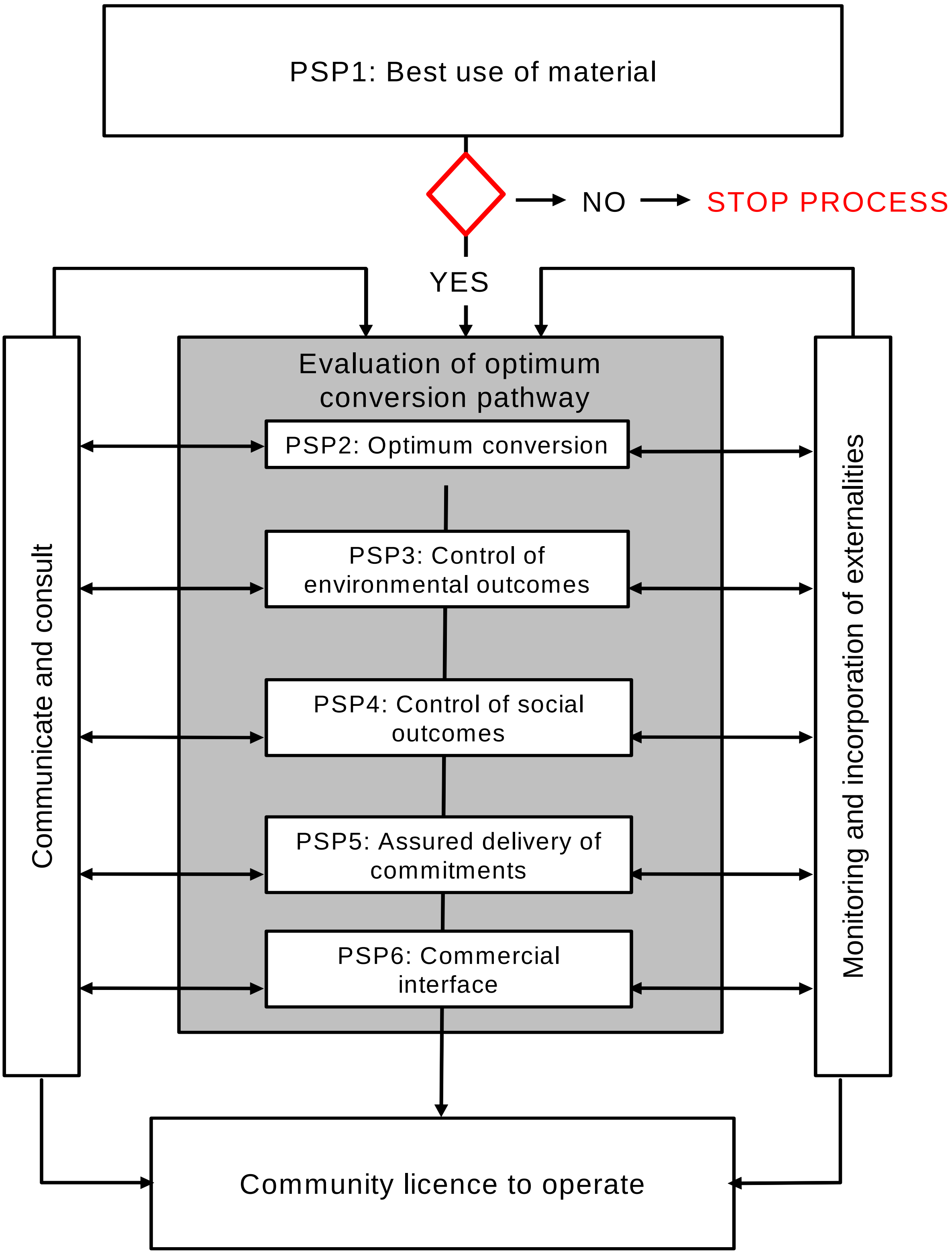
Table 3-11: PSP6 Qualitative Assessment Matrix

Issue	Assessment		
	Yes	No	Provisional
Have the commercial arrangements for the proposal or project been developed to support and reinforce the sustainability criteria of all other PSPs?			

- *A **yes** response would support the continued development of the project.*
- *A **no** response would suggest that a further review of the proposed assurance mechanisms was required or that the proposal should proceed no further.*
- *A **provisional** response would indicate that positive responses to previous or future criteria would be required to provide the level of confidence necessary in a formal consent or approval process.*

Section 4: The Assessment Tools

Assessment Roadmap



Section 5: Glossary

Aggregate/aggregation	Collect materials together with a view to create a critical mass for a subsequent operation or activity
Anaerobic digestion (AD)	The decomposition of biologically unstable organic materials by micro-organisms specifically suited for an oxygen depleted (free) environment. The primary products of AD are an energy rich (methane) biogas and a biologically stable residue (digestate).
Ash	The mineral or inorganic residue of a (complete) combustion process
Avoidance	A waste management strategy that seeks to avoid the generation of the waste in the first instance
Bagasse	The residual woody stem material that results from the process to recover the sugar content from sugar cane
Beneficiation	The further improvement by quality of a material stream to specifically meet end user requirements and specifications
Biogas	The off gas produced from the anaerobic digestion or decomposition of biologically unstable materials. Such conditions might be created naturally, or in a landfill or in-vessel in an AD facility.
Biomass	Total quantity or weight of organisms in a given area
Bioreactor Landfill	A landfill where the rate of anaerobic decomposition is specifically managed and accelerated to increase the generation of biogas and to accelerate landfill stabilisation.
Calorific value	The energy value per unit mass (or volume) that is released by a material in combustion, normally measured in mega-joules per kilogram (MJ/kg) or giga-joules per tonne (GJ/t).
Char	Carbon material that remains after the incomplete combustion of biomass, for example, charcoal is left after the incomplete combustion of wood.
Clean(er) production	The management technique that seeks to minimise or eliminate the environmental impacts of manufacturing or productive processes with particular emphasis on presenting unavoidable offcuts, surpluses or residues as useful by-products (for subsequent use) rather than as (mixed) or negatively valued wastes.
Community licence to operate	The consensual agreement of the general community to sanction a particular (industrial) activity in their geographical area of concern
Consent or approval process	The prevailing landuse and planning authorities manage a structured process whereby industrial or productive activities require prescribed consents, approvals or licences for initial establishment and ongoing operations
Digestate	The digested output from an anaerobic digester

Energy from waste (EfW)	An approach to resource recovery that focuses on maximising the amount of **energy** that can be recovered from materials that would otherwise be disposed of to landfill through a variety of energy recovery technologies (contrast with waste to energy).
Energy recovery technologies	Energy recovery technologies refer to a technology or methodology that seeks to recover the calorific value of a material
Environmental externalities	The range of environmental impacts (positive and negative) that are not brought to account in conventional market based accounting systems. This results in a market failure in that the true cost of a given activity is not reflected in the market price of the good or service.
Highest Resource Value	The highest market value of a particular resource after accounting for both the costs of recovery or beneficiation for such a use and after fully accounting for any relevant environmental externalities
Initial arising	The first point at which a waste stream or by-product presents in the value chain requiring an appropriate logistic response
Lignocellulosic	Lignocellulose is the combination of lignin, hemicellulose and cellulose that forms the structural framework of plant cell walls. Here lignocellulosic materials are used to describe wood, garden organics (greenwaste) and other wood derived products such as paper.
Methane	A colourless, odourless and flammable gas that is created by the decay of organic matter. It is the chief component of natural gas and biogas (C_2H_4)
Monofill	The practice of using landfill as a storage receptacle for source separated and homogenous materials such as tyres.
OECD	Organisation for Economic Cooperation and Development
OH&S	Occupational Health & Safety
Process engineered fuels (PEFs)	Refers to fuels that are manufactured from selected materials that would otherwise be disposed of to landfill. They are quality controlled, relatively homogeneous and are produced fit for purpose use in a cement kiln or power station. Sometimes PEF is also referred to as Refuse-Derived Fuel (RDF).
PSP	Project scoping principles
Reduce	See Avoidance
Recycling	The act of reclaiming resources from materials that would otherwise be disposed of to landfill for the purposes of reprocessing into either the same or similar products (direct recycling) or into different product types altogether (indirect recycling).
Residual urban wastes	The residual material that cannot be avoided and that is unable to be re-used or recycled.
Reuse	An activity that re-uses any given material or product for essentially the same original purpose in the same original form.
Secondary resource	A grouping noun for materials recovered from waste streams that would otherwise be disposed of to landfill.

Waste	Any material that has no further use to the owner (perceived or real) and arises from: i) By-product of manufacture or resource extraction, ii) Off-cuts, over runs, out of specification materials in manufacture and assembly, iii) End of service life product, iv) Broken, obsolete or unwanted product.
Waste hierarchy	The name given to a hierarchical approach to resource use and recovery that states that the best outcome is to Avoid the generation of the waste in the first instance, then to Re-use and Recycle and unavoidable wastes, followed by Treatment and Energy Recovery. Landfill is only used as a measure of last resort.
Waste minimisation	There are three interpretations of Waste Minimisation: i) The goal of minimising the generation of all waste as an end in and of itself (see also Waste Avoidance), ii) A tool to achieve sustainability outcomes by looking for opportunities within manufacturing or consuming to minimise the generation of unnecessary waste, iii) A grouping term that covers all resource recovery activities such as re-use and recycling, because in becoming a resource the "waste" is minimised.
Waste to energy (WtE)	Waste to energy is a waste management approach where the focus is on material destruction and where energy recovery is a by-product. This style of approach is best evidenced by mass burn incineration (contrast with energy from waste).

Section 6: Appendixes

Appendix A **Working Group Members**

Appendix B **Reference Group Members**

Appendix C **Sponsors**

Appendix D **Australia's National Strategy for Ecologically Sustainable Development**

Appendix A – Working Group Members

The Working Group retained editorial control of the project and overall project delivery as to quality, time and budget.

Name	Organisation
Mark Glover (Chair)	Renewed Fuels Pty Ltd
Ron Wainberg (Treasurer)	NSW Branch WMAA
Matthew Warnken (Project Manager)	Warnken ISE
Jeff Angel	Total Environment Centre
Stephen Schuck	Bioenergy Australia
Tony Wright	Wright Corporate Strategy
Neil Chapman	Resource NSW
Graeme Jessup	SEDA
Raymond Kidd	Department of the Environment and Heritage
Jenny Pickles / Cathy Van der Zee	EcoRecycle Victoria
David Moy	Qld Branch WMAA, Qld University
Fraser Bell	SA Branch WMAA, Finlaysons
Carinda Rue / Iain Williams	Tas Branch WMAA, DPIWE
Lillias Bovell	WA Branch WMAA, WA Department of Environmental Protection
Yolande Stone (Observer)	Planning NSW

Appendix B – Reference Group Members

The Reference Group was established to peer-review and critique the initial draft of both the Sustainability Guide and the Code of Practice. The commitment of the Reference Group members was documented by individually signed Consent to Act forms (see attached forms). Formal submissions were received from 22 of the original 51 members of the Reference Group (see table below).

Name	Organisation
Craig Midson	Australian Greenhouse Office
Stephen Joseph	Biomass Energy Services & Technology
Mark Hipgrave	Brightstar Environmental (Qld)
Don Chambers	C4ES
Patricia Nicholls	C4ES
Kathryn Turner	Cement Industry Federation
Joe Lunardello	City of Monash
Allan Pilcher	Country Energy
Sara Beavis	CRES, Australian National University
Griff Rose	CVC Reef IM
Brett Corderoy	Delta Electricity
Graham Spalding	Department of Environment Waste Management Branch
Clinton Watkins	Development Manager & Economist - EcoCarbon Incorporated
Toby Hutcheon	Ecomatters
Greg Watt	Energy Futures Australia
Louise Drolz	Environment Business Australia
John Lawson	Global Renewables Ltd
Michael Clarke	Griffith University
Russell Wade	Individual
Nick Orr	Individual
Craig Fraser	Individual
Neil Rose	Maroondah City Council
Christine Wardle	Meinhardt
Peter Brotherton	National Environmental Consultative Forum
Sharon Denny	Office of Energy & Treasury (Qld)
Nigel Green	Office of Environment & Heritage, NT Government
David Rossiter	Office of the Renewable Energy Regulator
Shani Bienefelt	Pantechnicon
Peter Goggin	PEG Business Solutions
John Sparkes	Planning NSW
Joanna Missen	PPK
Kylie Hughes	Queensland Environmental Protection Agency
Amy Hogan	Queensland Environmental Protection Agency
Tim Powe	Queensland Environmental Protection Agency
Neil Chapman	Resource NSW
Marc Stammbach	Rethmann Australia Environmental Services
Andrew Thaler	scrapp.com
Chris Pickering	Stanwell Corporation Limited
Gabrielle Henry	Sustainable Energy Authority (VIC)
John Hewitson	Teris (Aust)
Andrew Brownlow	Terra Consulting
Don White	University of Sydney - Department of Chemical Engineering
Lynne Forster	University of Tasmania
Denis James	Visy Recycling
Mohan Selvaraj	Waste Service NSW
Terry Carter	Western Power Corporation
Paul Oakes	Worley Developments

The comments from the review process were assessed by the Working Group and included as deemed appropriate. It should be emphasised that there was a degree of diversity within the comments, ranging from strong support to strong opposition. Thus, the list of contributors should not be taken as an endorsement of the Sustainability Guide by either the individual or the organisation listed below.

Energy from Waste Sustainability Project

Reference Group Consent to Act Form

The Energy from Waste Division of the Waste Management Association of Australia (WMAA), received grant funding from the Australian Greenhouse Office (AGO) to prepare an Energy from Waste (EfW) Sustainability Guide and complementary Industry Code of Practice for the EfW industry. Drafts of these documents have been completed and are now ready for circulation to the Reference Group.

The main role of the Reference Group is to act as the primary body of review for the Sustainability Guide and Code of Practice. It is anticipated that in addition to an individual review, members of the Reference Group will also solicit input, comment and feedback from their respective members/constituency/colleagues on draft documents and then channel this information back to the Working Group. The general duties of the Reference Group include:

- Reviewing draft documentation from the perspective of the organisation being represented and the wider stakeholder group,
- Checking of any technical data where relevant,
- Providing written comment to the Working Group by the due date required (14 May 2003), and through a template that will be supplied by the Project Manager,
- Indicating the level of "sign-off" that the member (individually or on behalf of an organisation) would be prepared to offer in support of the final publications,
- Disseminating the final publications throughout existing networks.

It should be noted that the Working Group does not necessarily undertake to include *verbatim* all of the written submissions received from the Reference Group into the final publication. The Working Group will, however, undertake to consider these views and to strive to reach a consensus position.

Membership on the Reference Group is honorary and has been initiated by application or nomination to the Working Group. By signing this "Consent to Act" form the Reference Group member offers to participate on the Reference Group and agrees to undertake the duties that are outlined above. A list of participating Reference Group members will be maintained on the EfW Division's website.

Name:	Date:
Signature:	Phone:
Organisation Represented:	Fax:

Please sign, date and fax this form back to 02 9571 4900

Appendix C – Sponsors

Australian Greenhouse Office

Renewed Fuels

Cement Industry Federation
QLD Environmental Protection Agency
Resource NSW
SA Environmental Protection Agency
SEDA NSW
Waste Service NSW

Babcock & Brown
Sustainable Energy Authority Victoria

C4ES
Delta Electricity

CS Energy
Global Renewables
Department of the Environment and Heritage

CVC Reef
Novera Energy
Recycling and Recovery Industries
Stanwell Corporation

Appendix D – Australia's National Strategy for Ecologically Sustainable Development

Available online at http://www.deh.gov.au/esd/national/nsesd/strategy/index.html.
Australia's National Strategy for Ecologically Sustainable Development (ESD) aims to provide strategic directions and a framework for government to direct policy and decision-making. The Commonwealth's 1992 definition of ESD was:

"A pattern of development that improves the total quality of life both now and in the future, in a way that maintains the ecological processes on which life depends" (NSESD 1992).

This strategy had 3 core objectives:

1. To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.

2. To provide for equity within and between generations (intra-generational and inter-generational equity).

3. To protect biological diversity and maintain essential ecological processes and life support systems.

Seven guiding principles for achieving these objectives are proposed. These are that:

i) decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations,

ii) where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation,

iii) the global dimension of environmental impacts of actions and policies should be recognised and considered,

iv) the need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised,

v) the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised,

vi) cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms, and

vii) decisions and actions should provide for broad community involvement on issues which affect them.

It is identified in the strategy that the guiding principles and core objectives need to be considered in their entirety, and that no objective or principle should predominate over the others.

Australian Industrial Ecology Network Pty Ltd
PO Box 5523, West Chatswood NSW 1515 • ABN 44 601 455 743
1300 446 303 • 02 8624 4779 • info@aien.com.au • www.aien.com.au

Attachment B:

Western Sydney Subregional Resource Recovery - Options Analysis

WSROC
Advocating for the people of Western Sydney

Western Sydney Subregional Resource Recovery

Options Analysis



The Hills Shire | Hawkesbury City Council | Blue Mountains City Council
Blacktown City Council | Penrith City Council

This document has been supported by the NSW Environment Protection Authority (EPA) with funding from the waste levy.

P.O. Box 6112, Lake Munmorah, 2259

Data presented is based on best available information provided to Eco Waste Pty Ltd at the time of the report, which has not been independently verified. As such, the data can only be considered as a guide to meet the objectives of this subregional resource recovery options analysis, and should not be relied upon for any other purpose.

Executive Summary

Five councils have come together to investigate future options for resource recovery in the northwest sector of Western Sydney. The councils:

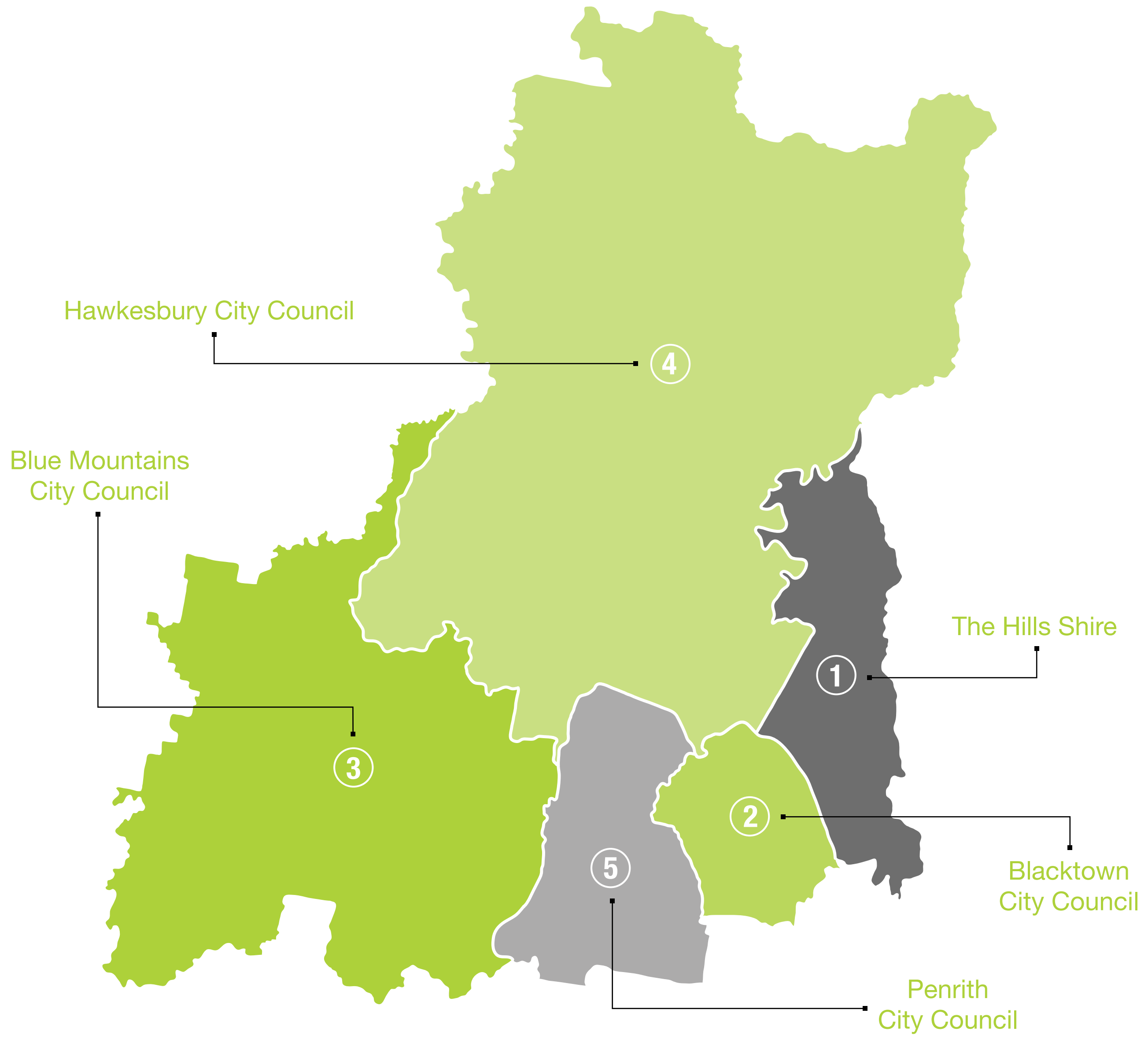
- The Hills Shire;
- Blacktown City Council;
- Blue Mountains City Council
- Hawkesbury City Council; and
- Penrith City Council;

have initiated a project to develop a Regional Waste Strategy (RWS).

These five councils represent **>800,000** population and cover a geography as described in Figure 0-1.

The five councils had various needs and expectations of the RWS project (Section 4) but from the outset, all agreed that a resulting RWS would meet all their respective and collective needs if the following strategic objectives were addressed/achieved.

Figure 0-1: The WSROC “Sub-Group” councils



Specific Strategic Objectives to be Addressed/Achieved

a) When fully implemented, the RWS should be able to deliver >90% diversion (from landfill and/or S88 liability) for all wastes under management.

b) The eventual cost to the ratepayer (averaged across the Sub-Group councils) of all/any new systems and infrastructure proposed in the RWS should be no more than the current costs (target $340-$380/ratepayer, including the respective cost of collection services).

c) The new RWS should establish a sound commercial platform for the delivery of all future waste services by councils that can be budgeted with CPI certainty, (rather than the "hockey-stick" escalations that characterise waste management costs for councils at present).

d) Where new waste receival, sorting and processing systems and infrastructure is proposed, councils should be distanced from any subsequent process or market risk.

e) Where new waste processing facilities are proposed in the RWS, councils should have the basic option of providing wastes to the expert providers of such facilities, for an agreed gate fee as the absolute limit of their financial exposure. However, where such facilities are run as profitable concerns, councils should have the opportunity to participate in the equity structure for such facilities where they have a commercial appetite for such investments.

f) The establishment and/or procurement of all/any new waste-processing facilities must be established in full compliance with any relevant local council tendering and/or asset procurement procedures and be able to demonstrate best value for money for residents.

g) Wastes under management, as proposed in the RWS, should be handled within a streaming/cascading/regime, such that Highest Net Resource Value (HNRV) is achieved at all times.

h) The community should be fully serviced with convenient and cost-effective waste management systems that cap Capex/Opex costs for councils, but also leave scope for optimised participation in the system to derive benefits for individual ratepayers and/or council as a whole.

i) Whatever the proposed systems and infrastructure resulting from the RWS, the achievement of councils' overriding WHS obligations must never be compromised.

Approaches Adopted to Achieve these "Breakthrough" Outcomes

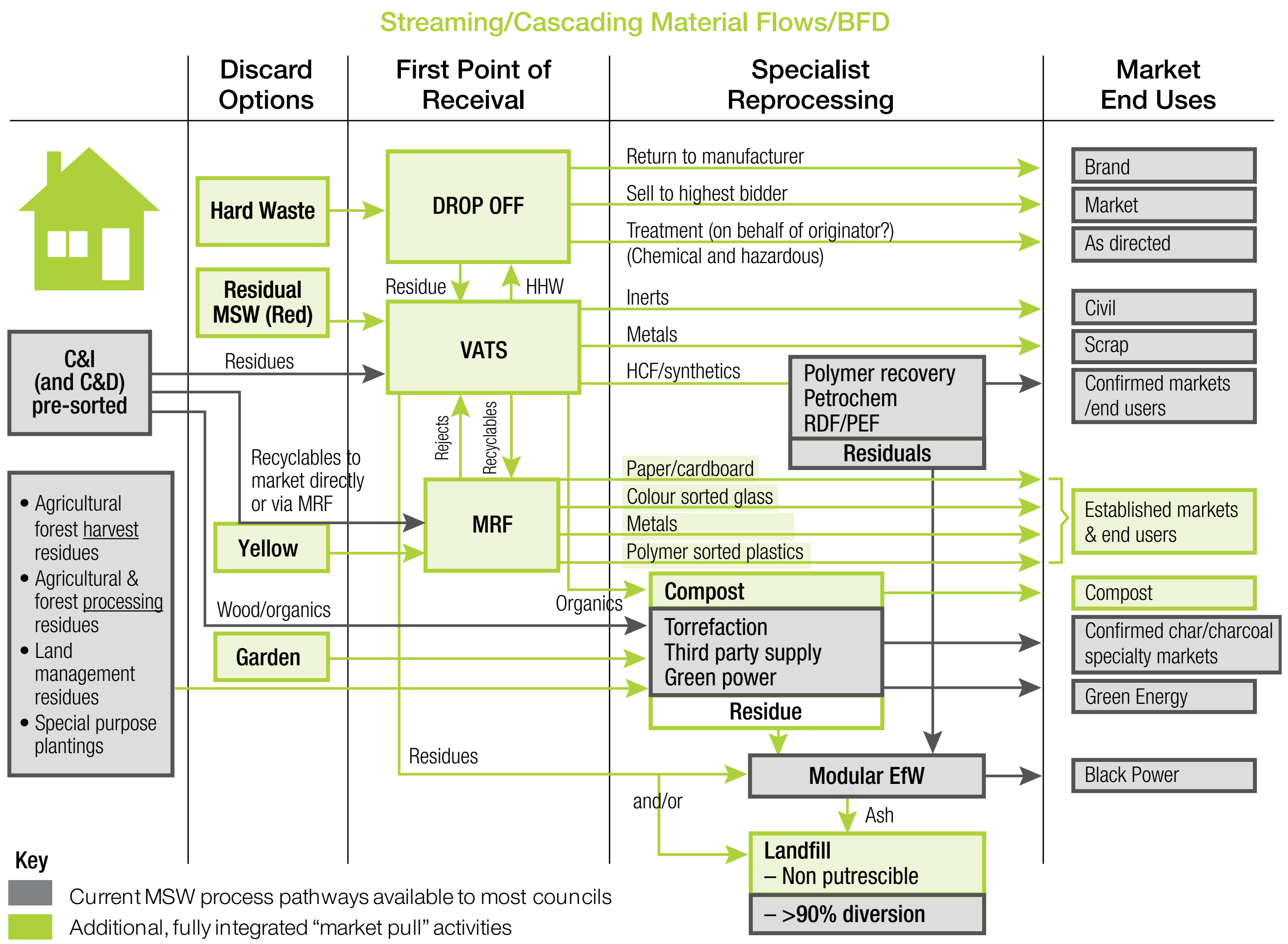
"We can't solve our problems using the same level of thinking that created them", Einstein.

The vital difference between managing urban wastes for simple public health objectives alone and managing them for optimum resource recovery is the focus on presenting reclaimed materials back for reuse in the productive economy in a manner that creates "market pull" (3.6.1) rather than the more usual "supply push".

The primary RWS strategies are to:

- Identify the most cost-effective processing/ supply/value chains to convert the materials under management into products that will represent full and fair value back to the community.
- Design the material flows around a "streaming/cascading" approach to ensure the greatest net value is realised from all materials under management, and "next best" uses and applications are always available, to avoid the binary outcomes that currently prevail, whereby materials are either reclaimed or lost to landfill.
- Strive to achieve HNRV from all materials under management, rather than just least cost disposal.
- Focus on value adding the biomass/organics fraction of urban wastes, since this fraction makes up some 50-60% of the materials under management, and, in a carbon constrained economy, such materials cannot only present as high quality composts, but also feed into the complex supply/value chains to produce a wide range of bio-products that ultimately can act as "drop in" replacements for "fossil fuel" based products. These outcomes are optimised by facilitating direct engagement with the broader biomass processing/bio-products manufacturing sectors in the region, and further afield as required.

Figure 0-2: Streaming/Cascading Materials Flows/Block Flow Diagram (from Fig. 5-1)



Achievement of all Strategic Objectives

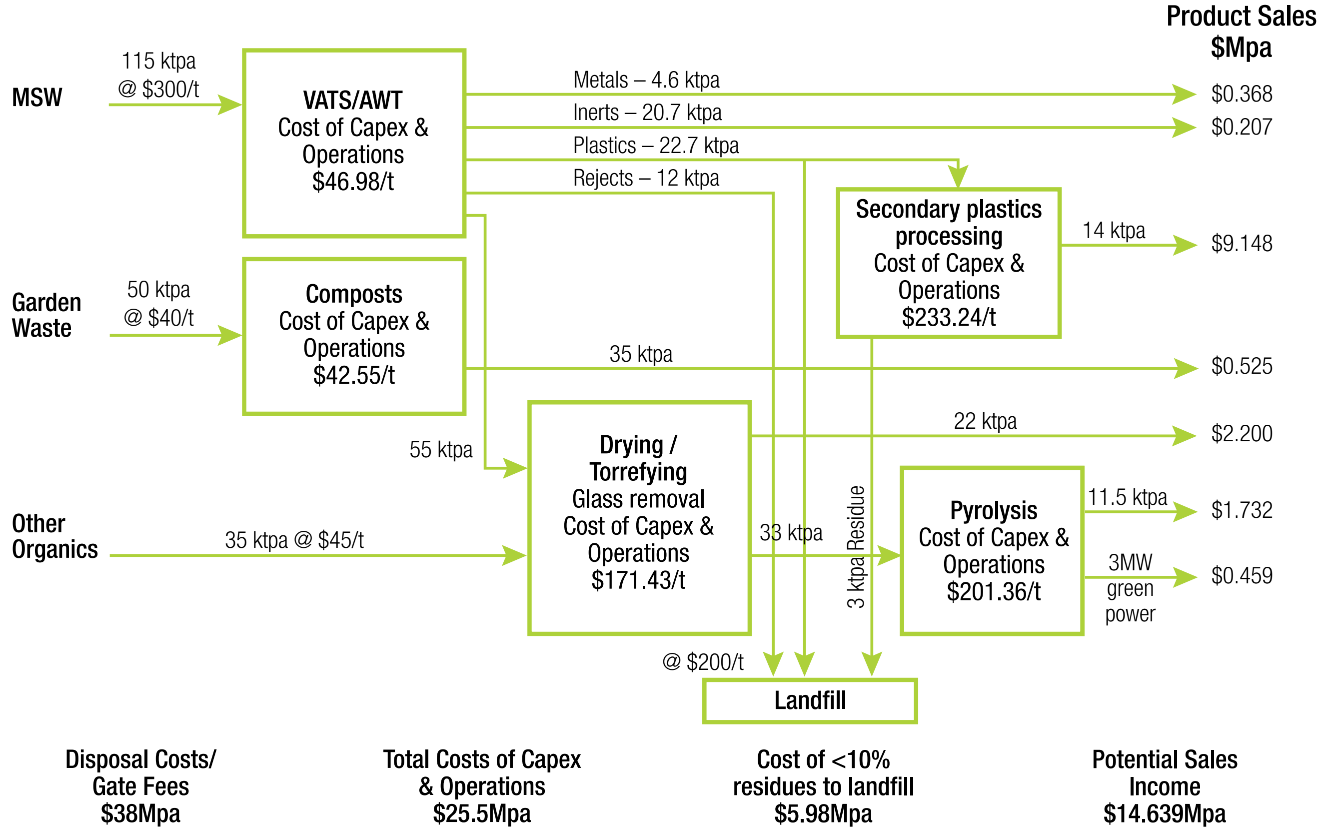
The RWS demonstrates a “low risk” pathway to the achievement of all these strategic objectives, and the highlights include:

- A detailed description of all the systematic resource recovery operations and capabilities necessary to achieve >90% diversion of urban wastes under management into highest net resource value (HNRV) materials and products.
- An initial “high level” financial and commercial viability assessment that shows that if the considerable Sub-Group payments as gates fees at landfills, including the respective S88 levy payments, is progressively reallocated to the provision of resource recovery systems and infrastructure and added to the HNRV receipts from sale of products, a net reduction in costs to the Sub-Group councils could be achieved after allowing for the extra operational and capital servicing costs that such an approach would require, as summarised Table 0-1.

Table 0-1: Total funding available to justify a systematic resource recovery approach

	$Mpa
Avoided landfill	$38M
Receipts from sales	$14M
Sub Total	**$52M**
Less cost of new facility	$25.5M
Residual disposal	$6M
Sub Total	**$31.5M**
Positive balance to cover profit and development contingencies	**$20.5M**

Figure 0-3: First order viability of fully implemented RWS



NB: Supporting data and analysis – see Attachment F. Any discrepancies between Fig. 6-1 and Attachment F may be due to rounding errors.

All other strategic objectives as described have been achieved and/or accommodated in the RWS, and a detailed explanation of the key steps and actions necessary to ensure satisfactory project completion over the short, medium and long term has been provided.

Actions to Achieve Breakthrough Outcomes

The RWS concludes by assessing the “risk of completion” for such a breakthrough RWS as low, on the basis that dedicated and specialist resources are eventually appointed to coordinate, manage and project develop the RWS on behalf of the Sub-Group councils, but within a structure whereby councils’ risks and costs are limited to a waste “supply” role and appropriate structures are put in place to allocate specified performance risks to specialist third parties.

The need for such a dedicated project implementation structure reflects the generational change from the historical provision of waste services to the proposed integrated approach, that will more appropriately allocate risk, responsibility and reward than is evident in the prevailing waste sector.

Table of Contents

List of Tables

List of Figures

Glossary

AWT	Alternative waste treatment (facilities)
Bale fill	A landfill where materials are stored as stacked bales rather than placed as loose waste to be compacted in situ
BAU	Business as usual
B.O.O	Build, Own and Operate
Burn out	Complete thermal oxidation of carbon, leaving only mineralised ash
C&I	Commercial and Industrial waste
C&D	Construction and Demolition waste
Calorific value	Energy released as heat when combusted
Cascading	See streaming
CBOT	Chicago Board of Trade
CFI	Commonwealth Government Carbon Farming Initiative Program
Circular economy	A generic term for an industrial economy where biological and technical nutrients (resources) circulate at highest quality, and avoid being lost to the general biosphere
Composting	Aerobic, microbiological decomposition of vegetative matter
Co-processed	Two or more materials processed together
CPI certainty	Budget escalators that are closely linked to the published Consumer Price Index
Down cycle	Converting waste materials into new materials or products that represent lesser quality or reduced functionality
EfW	Energy from Waste
Externalities	Consequences or side effects that are not directly captured in any particular or relevant market transaction
Fe	Ferrous (iron) metals
Flat lining	Economic projections that do not increase
FOGO	Food Organics/Green Organics combined collection and processing
GDP	Gross Domestic Product
Green bin – organics stream	The organics collection system selected by respective councils

Hard waste/clean up service	The collection/drop-off services selected by respective councils for bulky or occasional discards from households
HCWMF	Hawkesbury Council Waste Management Facility
Highest Net Resource Value (HNRV)	The highest value a reprocessed material can/does achieve in the market NET of the collection and processing costs to achieve this value
Indeterminate raw material	Raw material or process inputs that present with no determined quality specification
Industrial Ecology	The study (and management) of material and energy flows through industrial systems
Inventory risk	The risk (and subsequent management) of matching supply and demand of physical materials
Kerbside 3 bin waste discard system	A recycling container and/or system An organics recovery system A residual waste container and collection system
LFG	Landfill Gas
Loop closing	The final process or action necessary to complete (or close) a material flow
LME	London Metals Exchange
Market failure	The inefficient allocation of goods and services by a free market
Market pull	The demand for goods or services by the free market
MSW	Municipal Solid Waste
Non Fe	Metals other than Ferrous (iron)
OECD	Organisation of Economic Cooperation and Development – currently 33 sovereign states
O&M parties	Operations and Maintenance parties
ONP	Old Newspaper
POEO	*Protection of the Environment Operations Act (1997)*
Price taker	The party only able to receive the price the buyer is willing to pay
Problem waste	MSW and C&I wastes that present as too toxic, valuable or bulky as to be adequately managed via usual waste management or resource recovery processes
Productive economy	The national economy as measured by Gross Domestic Product
Product Stewardship	The whole of “supply chain” responsibility for managing the environmental and resource conservation outcomes

Putrescible	Biologically active or reactive urban wastes that are subject to putrefaction
RDF/PEF	Refuse Derived Fuel/Process Engineered Fuel: both terms refer to “fuel” products manufactured (predominantly) from wastes to meet a defined product specification
Red bin – residual waste stream	Receptacle for the collection of residual household waste
Shandy, shandied	To blend materials so that the final product quality specifications are achieved using a mix of raw materials
Sight unseen trading	Trading materials and commodities against established and verifiable conditions and specifications, such that the purchaser does not need to actually inspect the goods as the basis for the trade
Specific/general waste exemption	As defined under clauses 51 & 51A of the POEO regulations (2005)
Supply certainty	The requirement that a facility or plant operator needs to ensure that the facility or plant will have input materials to process
Supply pushed	The market having available supply in excess of demand
Streaming	The concept of **streaming** materials to their highest and best use whenever it is practical or cost-effective to do so, but providing a “cascading” next best option when such an outcome is unachievable and so avoiding binary outcomes where materials are either processed for HNRV, or lost to disposal as the only available default option
STPs	Sewage Treatment Plants
TCLP	Toxicity Characteristic Leaching Procedure
Thermal efficiency	The efficiency with which a process realises the inherent energy content of input fuels
Thermal gradient	The option to apply a full range of temperature increases to the processing of waste streams as another “sorting” or “contaminant removal” technique
Thermal processing gradient	As above
Urban waste streams	MSW, C&I, C&D
Value Added Transfer Station (VATS)	The first point of receival for collected wastes where a level of generic sorting of the materials is undertaken to not only provide consolidated bulk loads for subsequent transport, but the quality and value of the materials is enhanced in the process (rather than degraded as with traditional waste transfer stations)
WARR	*Waste Avoidance and Resource Recovery Act* (2001)
Yellow bin – dry recycling stream	Receptacle, collection and processing system for traditional dry recyclables

1. Background and Context

1.1 Introduction

1.1.1 Participating Councils – the WSROC "Sub-Group"

The WSROC Sub-Group of Councils includes:

- The Hills Shire;
- Blacktown City Council;
- Blue Mountains City Council;
- Hawkesbury City Council; and
- Penrith City Council.

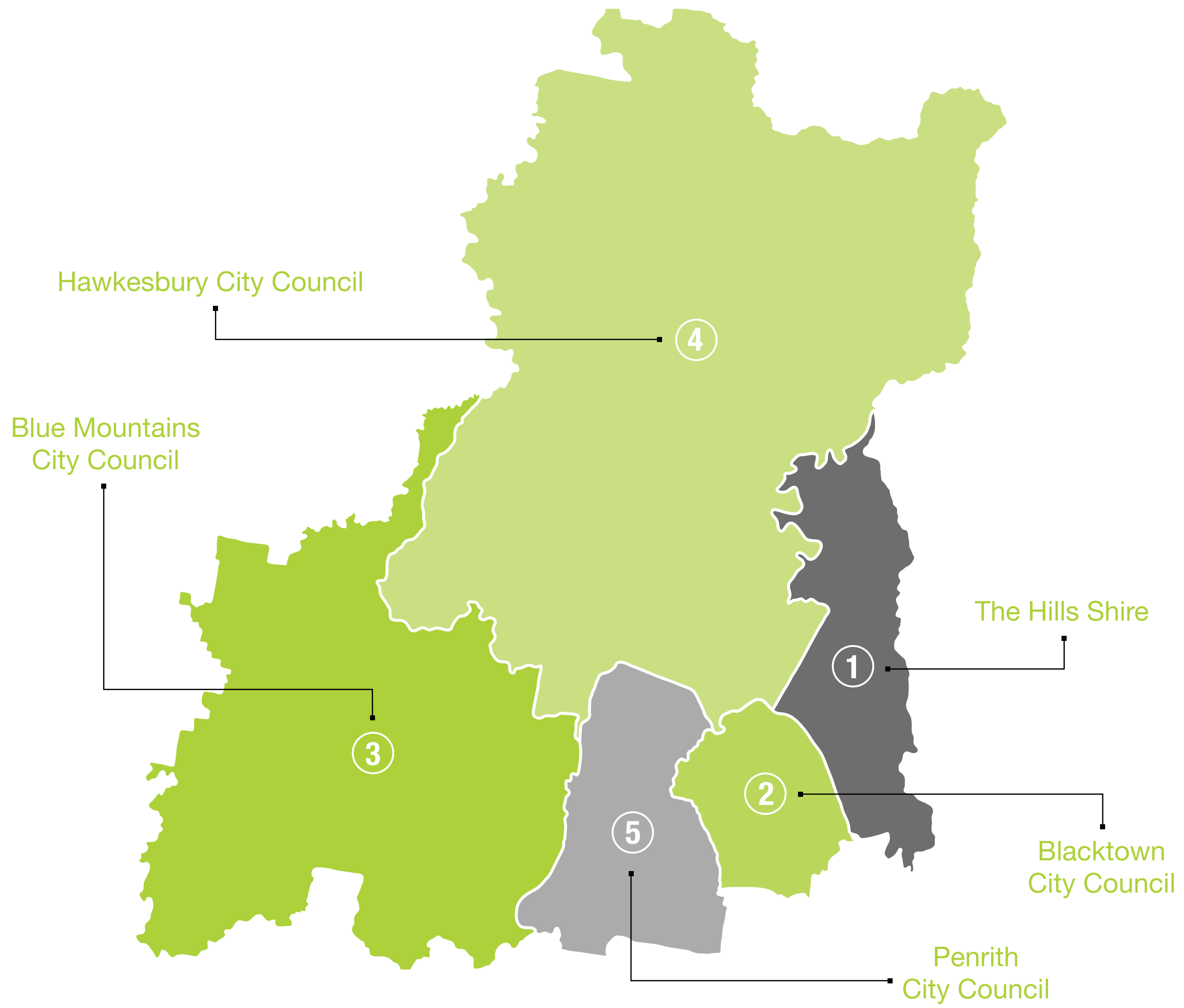
Each council's particular needs and circumstances are discussed Section 4.

Independent of the current NSW Environment Protection Authority (EPA) initiatives (1.1.2 below), these five councils initiated a project Q3 2013 to develop a regional approach to their respective waste management/systematic resource recovery needs and aspirations.

These five neighbouring councils have a history of collaboration on various programs and, with a combined population of >800,000, represent sufficient critical mass as to be able to fully justify and support any new infrastructure proposals that might arise.

Further, all five councils are ideally placed to access potential resource recovery facilities infrastructure if located in the region to the South of the Hawkesbury Municipal area.

Figure 1-1: The WSROC "Sub-Group" Councils



And finally, if this Sub-Group of councils was to initiate the development of systematic resource recovery facilities and infrastructure to service their own needs, such infrastructure may be of significance in the broader Sydney Basin context, which could derive further benefits for the Sub-Group councils themselves.

1.1.2 Parallel NSW EPA Initiatives

In October 2013, the NSW EPA issued their (Draft) "NSW Waste Avoidance and Resource Recovery Strategy 2013-21".

The strategy vision includes to:

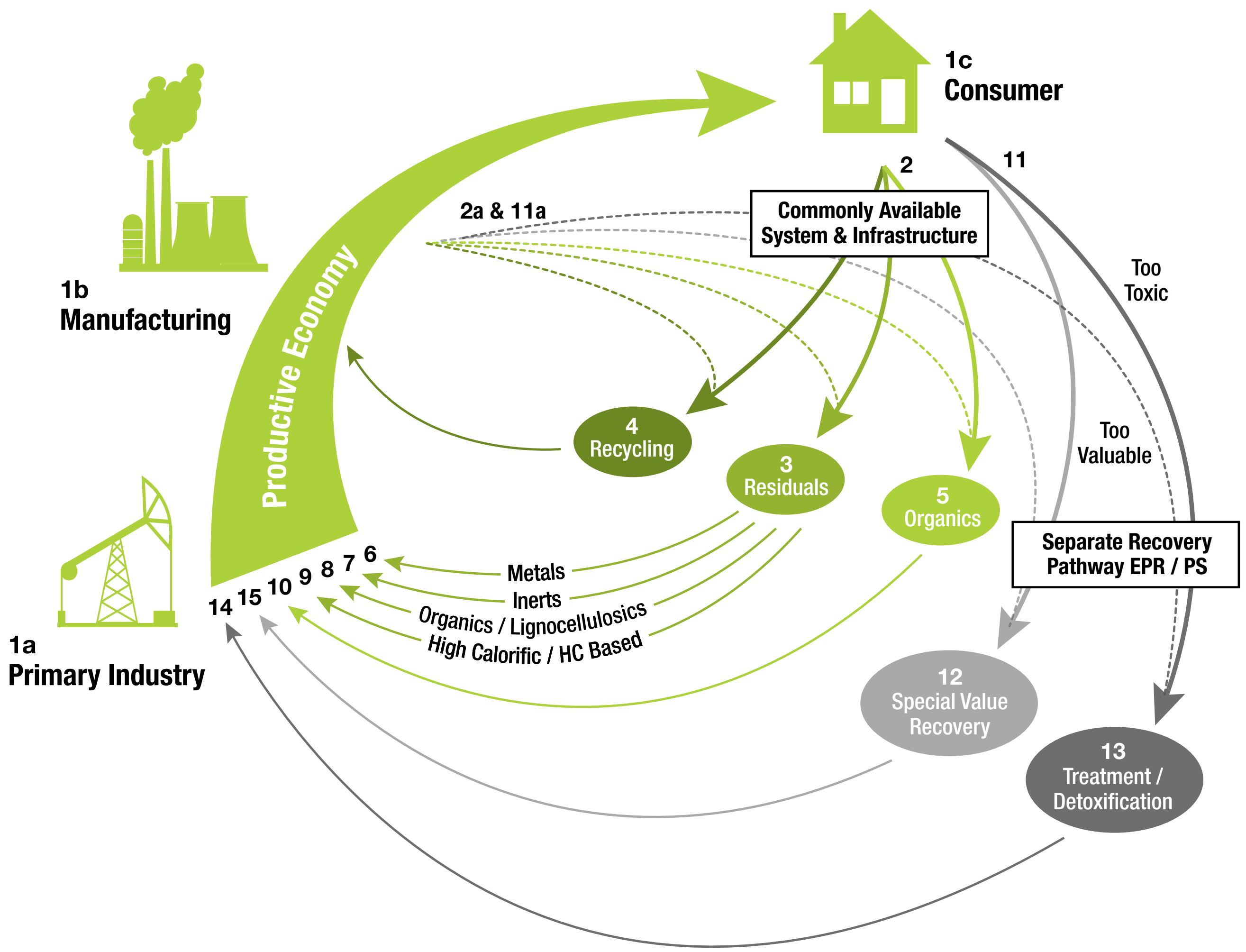
"Enable the whole NSW community to improve environmental and community wellbeing by:

- Reducing the environmental impact of waste; and
- Using resources more efficiently.

Using resources efficiently and **keeping materials circulating in the productive economy** can also help **to create jobs and grow the NSW economy"**.

NB: Fig. 1-2 has been adapted in the RWS to demonstrate the concept of "…materials circulating in the productive economy…"

Figure 1-2: Relationship of post-consumer waste sector to the Productive Economy



The EPA WARR strategy identifies six key areas for specific attention, including:

1. Avoidance and reduction of waste generation;
2. Increasing recycling;
3. Diverting more waste from landfill;
4. Managing problem wastes better;
5. Reducing litter; and
6. Reducing illegal dumping.

A further specific objective of the RWS is to develop strategies and programs to systematically address and advance these six topic areas.

Within the detail of the (Draft) WARR strategy, certain concepts are promoted and listed here to further guide and inform the RWS development process:

i) Drop-off centres to be developed as a platform for problem waste management and to provide a practical framework for the logical advancement of Product Stewardship programs and initiatives.

ii) Demonstrate and facilitate the links between the provision of urban waste management systems and infrastructure and the advancement of Industrial Ecology methods and practices.

iii) Councils to focus on local/regional applications for soil improvement products and practices as a potentially sustainable market for products containing biomass/organics that can be reclaimed from urban waste streams.

iv) EfW opportunities to be considered in the role of sustainably managing **waste processing residues** in preference to simple landfill only.

v) Councils to give priority to the development of **regional solutions in collaboration with "neighbours"** to achieve optimum systems and infrastructure efficiency.

This later concept (v) had particular relevance to PCC, with the result that The Hills Shire (THS), Blue Mountains City Council (BMCC), Hawkesbury City Council (HCC) and Blacktown City Council (BCC) accepted the invitation to form a **WSROC Sub-Group** based on not only their "neighbourliness" but also the geographic and potential infrastructure synergies.

1.2 RWS Core Focus Areas and Recurring Themes

Whilst the RWS Success Criteria, guiding philosophies and specific strategies are all dealt with in detail in subsequent sections, a selection of the most crucial are summarised here for context.

1.2.1 Historical Context

Traditionally, (say until the 1980s) individual municipalities operated waste collection and disposal services to achieve public health requirements as a primary objective, and often as a totally internal service delivery program, since most councils had their own landfill disposal facilities – **the historical approach**.

Then, up until almost the present day, landfill scarcity and ever more onerous environmental protection regulations and operational requirements saw a period of considerable landfill consolidation, and the resultant council collaboration around common shared disposal facilities. At the same time, the rapid increase in fast moving, consumer packaged goods saw the systematic introduction of what has now matured as the "yellow" bin, dry recyclables system. Both of these initiatives have seen the need for councils to integrate and collaborate for full service delivery well outside their respective boundaries and spheres of direct influence. This development provides a strong indicator as to the strategic roles and influences councils will need to foster and develop to achieve optimised resource recovery targets in the future – **the "collaborative" approach**.

Attachment A, an Eco Waste Discussion Paper EWDP 13-013R provides background on the generic issues related to channelling materials reclaimed from urban waste streams back into actual "market facing" products and services.

The approach for this Regional Waste Strategy (RWS) will be to identify highest value uses and applications (Attachment B – EWDP 13-014R) for materials that could be readily recovered from residual urban waste streams with or without pretreatment or processing to an interim stage, so that they can present with confidence and assurance as supplementary, or virgin raw material replacements, into finished products; and thus introduce secure "market pull" into the resultant processing cost structures – **the fully integrated approach** as described herein.

1.2.2 Closing the Loop/Making Products from Waste

As described above, the history of waste management for local councils has been defined by the primary observance of public health protection obligations, with resource recovery as a "by-product" of the core business.

The RWS will present both the need and opportunity for the primary goal to be to channel materials under management back into the Productive Economy as efficiently as possible (Figure 1-2), with public health and environmental protection as an essential, but subsequent consideration.

The disciplines for presenting reclaimed resources that can be accepted back into the Productive Economy for full and fair value requires councils to collaborate closely and productively with the respective industry sectors and specialists, but if such collaborations are fully productive, "market pull" for reclaimed materials can replace the current "supply push" with much improved economic and commercial circumstances for all (Attachment A).

1.2.3 Product Stewardship

Perhaps the most significant new public policy initiative to emerge from OECD jurisdictions in recent years, and now legislated in Australia, is the concept of Product Stewardship – or Producer Responsibility. In brief, this approach advocates a whole-of-supply-chain approach to optimising resource use in the provision of goods and services to the community, and a "sharing" of the responsibility for the achievement of the ultimate benefits[1].

Whilst this issue is dealt with in detail in Section 3 – Approach & Methodology and forms the framework for the logical development of Section 5 – Proposed RWS, the fundamental issue to be addressed in the RWS is to demonstrate that the emerging issues and benefits are fully understood and completely incorporated into the final RWS and resultant recommendations.

In brief, the RWS needs to acknowledge the emerging disciplines of Industrial Ecology, to assist manufacturers of goods and services to plan for the optimised use of resources in the delivery and consumption of their respective product and service offerings, but most importantly, to advocate for the appropriate post-consumer systems and infrastructure to enable the planned outcome **to be actually achieved**.

This issue will be mostly addressed in Section 3.6.4 in the RWS during the discussion of drop-off centres/hard waste collections and council clean ups and at Section 5.2.6, which will specifically address items 1.1.2 i) and ii) above.

1.2.4 Streaming/Cascading Approach

The historical approach to the delivery of waste management services related to the observance of public health protection obligations. For this outcome only one discard option/household was required (usually a 55 L can).

However, as the "loop closing" resource recovery imperatives have emerged, householders are now presented with at least three discard options including the "yellow bin" – dry recycling stream, various systems for garden waste recovery and the "red bin" for residual wastes. A range of occasional kerbside/hard waste/drop-off options is also provided on a council-by-council basis.

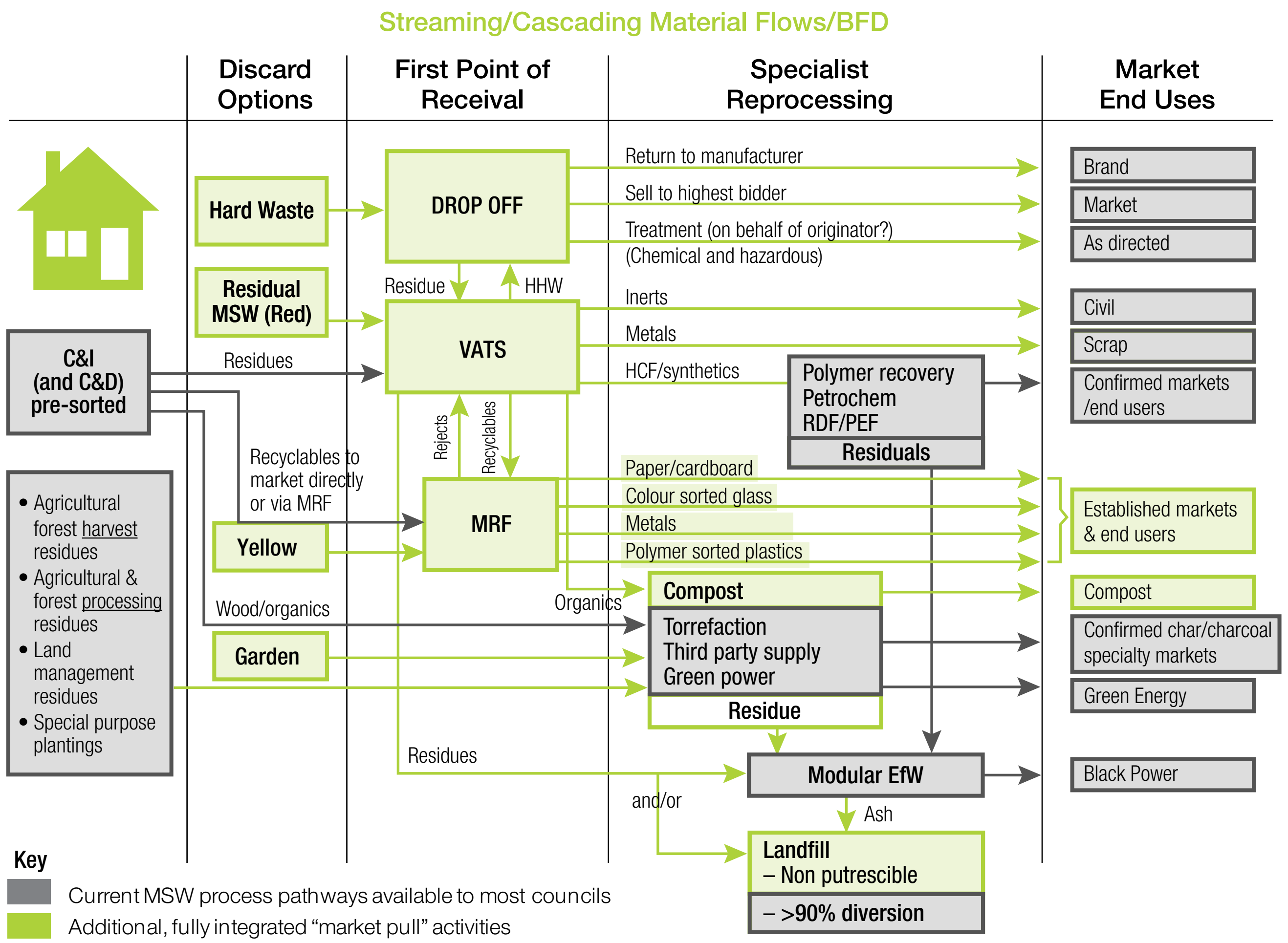
The strategic rationale for providing these additional discard options, over and above the basic "red bin" service (which addresses public health protection objectives), is to create more homogeneous streams of material than would otherwise be available from a red bin only service, as the basis for optimising subsequent resource recovery activities. In effect, residents are being given the opportunity to assist with and influence the ultimate resource recovery outcomes by simply discarding certain materials, like-with-like, to simplify the subsequent waste sorting, resource recovery activity. This represents a **"streaming"** approach; and requires councils to educate, inform and motivate residents, to make a significant contribution to the possibility and efficiency of subsequent resource recovery value and quality.

1 Direct producer engagement is the primary approach adopted in the RWS for the achievement of 1.1.2 (a) and (d) above and as detailed in 5.2.1-6.2.1 and 5.2.6-6.2.6

The **"cascading"** concept accepts that not all materials will be appropriately discarded into the proposed "stream", or that all materials "streamed" and sorted will find the highest value end markets available from time to time; so, rather than such materials defaulting to the ultimate discard/landfill alternative, an integrated streaming/cascading system will keep providing "next best" resource recovery options and thus provide a dynamic "systems and infrastructure" platform **that councils have the opportunity to manage proactively for best results.**

These issues and outcomes are discussed in detail in Section 5, but Figure 1-3 summarises the concept that sees discarded materials present for inclusion into a number of different products, such that only genuinely "residual" or waste materials present for ultimate disposal.
The systematic articulation of this concept is at the basis of achieving the >90% ultimate diversion objective.

Figure 1-3: Streaming/Cascading Materials Flows/Block Flow Diagram (from Fig. 5-1)



1.2.5 It's All About the Biomass

Even with "green bin" and/or drop off and/or kerbside collection services, some 40-60% (depending on local demographics) of materials presenting in urban waste streams are biomass based, organic materials originating from gardens, food preparation, food waste and organics, and contaminated paper and cardboard packaging etc.

The biomass fraction of urban wastes may be the "biodegradable" fraction, but the biomass fraction is the single cause of urban wastes presenting as "putrescible" and generating the primary emissions, odour and leachate issues at landfill, and is the sole attractant for vermin and vectors etc. Converting these materials into valuable end products is a core focus of the RWS, and whilst the most cost-effective processing options usually involve composting, for suitable source separated (streamed) materials there are several factors which hinder the realisation of their value:

a) The market for such materials is yet to demonstrate full and fair value back to councils for such composted products.

b) The market is trending towards saturation for all but the best defined and highest value products.

c) Most of the mixed residual organic materials left in Municipal Solid Waste (MSW) cannot be processed into high value products by composting alone, due to the heterogeneous nature of the materials as received from households.

Section 3 (Approach and Methodology) and Section 5 (Proposed RWS) (5.2.8 and 5.2.11 F) provide targeted responses to these issues.

1.3 Financial and Commercial Issues

The NSW EPA commissioned KPMG to undertake a "Review of the NSW Waste and Environmental Levy". KPMG reported back in 2013, with a report that confirmed the immediate goal of the S88 levy, being to:

"…drive waste avoidance and resource recovery by providing an economic incentive to reduce waste disposal and stimulate investment and innovation in resource recovery technologies".

As discussed in Section 5 in detail, the current impact of the S88 levy for the WSROC Sub-Group councils equates to payments of some $12.5M/pa (approx. 115 ktpa to disposal x $107/t).

In traditional infrastructure financing terms, $12.5M/pa could fully service some $100M of appropriate capital expenditure by councils. Further, by processing MSW for optimum resource recovery, every tonne productively recovered will be a tonne that will not require landfill disposal, thus providing the existing landfill gate fee cost (approx. $200/t) to be productively applied to justify the expenditure on carefully designed, selected, procured and operated "market pulled" waste processing systems and infrastructure.
In other words, the incremental increases in the S88 levy, in parallel with the ever more onerous environmental protections now being proscribed for disposal facilities, are now imposed on councils to such a level that alternatives to landfill disposal are now commercially attractive in their own right. This has been the express intent and objective of government policy, including the S88 levy, for at least the last 10 years, and now the change to systematic, "loop closing" resource recovery is cost-effective, as described in Section 7.

A core focus area for the RWS is to propose a regional systems and infrastructure plan that will outline a fully integrated strategic approach for the five Sub-Group councils that will:

a) Demonstrate the essential pathways that need to be adopted to present reclaimed urban waste materials such that they will be fully accepted and valued by the Productive Economy.

b) Provide "streaming/cascading" options to economically manage inventories in response to market fluctuations.

c) Reallocate the existing expenditure on S88 levies and disposal fees to the systematic reclamation of resources.

These outcomes to be achieved within a risk/reward profile acceptable to the Sub-Group councils, such that:

i) >90% of materials under management will be diverted from landfill disposal.

ii) Future budgeting for the provision of waste management services should be possible with at least CPI certainty if not a "flat lining" or deceasing net cost in real terms/service.

iii) The existing cost structures, created by ever increasing (>CPI) disposal costs, the S88 levy and very low value returns from the sale of reclaimed materials are, within the period identified for the full development and implementation of the RWS, shown to be the turning point for councils in terms of total waste management costs.

Summary of Section 1 – Background and Context

The WSROC Sub-Group of Councils, including:

- The Hills Shire;
- Blacktown City Council;
- Blue Mountains City Council;
- Hawkesbury City Council; and
- Penrith City Council.

have identified that as a region of "neighbours", collaboration may well deliver the next generation of systematic resource recovery systems and infrastructure much more cost-effectively.

The actions of this Sub-Group were entirely compatible with, supportive of and in parallel with the issuing of the draft WARR strategy (2013-2021) which, in part, was encouraging of the development of such RWS and was providing financial support to achieve.

The specific needs and requirements of the respective Sub-Group councils have been recorded and collated.

Core focus areas and recurring themes that will guide and/or be addressed in the RWS have been outlined for context in helping to identify and scope the main thrust of the RWS.

2. Strategic Objectives

From the very inception of the RWS development project the five Sub-Group councils involved sought to lay down some goals or strategic objectives to benchmark both the RWS development process and the outcomes established in the finally signed off RWS document.

2.1 Criteria for (RWS) Success

The following Criteria for Success were proposed, developed and agreed at the initial Sub-Group meetings and are listed here with some background to each.

a) **When fully implemented, the RWS should be able to deliver >90% diversion (from landfill and/or S88 waste levy) for all wastes under management.**

A founding principle for the introduction of the S88 levy (KPMG, 2013) was to provide a clear commercial disincentive for continued landfill disposal of urban wastes from which recovered resource value could be productively realised. The basic concept being that the more expensive landfill disposal is, the more commercially attractive alternative resource recovery processes appear.

With S88 levies now at $107/t and due to escalate at $10 pa + CPI, the avoidance of the S88 levy obligation could equate to a saving of $20.4M/pa,[2] that could service some $100-$200M of new capital expenditure applied to process the same urban waste streams for optimsied resource recovery.

b) **The eventual cost (waste service charge)/ratepayer (averaged across the Sub-Group councils) of all/any new systems and infrastructure proposed in the RWS should be no more than the current costs (target $340-$380/ratepayer, including the respective cost of collection services).**

In undertaking the RWS, the basic proposition is that all new systems and infrastructure costs proposed should be capital justified by:

i) The savings in S88 levy liability.

ii) The avoided disposal costs.

iii) The increased receipts from the sale of recovered resources.

iv) Commensurate reductions in environmental management costs (licence fees, gas management costs, monitoring costs etc.).

c) **The new RWS should establish a sound commercial platform for the delivery of all future waste services by councils that can be budgeted with CPI certainty, (rather than the "hockey-stick" escalations that characterise waste management costs for councils at present).**

2 PCC, BCC, THS – SMA @ $107.80; HCC – ERA @ $107.80; BMCC – RRA @ $53.70 = $20,384,847

The major contributors to the "above CPI" annual costs of delivering the waste services to ratepayers for individual councils include:

i) Ever increasing cost of regulations and increasing environmental protection costs imposed by EPA.

ii) The scheduled escalation in S88 levy costs.

iii) The ever increasing level of service provision required by the community.

iv) The limited or token value received for reclaimed/recovered resources.

The RWS will strive to:

- Standardise and propose a platform of best practice service delivery that meets or exceeds community needs and expectations, and that will not need undue continuous improvement and upgrading.
- Optimise the value received for all recovered resources.
- Establish mutually beneficial relationships with expert service providers and end markets that will standardise system operating costs.

d) Where new waste receival, sorting and processing systems and infrastructure is proposed, councils should be distanced from any subsequent process or market risk.

All resources recovered from urban waste streams must be subsequently directed to specific or identified markets or reuse opportunities, which then include these resources into the manufacture of actual products. The process of manufacturing such products, and supporting such brands, commercial offerings and marketing is not core business for councils.

e) Where new waste processing facilities are proposed in the RWS, councils should have the basic option of just providing wastes to the expert providers of such facilities, for an agreed gate fee as the absolute limit of their financial exposure. However, where such facilities are run as profitable concerns, councils should have the opportunity to participate in the equity structure for such facilities where they have a commercial appetite for such investments.

This situation should be reviewed purely on a case-by-case, council-by-council basis.

f) The establishment and/or procurement of all/any new waste processing facilities must be established in full compliance with any relevant local council tendering and/or asset procurement procedures and be able to demonstrate best value for money for residents.

g) Wastes under management, as proposed in the RWS, should be handled within a streaming/cascading/regime, such that Highest Net Resource Value (HNRV) is achieved at all times.

This approach accepts that urban wastes present at different times, in different places and by different members of the community who themselves may have different motivations and levels of understanding. A streaming/cascading system for urban waste management encourages **all presented wastes** to be **streamed** to their highest net resource value, but if such an outcome is unavailable, then materials **cascade** down to the next best use rather than being lost to disposal only.

h) The community should be fully serviced with convenient and cost-effective waste management systems that cap Capex/Opex costs for councils, but also leave scope for optimised participation in the system to derive benefits for individual ratepayers and/or council as a whole.

Proactive community participation can reduce system costs and achieve individual and system-wide benefits. Appropriate incentives should not be suppressed in the drive for uniformity and cost control.

i) Whatever the proposed systems and infrastructure resulting from the RWS, the achievement of councils' overriding WHS obligations must never be compromised.

Summary of Section 2 – Strategic Objectives

To ensure that a final RWS addresses the needs, aspirations, capabilities and respective starting conditions of participating councils, the assessment criteria have been developed by the participating councils.

3. Approach and Methodology

3.1 Introduction

To achieve the Sub-Group strategic objectives which will meet and/or exceed the performance minimums as projected as the NSW WARR goals, there are some strategy defining approaches that are additional to those addressed in Section 1.

With systematic and cost-effective resource recovery as the primary strategy focus, supported by the high level strategy "drivers" (3.2 below) and the commercial imperative generated by the factors making landfill disposal so expensive, the approach and methodology adopted in the past will not be appropriate for current needs.

3.2 Strategy "Drivers" – Commercial, Social, Environmental and Economic

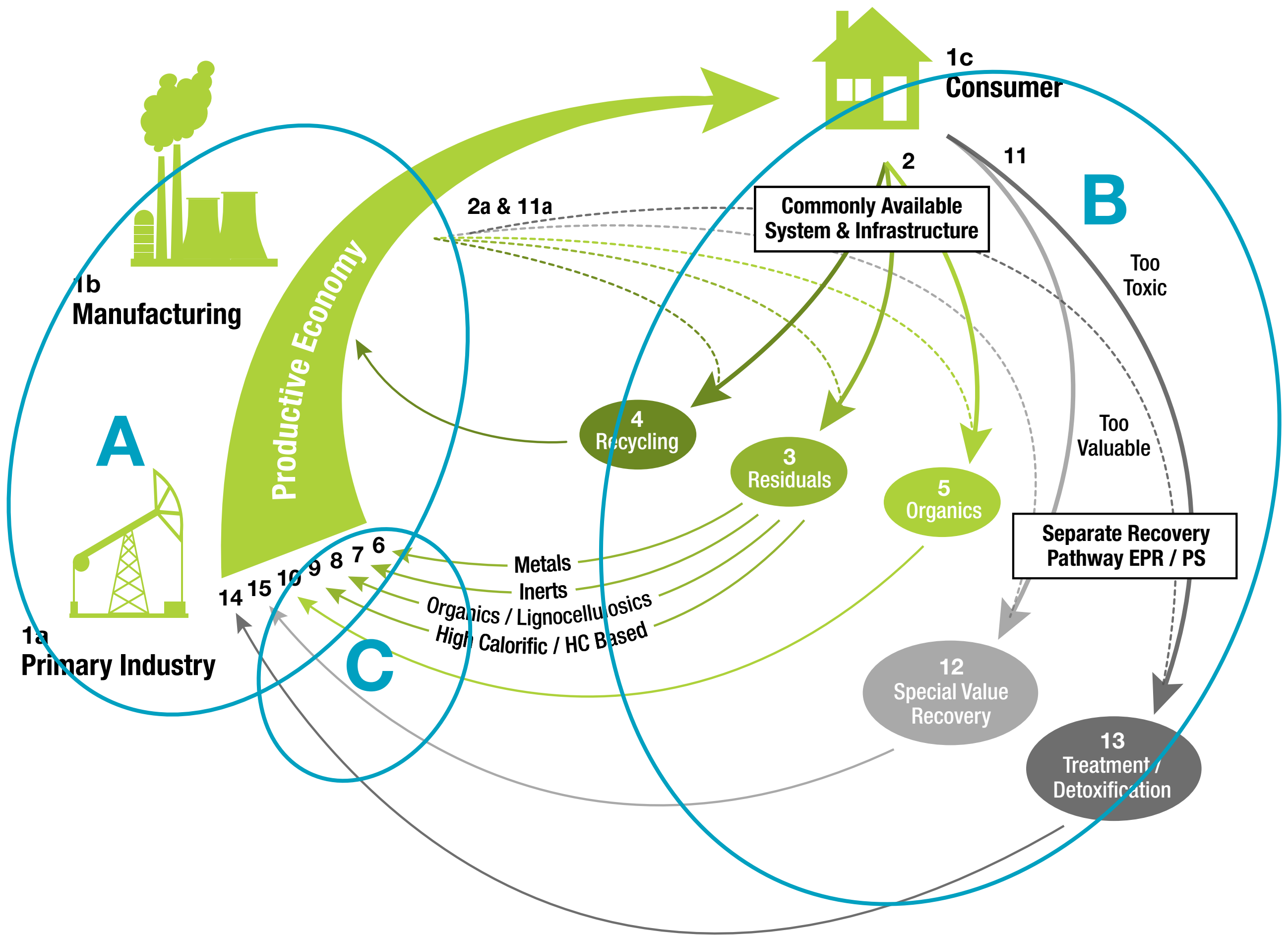
Fig. 3-1 presents a stylised representation of the urban waste management task as it relates to the productive economy as in the NSW EPA (draft) WARR Strategy 2013-2021. In brief, the full range of goods and services that are made available to the community have traditionally presented, post-consumer for ultimate disposal. This outcome has and is presenting as a detrimental market failure, in that tangible externalities are not brought to account in the process of providing the original goods and services. Such an outcome is a contributing factor to one or all of the more widely understood and acknowledged public policy agendas.

- **Carbon emissions** – the accumulation of "fossil" carbon in the atmosphere, exacerbated and sustained by the excessive extraction, conversion, use and disposal of energy and natural resources in the provision of such goods and services.
- **Resource depletion** – many of the primary resources applied in the provision of the above goods and services are finite, or potentially degrading of our collective environment in their production, conversion and consumption.
- **Commercial factors** – systematic resource recovery can now be demonstrated to be a more cost-effective option than simple disposal, if implemented with regard to the realisation of Highest Net Resource Value (HNRV) for all materials under management (Attachment B).
- **Social factors** – the general community abhors wastefulness, as has been demonstrated by the enthusiasm with which they participate in recycling, and select drop off and green waste schemes. Whilst as individuals their relative impact may be small, but as organised collectively via their local and state government representatives, the results can drive and influence the political processes.
- **Environmental factors** – optimising the sustainable use and application of resources, and minimising any detrimental environmental impacts in the process, is a basic contributor to a sustainable and/or circular economy.
- **Economic factors** – the sensitive and thoughtful use and application of resources and their continuous return into the productive economy is a strong driver of economic growth and development, mostly funded by the constantly realised HNRV of the actual materials themselves, thus internalising the wastefulness that currently presents as the unsustainable economic externality to conserve resources and generate sustainable growth.

3.3 What is Urban Waste and where does it come from?

- All goods and services consumed by the community as a whole present "post-consumer" as urban waste streams – MSW – usually managed by local councils.
- The manufacturers and commercial enterprises generate waste, offcuts, by-products or otherwise unwanted materials in the normal course of their activities and these materials present at 2a and 11a in the figure below and are referred to as the Commercial and Industrial (C&I) waste streams – usually handled by private contractors.
- The construction, infrastructure, engineering and land development sectors also generate land clearing/preparation and demolition wastes and actual construction wastes, referred to collectively as Construction and Demolition wastes (C&D) – usually handled by private contractors.

Figure 3-1: The vital relationships between the manufacturers, the resource recovery sector and the Productive Economy



Key:

A = The brands, manufacturers and providers of all the essential goods and services used and consumed by the general community

B = **The Resource Recovery Sector** – the providers and operators of all the systems and infrastructure necessary to collect, sort and aggregate all the materials presenting in urban waste systems such that they can be usefully presented back for valuable application in the Productive Economy

C = The crucial point where recovered resources and energy are presented back for use in the Productive Economy to supplement/replace primary resources

NB: The key to the numbers 1-15 Fig. 3-1 can be found in Attachment C, pages 10-19.

3.4 The Evolving Role of the Waste Collection and Sorting Sector

The traditional role of collecting and disposing of MSW has been a core local council function since municipalities were created. In more recent times the actual operational aspects have been contracted to specialist waste service contractors but the basic business model is still generically a fee-for-service model – whatever the level of service required or requested by councils, a per service, per resident or per tonne rate is quoted and contracted, and then provided.

This basic service may well include the provision of containers, the regular servicing of these containers and the subsequent sorting and processing of the collected materials, but all based on a fee-for-service model, in that whatever the client (a council) asks for and pays for, they get. The big change now occurring, that is severely testing this existing business model, is the need to actively transition the collected and (roughly) sorted materials into **actual products** – products for which real demand can be evidenced, products that utilise the reclaimed materials at or close to their inherent HNRV and where **full and fair value for such reclaimed resources is reflected in a local council's net cost of service budgets.**

3.5 The "Route-to-Market" for Recovered Resources

Until now, the only proven and demonstrated route-to-market for resources reclaimed from urban waste streams was via a clear two stage process whereby, Stage 1, the fee-for-service, waste collecting and (primary) sorting contractors present sorted materials in a form and to a standard determined and accepted by the subsequent end user/product manufacturing sector, who then "shandy" the reclaimed resources into their production processes (maybe after a further sorting/beneficiation process) so as to replace/supplement the higher quality but more expensive virgin resources.

Invariably, the end users are established businesses/sectors that currently produce their product range from virgin resources and have established customer/market expectations/ benchmarks in the process. Unlike the fee-for-service model for the waste collection and sorting sector, such end users are **wholly dependent on reliable/recurring product sales;** their ultimate commercial viability must not be jeopardised by affecting product quality just to use more or lower quality recovered resources.

In summary, the route-to-market for some existing recovered resource streams is informative and some actual material specific examples demonstrate this approach:

- **Ferrous and Non-Ferrous Metals**

a) The waste collection and sorting contractors recover these materials as an integral part of their waste sorting operations.

b) These materials are sorted to a level of resource purity as generically established by the global scrap metal sector and as particularly defined by such institutions as the LME and CBOT which facilitates "sight unseen" trading.

c) Metal products converters and/or manufacturers then acquire these reclaimed resources for inclusion into the existing manufacturing operations to replace/ supplement virgin raw materials in their established businesses.

d) The final products present to the eventual end user without any need to apologise for or justify their origins. The final products justify their market position based on performance and attention to customer need, and defined final product specifications – not because they contain "reclaimed" resources.

- **Paper and Cardboard**

a) The waste collection and sorting contractors recover these materials as an integral part of their waste sorting operations.

b) These materials are sorted to a level of resource purity as generically established by both the international paper/cardboard trading sector and/or any particular end user with a specific need for such materials.

The global paper/cardboard markets put values on the various grades of recovered paper and cardboard that reflects what materials of a particular quality are worth when benchmarked against alternative virgin resources that could perform the same or similar functions.

c) The end users of these reclaimed resources then use them to replace/supplement virgin resources necessary to make the particular product that is their specialty.

d) The end user of the selected reclaimed paper/ cardboard materials relies on the quality and demand for their actual product offering to survive and prosper. Reclaimed materials can offer an opportunity to reduce virgin raw material supply costs, but never at the risk of degrading ultimate product quality and marketability.

- **Similar Route-to-Market Process Flows Exist for Reclaimed Glass and Polymer Sorted Plastics**

This conceptual route-to-market has been adopted in the RWS as the foundation strategy to place materials proposed to be recovered from the Sub-Group waste streams.

Of particular importance in achieving >90% landfill diversion targets is stimulating such outcomes in the biomass/organics fraction (40-60%) of MSW streams currently being disposed to landfill (approximately 100ktpa).

3.6 Adopted Methodology

3.6.1 "Market Pull"

A stated objective of the RWS is to achieve full and fair value for the recovered resources supplied back into the Productive Economy.

This must be a two stage process; the initial collection and sorting undertaken by the (fee-for-service) waste sector, and the eventual incorporation or "shandying" of the reclaimed resources into finished product (and energy) manufacture by the respective product manufacturers as described in Section 3.5.

A feature of the historical development of the recovered resources sector has been their ability to offer only the minimum prices for the reclaimed materials, (cullet, metals, paper and cardboard, and polymer sorted plastics etc.) arguing that:

- The quality was inferior.
- The demand for the finished products was "soft".
- The availability was "supply pushed", in that the actual market demand was less than the volume of materials available.
- Councils preferred long-term budgetary certainty for the offtake of the various materials, meaning that "inventory" risk was placed with the end users, who would need to trade off, export or "down cycle" any materials that they accepted, but could not use beneficially within their respective core businesses.

To address these very valid issues and concerns, the methodology adopted within the RWS is to:

i) Negotiate the most appropriate quality standards for all recovered resource streams. Some of which exist, but may benefit from a review, and some (especially biomass) will need further nurturing;

ii) Proactively develop inventory management strategies, especially using the overriding streaming/cascading framework developed for the RWS, so that actual cost/benefit of passing the risk to agents or end users can be objectively assessed by a range of more proactive management approaches;

iii) Identify real/actual markets and end users for the full suite of reclaimed resources and encourage a "market pulled" relationship with markets (5.2.11).

This approach will be especially critical in the area of **biomass products and end users** if only because of the proportion (40-60%) of materials under management. As discussed in Section 5, the actual negotiations and responsibilities for the outcomes described above could be undertaken by:

a) Individual councils;

b) The Sub-Group as a whole;

c) The contracted waste collection and sorting service provider;

d) Some other appropriate body or agent;

e) Or a selection of a)-d) above as appropriate on a council-by-council basis, or material stream-by-material stream. The point here is that this level of effort and engagement will be essential to the full achievement of the stated objective.

In summary, the systems and infrastructure scoped and proposed in the RWS will be specifically tailored to deliver the reclaimed resources in the manner and to the quality that will maximise value for the Sub-Group councils.

Summary of Section 3 – Approach and Methodology

Approach

- The RWS is being developed to define the systems and infrastructure necessary to recover resources from the regional (Sub-Group) urban waste streams so that the optimum balance is struck between the value realised for the waste streams under management and the process costs and risk allocations required to achieve such an outcome.
- The RWS is being developed to not only meet and/or exceed both the strategic objectives of the Sub-Group councils and the more general goals of the (draft) WARR Strategy, but to do so by scoping the systems and infrastructure necessary to achieve such outcomes as efficiently and cost-effectively as possible.
- A feature of the RWS will be the framework proposed for direct engagement with both the consumer goods and services manufacturing sector as well as the specific product manufacturing sector willing and able to incorporate recovered resources into their operations for mutual advantage.

Methodology

- To focus on addressing the issues that will derive optimum value from the recovered resources under management by striving to retain market pull as a commercial outcome.

4. Sub-Group Councils' Data

4.1 The Hills Shire Council

4.1.1 Current Strategy, Status and Vision

At its meeting 26 March 2013, Council resolved, in part that:

"Council develops a strategy for pursuing all possible opportunities available via the NSW Government's five-year Waste & Resource Recovery initiative including consideration of securing a site that allows the processing of garden organics with food."

In the second half of 2013, The Hills Shire commissioned Impact Environmental Consulting Pty Ltd (IEC) to develop a "Resource Recovery Plan and Strategy" for The Hills Shire for the 2013-2017 period.

4.1.2 Planned Initiatives and Possibilities

In September 2013, council staff reported the major findings of this report against agenda item "NSW Regional Waste Strategy".

The key findings, recommendations and vision for the future that this collaborative process produced, include, in summary:

a) The content and objectives of the NSW Government's "Waste Less, Recycle More" initiative were fully addressed and included.

b) That significant increases in resource recovery are unlikely to be (cost-effectively) achieved if council works in isolation. Regional collaboration with neighbouring councils is recommended especially with regard to the provision and procurement and access to the next generation of waste processing facilities and infrastructure; such as specialised organics processing facilities, AWT and EfW facilities.

c) Such regional collaboration should fully support the specific actions identified in "The Hills Future Community Strategic Plan" to provide services, infrastructure, information and education that facilitate resource recovery and encourage commercial and residential waste minimisation, including:

- Deliver safe, efficient and cost-effective waste, recycling, garden organics and clean up services;
- Manage hazardous waste to minimise environmental harm;
- Provide innovative education and communication programs that encourage community behaviour change to conserve resources and reduce waste generation;
- Develop and implement a Resource Recovery strategy;
- Investigate opportunities for the development of waste processing infrastructure in the NW of the region;
- Investigate regionally based resource recovery solutions; and
- Investigate feasibility to collect food and garden organics.

4.1.3 Performance Data and Statistics

Table 4-1: Population and Demographic Profile

Council Name	Population [a] (2011/12)	Projected Population 2021 [a]	Total Number of Individual Households in LGA [b] (2011/12)	% Single Unit Dwellings (SUDs) [b] (2011/12)	% Multi Unit Dwellings (MUDs) [b] (2011/12)	Socio-Economic Index a Ranking within State (High Rank, Decile, % = Good)		
						Rank	Decile	Percentile
The Hills Shire	176,986	216,500	59,710	86%	14%	148	10	12

Source: a) ABS b) Local Government Data Return 2011-2012

Table 4-2: Waste and Resource Recovery Collection and Processing Systems

Council Name	Residual Waste		Recycling		Garden Organics	
	Bin Size	Frequency	Bin Size	Frequency	Bin Size	Frequency
The Hills Shire	140L	Weekly	240L	Fortnightly	240L	Fortnightly

Table 4-3: Total Domestic – Waste and Resource Recovery Generation

	Total Recovered	Total Waste to Landfill	Total Domestic Waste Generated
Includes:	Domestic Kerbside, Clean Up, Drop Off, AWT Recyclables	Domestic Kerbside, Clean Up, Drop Off	
Council Name	Tonnes	Tonnes	Tonnes
The Hills Shire	38,772	46,311	85,083

Table 4-4: Total Kerbside Domestic – Waste & Resource Recovery Generation

	Kerbside Recovered	Kerbside Waste to Landfill	Total Kerbside Waste Generated
Includes:	Domestic Kerbside, Clean Up, AWT Recyclables	Domestic Kerbside, Clean Up	
Council Name	Tonnes	Tonnes	Tonnes
The Hills Shire	38,546	40,098	78,644

Table 4-5: Total Clean Up and Drop Off – Waste and Resource Recovery Generation

Council Name	Clean Up and Drop Off Dry Recyclables Collected	Clean Up and Drop Off Organics Collected	Clean Up and Drop Off Waste to Landfill	Clean Up and Drop Off Total Generation
	Tonnes	Tonnes	Tonnes	Tonnes
The Hills Shire	921	1,518	6,213	6,439

Table 4-6: Residual Waste Bin

	Council Name
	The Hills Shire
Yield per Household – kg/hh/wk	13.0
Per Capita – kg/ca/wk	4.3
Total Paper %	20.89%
Food Organics %	33.02%
Garden & Other Organics %	14.81%
Total Plastics %	11.93%
% Potential Dry Recycling	22.80%
Potential Dry Recycling – kg/hh/wk	2.40kg

Table 4-7: Waste Collection, Disposal and Processing

Council	Collection Contract Details				
	Service Covered (if day labour, record "N/A staff")	Service Provider	Processing / disposal location / Facility	Contract Duration	Contract Expiry Date
The Hills	Garbage collection contract	Transpacific Cleanaway		7 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Garbage disposal/ processing contract	Veolia Environmental Services	Woodlawn, Goulburn	2 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Recycling collection	Transpacific Cleanaway		7 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Recycling processing	Visy Recycling	Smithfield	7 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Organics collection (leave blank where service not provided)	Transpacific Cleanaway		7 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Organics processing	Sita Australia	Eastern Creek	2 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Clean Up Service – collection contract	Transpacific Cleanaway		7 years + 3 x 1 year extension options	30/9/2014 up to 2017
	Clean Up Service – processing	Veolia Environmental Services	Horsley Park	2 years + 3 x 1 year extension options	30/9/2014 up to 2017

Table 4-8: Recycling Bin

	Council Name
	The Hills Shire
Yield per Household – kg/hh/wk	6.1
Per Capita – kg/ca/wk	1.9
Recyclable Paper %	59.93%
Total Glass %	28.15%
Total Plastics %	6.83%
Total Ferrous %	2.33%
Total Non-Ferrous %	0.71%
% Contamination	3.50%

Table 4-9: Performance Analysis

Council Name	Yield (kg/hh/wk)			
	Residual Waste	Recycling	Garden Organics	Food Organics
The Hills Shire	13.0	1.9	2.4	n/a

Table 4-10: Diversion Rate

Council Name	Domestic Diversion Rate %			
	Total Domestic	Total Kerbside	Total Drop Off	Total Clean Up
The Hills Shire	45.6	49.0	98.6	1.8

4.2 Blacktown City Council

4.2.1 Current Strategy, Status and Vision

Blacktown City Council's current waste management strategy *"Resource (Waste) Management Strategy – December 2008"* establishes Council's principles for the provision of service delivery:

"The Strategy will enable council to manage waste as a resource and works in partnership with the community to provide services and programs that meet their needs. The Strategy has developed principles and objectives to assist in guiding council's decision-making process in terms of program and service delivery.

The Strategy aims to develop programs and deliver services that maximise conservation of resources, based on the following principles:

- Minimise waste generation including addressing consumption.
- Encourage reuse of items that are still useful.
- Maximise resource recovery.
- Collect waste in a manner that facilitates maximum reuse or recycling.
- Ensure safe, efficient and environmentally sustainable disposal of material that cannot be reused or recycled.
- Community engagement via the provision of information and a developed understanding of the community's needs as input into resource (waste) management services and to future planning of resource (waste) management and related services and programs."

For the medium term, Council is taking all residual MSW (weekly 240L "red" bin service) to UR3R-Eastern Creek. Through the use of this treatment process, the provision of the recycling service and resource recovery through the household clean up service Council achieved a diversion rate of 61% in 2012/2013.

These prevailing contractual realities mean that Blacktown City Council has time to fully consider:

a) Incremental improvements to the existing waste collection and processing systems, in the short, medium and long term;

b) Pathways to continuously improve the net returns to community from the processing and value adding of the organic fraction in residual mixed waste, in the medium term (especially in light of the new NSW EPA EfW Policy); and

c) Possible systems and infrastructure to facilitate optimised economic, social and environmental outcomes in the handling of hard waste/clean up/drop-off materials at a time when multiple national product stewardship schemes are current, emerging or in prospect.

Whilst BCC has the largest population of any council area in NSW, it also contains one of the most intense urban growth areas, such that the municipal population is anticipated to grow by some 40% by 2036 to approximately 500,000 and most of this growth is planned for the North West (NW) areas of the City.

4.2.2 Planned Initiatives and Possibilities

In summary, BCC is well positioned in the short to medium term with existing collection and processing arrangements in place. But with considerable growth occurring in the Council area, opportunities exist to collaborate with appropriate regional initiatives during the next 0-5 years as part of a structured program to:

a) Look for incremental opportunities to further improve cost-effective resource recovery outcomes within existing contractual arrangements; and

b) Thoroughly research and develop the next generation of processing and viable "route-to-market" options for the new growth areas, in the short to medium term, and the whole municipality in the medium to long term.

4.2.3 Performance Data and Statistics

Table 4-11: Population and Demographic Profile

Council Name	Population [a] (2011/12)	Projected Population 2021 [a]	Total Number of Individual Households in LGA [b] (2011/12)	% Single Unit Dwellings (SUDs) [b] (2011/12)	% Multi Unit Dwellings (MUDs) [b] (2011/12)	Socio-Economic Index [a] Ranking within State (High Rank, Decile, % = Good)		
						Rank	Decile	Percentile
Blacktown City Council	312,479	366,105	102,292	85%	15%	77	6	51

Source: a) ABS b) Local Government Data Return 2011-2012

Table 4-12: Waste and Resource Recovery Collection and Processing Systems

Council Name	Residual Waste		Recycling		Garden Organics	
	Bin Size	Frequency	Bin Size	Frequency	Bin Size	Frequency
Blacktown City Council	240L	Weekly	240L	Fortnightly	No service	–

Table 4-13: Total Domestic – Waste and Resource Recovery Generation

	Total Recovered	Total Waste to Landfill	Total Domestic Waste Generated
Includes:	Domestic Kerbside, Clean Up, Drop Off, AWT Recyclables	Domestic Kerbside, Clean Up, Drop Off	
Council Name	Tonnes	Tonnes	Tonnes
Blacktown City Council	79,710	51,744	131,454

Table 4-14: Total Kerbside Domestic – Waste and Resource Recovery Generation

	Kerbside Recovered	Kerbside Waste to Landfill	Total Kerbside Waste Generated
Includes:	Domestic Kerbside, Clean Up, AWT Recyclables	Domestic Kerbside, Clean Up	
Council Name	Tonnes	Tonnes	Tonnes
Blacktown City Council	78,810	45,744	124,554

Table 4-15: Total Clean Up and Drop Off – Waste and Resource Recovery Generation

Council Name	Clean Up and Drop Off Dry Recyclables	Clean Up and Drop Off Organics	Clean Up and Drop Off Waste to Landfill	Clean Up and Drop Off Total Generation
	Tonnes	Tonnes	Tonnes	Tonnes
Blacktown City Council	–	–	6,000	6,000

Table 4-16: Residual Waste Bin

	Council Name
	Blacktown City Council
Yield per Household – kg/hh/wk	18.9
Per Capita – kg/ca/wk	6.1
Total Paper %	17.42%
Food Organics %	30.52%
Garden & Other Organics %	29.81%
Total Plastics %	7.77%
% Potential Dry Recycling	20.96%
Potential Dry Recycling – kg/hh/wk	3.23kg

Table 4-17: Waste Collection, Disposal and Processing

Council	Collection contract details				
	Service Covered (if day labour, record "N/A staff")	Service Provider	Processing / disposal location / Facility	Contract Duration	Contract Expiry Date
Blacktown	Garbage collection	SUDs-Blacktown staff MUDs-Remondis		Remondis-state government contract	
	Garbage disposal / processing	SITA	Eastern Creek UR3R	20 years	01/08/2025
	Recycling collection	Transpacific Cleanaway		7 years	12/12/2018
	Recycling processing	Transpacific Cleanaway	Blacktown MRF	7 years	12/12/2018
	Clean Up Service	Blacktown staff			
	Clean Up Disposal / processing		Genesis, Veolia Horsley Park and Blacktown Waste (Marsden Park)	Gate Fee	

Table 4-18: Recycling Bin

	Council Name
	Blacktown City Council
Yield per Household – kg/hh/wk	4.8
Per Capita – kg/ca/wk	1.6
Recyclable Paper %	60.44%
Total Glass %	21.18%
Total Plastics %	8.52%
Total Ferrous %	3.07%
Total Non-Ferrous %	0.90%
% Contamination	10.53%

Table 4-19: Performance Analysis

Council Name	Yield (kg/hh/wk)			
	Residual Waste	Recycling	Garden Organics	Food Organics
Blacktown City Council	18.9	4.8	n/a	n/a

Table 4-20: Diversion Rate

Council Name	Domestic Diversion Rate %			
	Total Domestic	Total Kerbside	Total Drop Off	Total Clean Up
Blacktown City Council	60.6%	63.3%	n/a	0%

4.3 Blue Mountains City Council

4.3.1 Current Strategy, Status and Vision

Blue Mountains City Council currently owns the landfill at Blaxland which receives some 43 ktpa of mixed wastes, including MSW, C&I and C&D from the Blue Mountains LGA.

In planning for the long term (2030+), Council engaged MRA Consulting (2013) to prepare a "Waste Management Options Study" focusing on preferred collection systems and possible processing and residue disposal options.

Options for transporting wastes and recyclables to existing waste processing and disposal facilities were costed and compared. Where any waste is transported to existing facilities in the Sydney Basin or west to regional NSW, one collateral benefit was the extension of the operational life of the Blaxland facility.

Analysis of the "Waste Management Options Study" and subsequent community consultation identified three domestic waste service options for further consideration. However, none of these options significantly extend the life of Blaxland landfill, so other value for money opportunities will continue to be explored.

With the collaboration of the Sub-Group councils, the medium term option of a **new** processing facility at South Windsor presents a further option to be considered by council. However, the BMCC area stretches from right across the Blue Mountains, and wastes generated in the west of the council area would need to be transported a considerable distance to reach South Windsor.

A parallel strategic planning initiative undertaken by NetWaste has identified Lithgow as one of three possible regional centres most suitable for the establishment of a major garden/biomass processing centre (the others being Orange and Dubbo).

So, whereas the MRA Consulting options study considered only **existing** processing/disposal facilities, if a medium to longer term view is adopted, South Windsor and Lithgow could be considered by BMCC as potential processing (and disposal) options.

Should these two options progress in the short term, the nature of the processing capabilities will significantly inform the preferred collection options and strategies for Council.

4.3.2 Planned Initiatives and Possibilities

In the short term, Council's proposed strategy is to:

- Continue with the current services that have been found to be the most efficient, value for money service of those currently available;
- Continue to work with the RWS Sub-Group to explore opportunities that might offer value for money waste processing and disposal options to Council's east; and
- Engage with possible partners to explore opportunities that might offer value for money waste processing and disposal options to Council's west.

4.3.3 Performance Data and Statistics

Table 4-21: Population and Demographic Profile

Council Name	Population [a] (2011/12)	Projected Population 2021 [a]	Total Number of Individual Households in LGA [b] (2011/12)	% Single Unit Dwellings (SUDs) [b] (2011/12)	% Multi Unit Dwellings (MUDs) [b] (2011/12)	Socio-Economic Index [a] Ranking within State (High Rank, Decile, % = Good)		
						Rank	Decile	Percentile
Blue Mountains City Council	78,391	83,700	32,419	100%	0%	128	9	84

Source: a) ABS b) Local Government Data Return 2011-2012

Table 4-22: Waste and Resource Recovery Collection and Processing Systems

Council Name	Residual Waste		Recycling		Garden Organics	
	Bin Size	Frequency	Bin Size	Frequency	Bin Size	Frequency
Blue Mountains City Council	140L or 240L	Weekly	140L	Weekly	No service	–

Table 4-23: Total Domestic – Waste and Resource Recovery Generation

	Total Recovered	Total Waste to Landfill	Total Domestic Waste Generated
Includes:	Domestic Kerbside, Clean Up, Drop Off, AWT Recyclables	Domestic Kerbside, Clean Up, Drop Off	
Council Name	Tonnes	Tonnes	Tonnes
Blue Mountains City Council	20,278	28,667	48,945

Table 4-24: Total Kerbside Domestic – Waste and Resource Recovery Generation

	Kerbside Recovered	Kerbside Waste to Landfill	Total Kerbside Waste Generated
Includes:	Domestic Kerbside, Clean Up, AWT Recyclables	Domestic Kerbside, Clean Up	
Council Name	Tonnes	Tonnes	Tonnes
Blue Mountains City Council	8,212	23,952	32,164

Table 4-25: Total Clean Up and Drop Off – Waste and Resource Recovery Generation

Council Name	Clean Up and Drop Off Dry Recyclables	Clean Up and Drop Off Organics	Clean Up and Drop Off Waste to Landfill	Clean Up and Drop Off Total Generation
	Tonnes	Tonnes	Tonnes	Tonnes
Blue Mountains City Council	761	11,305	4,715	16,781

Table 4-26: Residual Waste Bin (2011)

	Council Name
	Blue Mountains City Council
Yield per Household – kg/hh/wk	14.0
Per Capita – kg/ca/wk	5.8
Total Paper %	17.23%
Food Organics %	24.89%
Garden & Other Organics %	29.72%
Total Plastics %	9.78%
% Potential Dry Recycling	19.69%
Potential Dry Recycling – kg/hh/wk	2.54

Table 4-27: Waste Collection, Disposal and Processing

Council	Collection contract details		
	Service Covered (if day labour, record "N/A staff")	Service Provider	Processing / disposal location / Facility
Blue Mountains	Garbage collection	Council staff	
	Garbage disposal / processing	Operated by Remondis/ Thiess on behalf of BMCC	Blaxland (council) landfill
	Recycling collection	JJ Richards	
	Recycling processing	Visy Recycling	Smithfield
	Clean Up Service	Council staff (including chipping)	
	Clean Up Disposal / processing	Council landfill for clean up materials	Blaxland landfill

Table 4-28: Recycling Bin (2011)

	Council Name
	Blue Mountains City Council
Yield per Household – kg/hh/wk	5.1
Per Capita – kg/ca/wk	2.1
Recyclable Paper %	56.34%
Total Glass %	31.59%
Total Plastics %	6.99%
Total Ferrous %	2.33%
Total Non-Ferrous %	0.38%
% Contamination	3.46%

Table 4-29: Performance Analysis

Council Name	Yield (kg/hh/wk)			
	Residual Waste	Recycling	Garden Organics	Food Organics
Blue Mountains City Council	13.98	5.1	0	0

Table 4-30: Diversion Rate

Council Name	Domestic Diversion Rate %			
	Total Domestic	Total Kerbside	Total Drop Off	Total Clean Up
Blue Mountains City Council	41.4	25.5 (35.04% if chipping service included here instead of with clean up)	70.4	75.3

4.4 Hawkesbury City Council

4.4.1 Current Strategy, Status and Vision

In 2005, C4ES was engaged to consider "Future Waste Strategies for HCC and its Community", and in January 2011 APC was engaged to provide an update on this work in a report *"Waste Options Report"* to include changes in policy, technologies and markets.

Later that year (December 2011) APC was also engaged to conduct a community consultation for garden waste service options.

And finally, in April 2013, GHD produced a site master plan for the HCWMF, which council owns and operates at South Windsor.

These documents and subsequent discussions with council staff provide the basis for the following high level summary:

- Currently residual ("red" bin) wastes (approx. 21 ktpa) are collected by council day labour and disposed entirely to landfill at HCWMF.
- Currently "yellow" bin dry recyclables are collected by J.J. Richards, under contract, and taken to Visy, Smithfield MRF for sorting and selling to end users.
- Approximately 50% of HCC residents in the more urban areas have "green" bins for clean garden waste which is collected by Sita and taken to Kemps Creek for composting. Sita then sells the end products.

The 50% of HCC residents in rural areas who have no garden waste collection service can self haul to HCWMF if motivated to do so. Of the rural residents canvassed, most either compost on their properties, self haul to HCWMF, or burn on site.

Council is currently reviewing the option of introducing an at-call mulching service with the possible supply of composting bins and education campaigns to better ensure garden waste utilisation.

The GHD report identifies HCWMF as potentially suitable for extended landfilling with or without select waste processing and resource recovery being established on site.

With regard to HCWMF, the current site could be filled, at current rates, by Q3 2019, and an adjacent block is being purchased to provide ongoing capacity and to provide room for mixed waste processing, organics processing and the establishment of MRF, transfer and/or drop-off facilities as determined during the current RWS process.

APC (December 2011) identifies the opportunity to collaborate with neighbouring councils (and a capability to receive C&I waste streams) as an opportunity to reduce the development cost of new capabilities at HCWMF for council, and to make the very latest waste sorting and processes available to HCC, which otherwise might not be cost-effective.

4.4.2 Planned Initiatives and Possibilities

Since the development of a full range of best practice waste processing facilities may not be cost-effective for HCC acting alone, the APC (December 2011) report advocates for HCC to focus on optimising their collection and kerbside service systems, so that if ever/whenever new infrastructure is established at HCWMF, council would be in an ideal position to supply wastes and adapt existing collection systems as required.

As current owners/operators of HCWMF and potential hosts for key elements of a regional solution, Council would look to derive benefits from:

- Favourable gate fees;
- Land rent; and
- Access to waste sorting and processing facilities (and their resultant end markets) that would be unlikely to be cost-effective for HCC acting alone.

4.4.3 Performance Data and Statistics

Table 4-31: Population and Demographic Profile

Council Name	Population [a] (2011/12)	Projected Population 2021 [a]	Total Number of Individual Households in LGA [b] (2011/12)	% Single Unit Dwellings (SUDs) [b] (2011/12)	% Multi Unit Dwellings (MUDs) [b] (2011/12)	Socio-Economic Index [a] Ranking within State (High Rank, Decile, % = Good)		
						Rank	Decile	Percentile
Hawkesbury City Council	64,234	73,800	22,210	90%	10%	121	8	79

Source: a) ABS b) Local Government Data Return 2011-2012

Table 4-32: Waste and Resource Recovery Collection and Processing Systems

Council Name	Residual Waste		Recycling		Garden Organics	
	Bin Size	Frequency	Bin Size	Frequency	Bin Size	Frequency
Hawkesbury City Council	240L	Weekly	240L	Fortnightly	No Service	–

Table 4-33: Total Domestic – Waste and Resource Recovery Generation

	Total Recyclables	Total Waste to Landfill	Total Domestic Waste Generated
Includes:	Domestic Kerbside, Clean Up, Drop Off, AWT Recyclables	Domestic Kerbside, Clean Up, Drop Off	
Council Name	Tonnes	Tonnes	Tonnes
Hawkesbury City Council	8,663	24,154	32,816

Table 4-34: Total Kerbside Domestic – Waste and Resource Recovery Generation

	Kerbside Recovered	Kerbside Waste to Landfill	Total Kerbside Waste Generated
Includes:	Domestic Kerbside, Clean Up, AWT Recyclables	Domestic Kerbside, Clean Up	
Council Name	Tonnes	Tonnes	Tonnes
Hawkesbury City Council	5,842	21,934	27,776

Table 4-35: Total Clean Up and Drop Off – Waste & Resource Recovery Generation

Council Name	Clean Up & Drop Off Dry Recyclables	Clean Up & Drop Off Organics	Clean Up & Drop Off Waste to Landfill	Clean Up & Drop Off Total Generation
	Tonnes	Tonnes	Tonnes	Tonnes
Hawkesbury City Council	1,075	1,676	2,220	4,971

Table 4-36: Residual Waste Bin

	Council Name
	Hawkesbury City Council
Yield per Household – kg/hh/wk	18.4
Per Capita – kg/ca/wk	6.4
Total Paper %	14.98%
Food Organics %	22.01%
Garden & Other Organics %	30.48%
Total Plastics %	9.74%
% Potential Dry Recycling	21.55%
Potential Dry Recycling – kg/hh/wk	2.99kg

Table 4-37: Waste Collection, Disposal and Processing

Council Name	Collection contract details						
	Service Covered (if day labour, record "N/A staff")	Service Provider	Processing / disposal location / Facility	Contract Duration	Contract Expiry Date	Any Min / Max tonnages requirements	Specific Conditions worth noting
Hawkesbury	Garbage collection	Council Staff		Ongoing	N/A	N/A	N/A
	Garbage disposal / processing	Council	Hawkesbury City Waste Management Facility	Ongoing	N/A	N/A	N/A
	Recycling collection	J.J. Richards		3+1	2016	N/A	Includes SME commercial recycling from Council serviced local businesses
	Recycling processing	Visy	Smithfield	3+1	2016	N/A	N/A
	Garden Organics collection	J.J. Richards		6+1	2020	N/A	Only from our "Urban" areas – 50% of total housing stock in LGA
	Garden Organics processing	SITA	Eastern Creek	6+1	2020	N/A	N/A
	Clean Up Service	Cleanaway		3+1	2016	N/A	N/A
	Clean Up Disposal / processing	Blacktown waste service	Marsden Park				

Table 4-38: Recycling Bin

	Council Name
	Hawkesbury City Council
Yield per Household – kg/hh/wk	5.6
Per Capita – kg/ca/wk	1.9
Recyclable Paper %	46.75%
Total Glass %	34.91%
Total Plastics %	8.67%
Total Ferrous %	2.53%
Total Non-Ferrous %	0.97%
% Contamination	9.46%

Table 4-39: Performance Analysis

Council Name	Yield (kg/hh/wk)			
	Residual Waste	Recycling	Garden Organics	Food Organics
Hawkesbury City Council	18.4	5.6	n/a	n/a

Table 4-40: Diversion Rate

Council Name	Domestic Diversion Rate %			
	Total Domestic	Total Kerbside	Total Drop Off	Total Clean Up
Hawkesbury City Council	26.4	21.0	63.3	0

4.5 Penrith City Council

4.5.1 Current Strategy, Status and Vision

In 2005, Council (via a specially convened Working Group) considered future waste management needs and evaluated service options against five key objectives:

1) **Convenience** – Systems and practices that are convenient for the community to use and understand, so that the educative message is simple and clear, high levels of participation can be attained, and low contamination will be observed.

2) **Recovery Targets** – Systems and practices capable of achieving high levels of resource recovery and move Penrith forward in delivering on state targets at a pace that is consistent with the evolving markets.

3) **Risk Exposure** – Systems and practices that place technology and operating risks with service providers and provide Council with a high level of surety in service supply.

4) **Competition** – Systems and practices that maximise potential for Council to derive value for money through competitive tenders and market competition.

5) **Health & Safety** – Systems and practices that maintain high levels of public health expected by the community and maintain council's standards for OH&S and work practices.

This approach culminated in the awarding of the:

- Garbage collection and disposal contract to Sita (2007–2017+2);
- The recyclables collection contract to Visy (2007–2017+2); and
- The organics collection and processing (composting) contract to Sita (2007–2017+2).

These main service, disposal and processing contracts are now more than 50% complete, with some 4-6 years yet to run.

Undertaking this Regional Waste Strategy at this time has the advantage of:

a) Incorporating the learnings from the performance of the current contract to this point; whilst

b) Providing sufficient time to trial or initiate programs to demonstrate alternative approaches or technologies within the assured framework of the current contract; and

c) Allowing sufficient time to identify, select and implement alternative approaches, if such changes can be shown to be necessary, advisable and/or beneficial in light of a detailed review of such options at this time, and to then be fully proven and operational before 2017.

In 2012 MRA Consulting was engaged to complete a review of the new waste management contracts and summarised as:

i) The new three-bin service has projected Penrith City Council to a net diversion rate of some 62.4% which is one of the best performances of any council in the country, and only marginally short of the NSW target of 66%.

ii) Further improvements will come from:

   a. Incremental improvements in operation and participation at kerbside with the current system;

   b. Improved market penetration from the compost products; and

   c. Systematic resource recovery from the residual waste and hard waste fractions.

4.5.2 Planned Initiatives and Possibilities

To systematically address these three areas identified for optimising resource recovery and thus diversion from landfill, Council wishes to fully explore the opportunity to achieve:

i) The realisation of full and fair value from the kerbside collection of dry recyclables;

ii) The realisation of full and fair value, and market penetration, from the recovered (and composted) organics;

iii) Optimised resource recovery from residual wastes; and

iv) The most cost-effective resource recovery from hard waste/clean up materials.

These core issues are common to most councils in the Sub-Group region and the development of this Regional Waste Strategy aims to identify the benefits of closely collaborating with neighbouring councils to achieve systematic responses to these objectives, and to do so more cost effectively as a Sub-Group, than might otherwise be achieved by each council acting independently.

4.5.3 Performance Data and Statistics

Table 4-41: Population and Demographic Profile

Council Name	Population [a] (2011/12)	Projected Population 2021 [a]	Total Number of Individual Households in LGA [b] (2011/12)	% Single Unit Dwellings (SUDs) [b] (2011/12)	% Multi Unit Dwellings (MUDs) [b] (2011/12)	Socio-Economic Index [a] Ranking within State (High Rank, Decile, % = Good)		
						Rank	Decile	Percentile
Penrith City Council	184,681	206,195	65,259	85%	15%	110	8	72

Source: a) ABS b) Local Government Data Return 2011-2012

Table 4-42: Waste and Resource Recovery Collection and Processing Systems

Council Name	Residual Waste		Recycling		Garden Organics	
	Bin Size	Frequency	Bin Size	Frequency	Bin Size	Frequency
Penrith City Council	140L	Fortnightly	240L	Fortnightly	240L	Weekly

Table 4-43: Total Domestic – Waste and Resource Recovery Generation

	Total Recyclables	Total Waste to Landfill	Total Domestic Waste Generated
Includes:	Domestic Kerbside, Clean Up, Drop Off, AWT Recyclables	Domestic Kerbside, Clean Up, Drop Off	
Council Name	Tonnes	Tonnes	Tonnes
Penrith City Council	54,447	32,832	87,280

Table 4-44: Total Kerbside Domestic – Waste and Resource Recovery Generation

	Kerbside Recyclables	Kerbside Waste to Landfill	Total Kerbside Waste Generated
Includes:	Domestic Kerbside, Clean Up, AWT Recyclables	Domestic Kerbside, Clean Up	
Council Name	Tonnes	Tonnes	Tonnes
Penrith City Council	24,225	29,025	83,250

Table 4-45: Total Clean Up and Drop Off – Waste & Resource Recovery Generation

Council Name	Clean Up and Drop Off Dry Recyclables	Clean Up and Drop Off Organics	Clean Up and Drop Off Waste to Landfill	Clean Up and Drop Off Total Generation
	Tonnes	Tonnes	Tonnes	Tonnes
Penrith City Council	222	–	3,807	4,021

Table 4-46: Residual Waste Bin (2011/ 2012 financial year)

	Council Name
	Penrith City Council
Yield per Household – kg/hh/wk	8.5
Per Capita – kg/ca/wk	3.0
Total Paper %	27.90%
Food Organics %	18.84%
Garden & Other Organics %	14.94%
Total Plastics %	14.34%
% Potential Dry Recycling	31.86%
Potential Dry Recycling – kg/hh/wk	1.845kg

Table 4-47: Waste Collection, Disposal and Processing

Council Name	Collection Contract Details				
	Service Covered (if day labour, record "N/A staff")	Service Provider	Processing / disposal location / Facility	Contract Duration	Contract Expiry Date
Penrith	Garbage collection	SITA		10 years	30/06/2017
	Garbage disposal (SUDs)	SITA	Eastern Creek Landfill		2/08/2016
	Garbage processing (MUDs+rural)	SITA	Kemps Creek SAWT		2/08/2021
	Recycling collection	VISY		10 years	30/06/2017
	Recycling processing	VISY	Smithfield	10 years	30/06/2017
	Food & Garden Organics collection	SITA		10 years	30/06/2017
	Organics processing	SITA	Kemps Creek SAWT	10 years	1/08/2019
	Clean Up Service	SITA		10 years	30/06/2017
	Clean Up Disposal / processing	SITA	SITA Davis Rd / Elizabeth Drive Landfill		(joint with above)

Table 4-48: Recycling Bin (2011/2012 financial year)

	Council Name
	Penrith City Council
Yield per Household – kg/hh/wk	6.0
Per Capita – kg/ca/wk	2.1
Recyclable Paper %	52.55%
Total Glass %	27.36%
Total Plastics %	9.88%
Total Ferrous %	3.59%
Total Non-Ferrous %	1.35%
% Contamination	6.96%

Table 4-49: Performance Analysis

Council Name	Yield (kg/hh/wk)		
	Residual Waste	Recycling	Garden Organics Food Organics
Penrith City Council	8.5	6.0	13.0

Table 4-50: Diversion Rate

Council Name	Domestic Diversion Rate %			
	Total Domestic	Total Kerbside	Total Drop Off	Total Clean Up
Penrith City Council	62.4	65.1	96.3	2.5

5. Proposed RWS

5.1 Introduction

In Section 1, the background and context for this WSROC Sub-Group RWS was established.

In Section 2, the agreed (Sub-Group) strategic objectives are recorded, and these outcomes meet or exceed all the strategic requirements of the recently issued EPA RWS Development Guidelines.

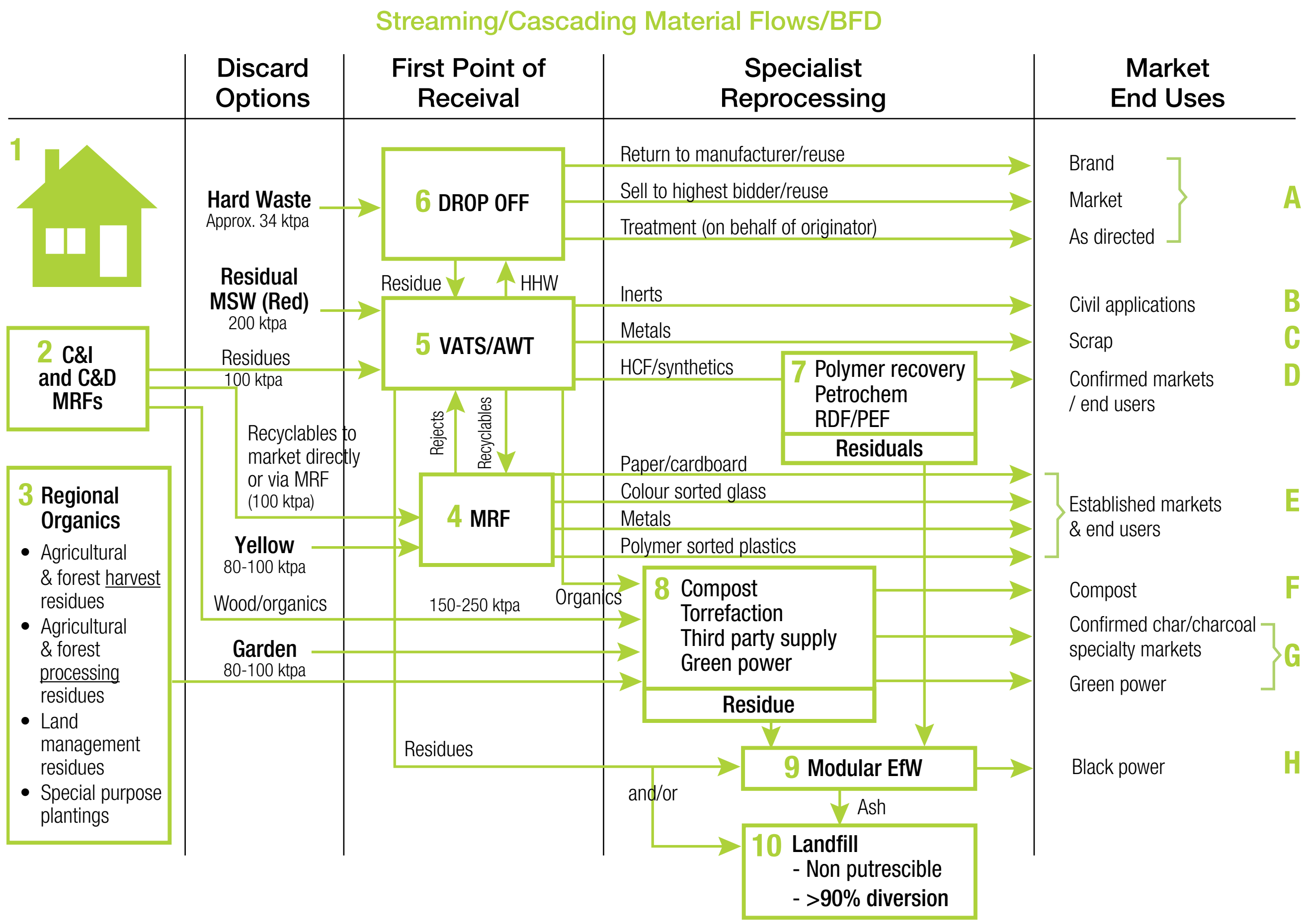
Section 3 outlined the approach and methodology adopted for the RWS, **with particular reference to the topic which is silent in the EPA RWS Development Guidelines: identifying the sustainable route-to-market for all the materials that need to be diverted from landfill, particularly the significant volume of biomass that cannot be usefully composted, but which is too inherently valuable (in a carbon constrained economy that will be looking to supply bio-based, "drop in" replacements / supplements for all functions currently serviced by fossil fuels) to be lost to landfill, even with LFG recovery or directly to EfW.**

Section 4 establishes the current services, strategies and volumes for each of the Sub-Group councils.

All this data and information has been synthesised to form the following RWS and action plan.

Figure 5-1 represents a conceptual block flow diagram of the proposed RWS, numbered at each functional node, with the following section to describe the issues and objectives at each point, the systems and/or infrastructure proposed at each point, action items arising and each summarised as to the strategic and/or policy objectives addressed at each point.

Figure 5-1: Proposed RWS block flow diagram and nodes of activity



5.2 Detailed Description of Every Action Node in the Proposed Sub-Group RWS

Key:

Node 1 – Residents, the Consuming Community

Node 2 – C&I / C&D Originated Waste Flows

Node 3 – Regional Organics/Biomass Sources

Node 4 – Dry Recyclables Sorting / MRF

Node 5 – Residual MSW, (VATS) / AWT / First Point of Receival Pretreatment Facilities

Node 6 – Drop Off / Hard Waste Management Sites

Node 7 – High Calorific Fraction (Secondary "plastics") Processing Options

Node 8 – Regional Biomass Management Facilities

Node 9 – Energy from Waste Facility for Residual Wastes

Node 10 – Residual Waste Landfill

Node 11 – Reclaimed Resources Markets and End Uses

The need for operations and outcomes for each of the numbered "nodes" in Fig. 5-1 are now discussed in detail.

5.2.1 Node 1 – Residents, the Consuming Community

i) Node 1 Description

(Consumer refers to both the individual consumer, and society as a whole, with needs and demands to be satisfied with material or resource-based goods and services.)

- The entire supply/demand dynamic in the economy revolves around the provision of goods and services to satisfy the various needs of the general population.
- Managing and handling all spent, surplus or unwanted materials, (wastes) is a state government jurisdictional responsibility; responsibility that is allocated to local government to manage operationally, at least for collection and disposal – the basic public health protection obligation. Striving for resource recovery and sustainable resource use outcomes is a politically driven agenda, promoted within the respective democratic processes for all three levels of government and also evidenced in consumption patterns and preferences of the consumers, for the originating goods and services. Evidence is available to confirm the consuming communities' enthusiasm for the need to respond proactively to the overriding strategic objectives.

ii) Issues, Opportunities and Operations

Since the community is generating the ultimate political drive for optimised resource recovery outcomes, and paying for the services through rates and taxes, it has become normal for councils to provide residents with a number of waste discard options to enable them to productively contribute to optimised resource recovery outcomes. The RWS promotes the provision of the four major discard options (see Attachment D):

- Stream #1 – yellow bin (approx. 80-100 ktpa);
- Stream #2 – green bin/organic (approx. 80-100 ktpa);
- Stream #3 – red bin residuals (>200 ktpa); and
- Stream #4 – a systematic response to hard waste/clean-up/product stewardship discard options (approx. 34 ktpa).

The recommended Decision Making Matrix (Attachment D, Table 1) is ideal for designing the preferred collection/streaming strategy for garden waste and could be readily adapted for application to hard waste/PS materials.

iii) Actions and RWS Response

- Engage with the community to engender support for programs or initiatives that promote the thoughtful purchase of goods and services with a view to:
  - a) Increasing the community's understanding of the whole of life and sustainability credentials of the various brands and products; and
  - b) Increasing the community's awareness of post consumer waste/resource recovery options.
- Educate for the optimised compliance with the four major discard options available;

- Consider the proposed Decision Making Matrix in the design of discard/collection services for green and hard waste; and
- Provide system feedback and performance information to maintain and increase community support.

iv) Intended Benefit

- Establishing "supply certainty" to subsequent processing facilities.
- To optimise the communities use of the four separate discard options as a significant contribution to achieving maximum HNRV resource recovery outcomes in the subsequent processing stages.
- To maintain and encourage continued political support for recycling, sustainable resource use and the avoidance of wastefulness.

v) Strategic Objective Supported and Achieved

WARR:

- Avoidance and reduction of waste generation
- Increasing recycling
- Diverting more waste from landfill
- Reducing litter (by promoting alternative discard options).

Sub-Group:

- Contributing to landfill diversion
- Helping to maintain/reduce net cost of service
- Optimising a streaming/cascading system
- Enjoying convenient and cost effective service
- Designing discard/collection/streaming systems that recover the most value from the materials and the lowest net cost.

5.2.2 Node 2 – C&I / C&D Originated Waste Flows

i) Node 2 Description

- The C&I (and C&D) waste flows are briefly described in 3.3 above.

Point of discard for commercial and industrial (C&I) waste

The manufacturing and service sectors produce a range of wastes that share many mutual characteristics with the materials discarded by consumers. This results in potential synergies from processing or recovering the highest net resource value from these materials within the same systems and infrastructure, and often servicing the same end markets. It therefore warrants detailed analysis.

A feature of C&I materials from individual generators is that they tend to be similar in characteristics week-in, week-out — e.g. a furniture factory generates timber waste or a clothing factory generates fabric scraps and so on. Because there are often inappropriate collection systems for these materials they are strong candidates to be value-added as by-products rather than being managed as mixed wastes.

Point of discard — valuable or toxic C&I

The same service and manufacturing activities that produced the materials presenting at Node 11 are likely to produce wastes and by-products of their own that could stimulate the value recovery or treatment capabilities that could beneficially process the post-consumer sources of the same materials (e.g. household hazardous waste and waste electrical and electronic equipment, batteries).

Or vice versa, the value recovery or treatment capabilities that are established to accept post consumer materials could process the similar by-products that arise from the originating service and manufacturing processes.

- Generically, C&I and C&D waste flows contain most of the same material types as MSW from the residential sector, (biomass/wood, metals, plastics/synthetics, glass, paper/cardboard, some organic/putrescible materials and inerts) but in different proportions – depending on their respective sources and collection methods.
- These materials are currently collected by the private sector in a price sensitive market, such that little streaming occurs at the source, and most materials are destined for direct disposal, unless a specific sorting facility is available to remove traditional recyclables before disposing of the remainder. Such sorting facilities, or MRFs, are usually capital justified by the reduction in the residual amount for landfill, and so are usually only adopted as a resource recovery initiative where either:

a) the prevailing landfill charges are sufficiently high; and/or

b) a landfill levy is applied.

NB: C&D wastes are often sorted to remove the heavy masonry/concrete/asphalt etc. fractions, which are sorted and crushed for use as aggregates. The residual timber is problematic for reuse due to the mix of clean timber, treated timber, engineered timber products and painted materials. After timber, metals and masonry are removed, the residual is usually landfilled.

ii) Issues, Opportunities and Operations

The sub-region generates some 350 ktpa of C&I waste and some 450 ktpa of C&D waste. Some 60% (210 ktpa)[3] of the C&I stream is biomass (wood/packaging/food waste etc.) The balance will be a mix of metals, plastics and the traditional dry recyclables and inerts.

Some 37% (165 ktpa)[4] of the C&D stream is biomass, mostly a wide mixture of wood types. After removal of the inert, masonry, concrete (including metals) fraction only a minor fraction remains for disposal.

The opportunity arising in the RWS is to:

a) Encourage dedicated C&I and C&D first-point-of-receival sorting facilities to recover recyclables, masonry and metals as above; and

b) To provide support to further process wood and residuals with or in parallel with the related material flows from the domestic MSW streams.

In the case of residuals, this could increase throughput volumes by some 50% to 300 ktpa in total.

In the case of dry recyclables, this could increase throughput volumes by some 100% to 200 ktpa in total.

In the case of green/garden/wood wastes (biomass) this could increase throughput volumes by 200% to some 250 – 350 ktpa in total.

In each case, the potential synergies available by considering the facilities, infrastructure and end markets for both MSW with the C&I and C&D streams could be developed for mutual advantage.

iii) Actions and RWS Response

Consult and collaborate with C&I and C&D collectors to optimise potential synergies and co-investment opportunities.

iv) Intended Benefits

To streamline the route to market for resources recovered from C&I and C&D where collaboration generates mutual advantage.

v) Strategic Objectives Supported and Achieved

WARR:

- Avoidance and reduction of waste generation (The establishment of the appropriate systems and infrastructure in the region can support a higher level of material brokering between C&I generators than the C&I collectors might justify in isolation)
- Increasing recycling
- Diverting the maximum from landfill
- Reducing illegal dumping

Sub-Group:

- Contributing to landfill diversion
- Providing the opportunity for co-investment and optimise facility cost-effectiveness to reduce net cost to ratepayers
- Optimise streaming/cascading outcomes

3 ECS Report January 2014
4 ECS Report January 2014

5.2.3 Node 3 – Regional Organics/Biomass Sources

i) Node 3 Description

As described in Attachment A and summarised in 3.5 above, materials recovered from urban waste streams need established "primary industry" sectors into which these materials can be "shandied" to reduce virgin raw material costs and impacts of the primary product manufacturing activity (e.g. cullet into bottle manufacture, paper and cardboard into box manufacture, scrap into EAF etc.). Some 50% of the materials being considered in the RWS are biomass/organics. **The approach taken in the RWS is to stimulate the development of the overall regional biomass generation and processing sector such that the urban waste generated organics have the best chance of accessing a viable regional industry** (see Node 8) into which they can be "shandied".

Box 5.1 – Parallel Study

The Sub-Group councils have commissioned a separate study to review the actual and potential regional biomass processing sector, against the following sub-categories:

a) Potential (non-MSW) sources

- forestry harvest residuals
- agricultural/horticultural harvest residuals
- forest and agricultural processing residuals
- land management and green field developing arisings
- biosolids and sludges
- special purpose crops

NB: Current uses and applications for these materials will need to be assessed to see if even higher value products could be manufactured from these materials as an outcome of this fully integrated RWS.

b) Potential regional markets

- tailor-made finished composts and mulches
- interim and finished biochar products
- stormwater management products
- green power/energy opportunities

c) Potential markets outside the Sub-Group region

- Metallurgical grade charcoals; and
- Assured biomass supplies to bio-refineries and specialist third parties.

ii) Issues, Opportunities and Operations

At a national and international level, a "biobased" industry is emerging in response to the need to "decarbonise" the economy in response to climate change and the finite nature of fossil resources.

This initiative has as its potential market the production of "drop in" biobased alternatives/supplements for every application currently supplied by fossil resources (gas, oil, coal). The current opportunity is to identify the benefits and possibilities for the Sub-Group region to participate to the fullest extent practical both within and without the Sub-Group region.

This approach will not only optimise the net benefits for regional waste management but could also establish a platform for appropriate regional economic growth and development.

Potential markets that urban waste derived wood waste/organics/biomass generally could support or be "shandied" into include:

- Quality compost products – unrestricted uses;
- Land remediation products – restricted uses;
- Torrefied/pyrolysed for inclusion into proprietary fertilizer products;
- Defined feedstocks into the manufacture of bioenergy products – gas liquid, solids; and
- Land management/stormwater products.

iii) Actions and RWS Response

To establish the most cost-effective/highest net resource value processing and product marketing opportunities for the various biomass/organics streams originating in the regional waste streams, collaboration with potential developers of a regional biomass processing capability (Node 8) would be beneficial – and could provide a secure (and HNRV) outlet for such biomass materials originating from municipal waste streams.

To achieve this, a detailed biomass resource mapping project will need to be undertaken to identify regional biomass supply, bio-product markets and biomass processing opportunities.

Once the optimal regional capabilities are identified, extra-regional or national alternatives could be considered and compared for net value realisation and offtake assurance.

Such a biomass mapping project might be beneficial on a "Sydney Basin" basis, since one opportunity for the Sub-Group region might be to process and value add organics which might be problematic or sub-optimal in the more urbanised areas of the Sydney Basin.

iv) Intended Benefits

The processing of the full range of biomass/organics presenting from the regional waste streams will be too heterogeneous and indeterminate as raw materials as to be suitable as the sole input into the manufacture of HNRV end products, which is in itself an RWS objective.

The HNRV of these materials will only be realised where they can be included as "ingredients" into finished products, where other virgin or more tightly specified raw materials are brought to bear in the manufacture of end products that can attract sustained market pull, **and such products be regularly adapted in direct response to ever changing market needs and appetites**.

By extending the scope of the RWS to grapple with these non-MSW materials, the intended benefit is to optimise the net returns to the community, not only in terms of creating a sustained response to the direct MSW issues, but to also stimulate commercial development in the Sub-Group region in the first instance.

Whilst such a broad ranging task is beyond the scope of this WSROC Sub-Group RWS, the Sub-Group could advocate that such an initiative be pursued by WSROC as a whole or DLG/EPA/OEH on a SMA, ERA or even RRA basis.

v) Strategic Objectives Supported and Achieved

WARR:

- increasing recycling
- diverting the maximum from landfill
- demonstrating and facilitating the links between the provision of waste management systems and infrastructure and the advancement of Industrial Ecology methods and practices
- specific focus on local/regional applications of soil improvement products containing reclaimed biomass and organics

Sub-Group:

This is a crucial program to achieve >90% diversion:

- given the importance of biomass as perhaps 40-60% of the total waste streams under management
- optimising the potential receipts from resources recovered from the regionally produced wastes
- providing a platform for business development and growth as a regional speciality

5.2.4 Node 4 – Dry Recyclables Sorting / MRF

i) Node 4 Description

See Attachment D, Stream #1 for stream description.

A dry recyclables MRF is the first point of receival for kerbside collected dry recyclables, where this specialised/co-mingled input stream is sorted and graded into the generic "secondary" materials such as:

- colour sorted glass
- residual glass fines
- plastics by polymer
- paper and cardboard – to established international specification
- ferrous and non-ferrous metals
- mixed sorting residual, consisting of a wide range of materials not immediately suitable for any known end use/user other than disposal or perhaps a suitably configured EfW facility before or after other film plastics or contaminated paper/cardboard is recovered for potentially emerging markets and end users

ii) Issues, Opportunities and Operations

The Sub-Group councils generate approximately 100 ktpa of such recyclables that are currently received and processed as an extension of the respective collection contracts, and any value attributed to the reclaimed resources is offset in the contract against the net cost of collection.

The same Sub-Group region could generate a further 100 ktpa of similar dry recyclables from independent C&I (and some C&D) sorting.

The main focus must be to determine and confirm whether the Sub-Group region (and even the WSROC region more generally) is:

a) actually achieving full and fair value for the secure flow of reclaimed resources under management; and

b) the most competitive pricing for the basic collection service, since offsetting the costs and benefits in this manner leaves room to conflict final pricing.

Further, under current arrangements the service provider takes primary process and market risk for the recovered materials, providing pricing stability for councils – which is an apparently attractive outcome given the considerable cost, complexity and commercial risk involved in setting up such MRFs and using/trading off all subsequently reclaimed materials.

In terms of net diversion targets, this recycling service is now relatively mature and only "incremental" improvements in volume may be possible, with the ongoing community education programs; **however, the materials in this stream are the most inherently valuable and readily reapplied and, perhaps in collaboration with other "neighbouring" regions, research into the net benefit received by councils could be undertaken and a level of competition introduced into the system over time**.

iii) Actions and RWS Response

To ensure the Sub-Group is receiving full and fair value for the supply of all the dry recyclables under management it is proposed that, either as a region, or as part of a broader grouping of councils, a detailed and independent economic and risk study be undertaken to confirm that current arrangements are delivering full and fair value to the community, and to provide an objective cost/benefit basis to inform programs aimed to encourage additional participation by residents.

The output from such a study would more fully inform the preferred or optimal tendering arrangement that the Sub-Group could/should implement going forward.

One benefit of adopting the streaming/cascading approach within the RWS is that "next best" options to recover value from all these materials will always be available in the event that the net value received is in effect no more than, or less than, the readily achievable "next best" option.

Under this scenario, an effective floor price can be established for each of the collected resources, and a level of overall inventory management introduced to encourage "market pull" for these materials, thus mitigating the risk of supporting the lowest price recovery because such material flows are currently always available in excess of immediate demand.

If, after due research and consideration, it is determined that providing subsidised and under valued resources as inputs into the manufacture of originating goods and services is equitable overall, for the consuming community – so be it. But, such cross subsidies should be understood and transparently administered.

iv) Intended Benefits

- Ensuring complete fairness and transparency in the post-consumer value/supply chain for resources recovered from the collection of dry recyclables.
- Ensuring full and fair value for the materials supplied to the specialty MRF operators and end users on behalf of the community.

v) Strategic Objectives Supported and Achieved

WARR:

- optimising the recovery rate and value realised from the "yellow bin", dry recyclables stream;
- optimising diversion from landfill for this specific fraction;
- supporting litter reduction; and
- providing a platform for the optimisation of Industrial Ecology initiative.

Sub-Group:

- supporting the >90% diversion target;
- optimising the realisation of HNRV and net returns from the materials to support the capping and eventual reduction in net cost of service delivery by Sub-Group councils; and
- applying the Sub-Group essential "supply" capability to push for the realisation of full and fair value.

5.2.5 Node 5 – Residual MSW, (VATS)/ AWT/First Point of Receival Pretreatment Facilities

i) Node 5 Description

See Attachment D, Stream #3 for waste stream description.

Currently residual MSW materials are taken directly from the collection vehicles to:

a) landfill (HCC, BMCC);

b) a transfer station for bulking up into larger loads for transport to landfill (THS); or

c) a complex AWT for select resource recovery and composting of the organic fraction (PCC, BCC).

The Sub-Group councils currently generate >200 ktpa of these materials, which represents some 61% of the total wastes under management across the region, and is the one major area where substantial additional resource recovery could be adopted to enable net diversion rates of >90% for the long term.

ii) Issues, Opportunities and Operations

Of the current practices, direct disposal to landfill provides no opportunity for any form of resource recovery from this fraction (other than token LFG recovery). Consolidating such materials at traditional transfer stations renders the materials even harder to subsequently sort, screen or process for HNRV resource recovery, and for those materials processed at existing AWT, the current approach is to aerobically stabilise ("compost") the biomass fraction with the aim of making a valuable soil amendment product and thus avoid landfill.

A signature recommendation of the RWS is to adopt a thermal gradient to the processing of the biomass/organic fraction physically recoverable from this residual "red bin" stream. See Box 5.2 for summary of rationale.

The inherent value of this stream of biomass material derives from the carbon, nutrients and mineral content which can all be enhanced and retained by introducing a thermal processing gradient to stabilise and value add these materials. And of most importance with such subsequent processing in prospect (Node 8) the performance specification of this Node 5 is **greatly simplified and should demonstrate significant cost/benefit advantages over the traditional AWT processes**.

Box 5.2 – Organics processing for greatest value and certainty, and to support "market pull" for the recovered organics

The RWS is focused to recover the HNRV from all materials under management.

Where biomass/organic material can be recovered as clean, uncontaminated and source separated (see Stream #2 Attachment D) composting can represent the most cost-effective processing option (i.e. net value after collection and processing costs).

Composting is essentially an ambient temperature, biomechanical processing technique, that stimulates biochemical reactions within the material (at up to >70%C), to biologically stabilise the material and present the nutrients as bioavailable and suitable for soil application to improve soil productivity. However, this basic receival, sorting, size reduction, composting and final product screening and grading processes has little or no capacity to remove physical and chemical contamination, hence clean source separate feedstocks are crucial. Also the finished products have a low bulk density, which limits distance to markets, and, to achieve optimum product pricing and market penetration, such materials may need to be blended with other higher value inputs and nutrients to best address identified end market needs. So composting is usually only cost-effective for clean, source separated garden wastes etc. and quite unsuitable for the mixed and contaminated (physical and chemical) biomass fraction of "red bin" residual MSW (see Node 8, 5.2.8 below).

The RWS is proposing to simply separate out all of the biomass/organic fraction presenting in the residual MSW stream (Node 5) and in-line process the recovered material with the application of a thermal gradient. Such that the material is torrefied to:

- condense the carbon and mineral nutrient content of the material
- remove plastic and (organic) chemical content to a gaseous phase for subsequent reuse/treatment
- improve bulk density for subsequent transport to markets
- improve material value to approx. >$150/t.

NB: The goal is to present the organic fraction of residual "red lid" wastes as substantially physically and chemically "decontaminated" so that the positive trace elements, carbon and nutrient content of the material can present as a defined "product" to be used as a minor ingredient in proprietary blends of fertilisers and other tailor-made soil productivity (and carbon sequestration) products, and to therefore achieve HNRV outcomes for councils.

With this outcome as the goal, the functional requirement for the Node 5 technology is very greatly simplified and de-risked from a process perspective, as compared to existing MBT AWT approaches.

iii) Actions and RWS Responses

The proposed "first point of receival" for the Sub-Group residual MSW "red bin" stream would be established to perform the following functions:

a) To perform as a Value Adding Transfer Station (VATS) and Alternative Waste Treatment (AWT) facility – sized and modularised to accommodate immediate needs and expanded to accommodate increased need over time.

b) The VATS function is to replace any traditional (top loading or push-pit) transfer stations (for a similar CAPEX/OPEX as a push-pit facility) by providing basic "load consolidation" for subsequent transport (if required), and by adding value to the materials (rather than just cost) by conditioning and sorting the material rather than just compacting. (See Attachment D, Stream 3 (e) for generic schematic and BFD).

c) The very simplified AWT function is achieved by delivering the mixed and indeterminate raw materials into four (4) primary material streams (not products), suitable for subsequent reuse/beneficiation/processing into HNRV end products: metals, inerts, plastics/synthetics and biomass. The secondary outputs would be:

- some dry recyclables that had been incorrectly discarded to the "yellow bin";
- Household waste HHW out takes (See Nodes 6, and 11A);
- oversize residuals (usually timber based for redirection to Node 9 and/or 10).

Such generic technology is widely available and can be competitively tendered for procurement without undue process risk. Some 500# such plants have been commissioned since the 1950s and some 150 are in current operation in a similar function. Six (6) such facilities have just been commissioned in the largest waste processing plant built in Doha, UAE 2011-12. The basic BFD (Attachment D) also reflects the exact process design employed at the Rapid City, USA MSW processing plant – other than instead of composting to produce ADC, this proposed facility would supply a drying/torrefaction plant instead.

Such facilities can be located as "transfer stations" close to source or centrally located on a site such as South Windsor to fully accommodate all stages of the RWS implementation plan.

iv) Intended Benefits

Because a core objective of the RWS is to scope and define the essential systems and infrastructure necessary to systematically optimise the recovery of resources from urban waste streams, whilst simultaneously proposing and stimulating the ultimate route to market for such reclaimed resources, this proposed Node 5 – the first point of receival and initial value adding of the, until now, more problematic residual waste stream is a **cornerstone recommendation**. The function it provides is of a capital cost and operational outgoings commensurate with traditional push-pit transfer stations, but will also provide the strategic benefits of a subsequent AWT as a collateral benefit.

This proposed VATS/AWT facility can demonstrate considerable cost/benefit advantages over the more familiar transfer station-to-AWT approach. The main reason is that traditional AWTs aim to make a compost as their primary (bulk) product. As discussed, creating a product that is safe and allowable as a compost is problematic and expensive given the difficulty of removing all the physical and chemical contaminants by mechanical means, at ambient temperature. And the final value of any product that actually achieves licensed criteria for land application will be low, certainly much lower than the cost of producing the material to the required standard.

The approach adopted in the RWS has been informed by identifying the HNRV application and emerging market for such materials, having regard to:

a) The inherently valuable properties of such a biomass/organics stream:

  - The carbon content – for bioenergy, soil carbon sequestration and soil productivity improvers;
  - The trace elements – especially Zn, Cu, Mo, B etc. which in measured/controlled quantities are crucial additives for Australian cropping and grazing soils; and
  - The inherent nutrients – especially N.P.K (S, Ca) etc.

These properties have an inherent resource value of some $300-$800/tonne if procured individually as commercially available products.

b) The cost of production – to realise the full resource value of these materials the properties (a) above) need to be presented:

- To a defined standard that customers/end users recognise and can rely on to provide such properties;
- To the finished product they are manufactured free of physical contaminants (plastic, glass, metals etc.); and
- Containing allowable limits of heavy metals.

All benefits that can be readily achieved via the adoption of selected "thermal gradient" processing.

c) The market price for the product benefits and properties supplied from traditional/virgin sources.

The value at (a) above, less the costs at (b) above should leave the "net resource value" in the $150-$250/t range, in line with emerging market expectations.

In comparison, the more traditional biomechanical, "composting" AWTs produce a product that only realises some $0-$30/t even after extensive mechanical sorting, composting and screening.

Whilst the introduction of such an approach will require specialist equipment, service providers, operators and the confirmation of robust markets, the RWS is being prepared in time for such markets and service providers to be identified and engaged, long before the essential Go/No Go dates identified in the RWS action plan.

And because the benefits to the Sub-Group councils, and their respective communities, are so significant, the steps advocated in the RWS action plan present as modest, in comparison with the Business As Usual approach of "composting" AWTs for this fraction.

Achieving the projected values for these materials is a key factor in achieving >90% diversion and maintaining overall waste management charges to ratepayers at no more than current rates.

Such a unit of functional capability is proposed to be a crucial unit in the overall provision of a fully functioning streaming/cascading operational strategy. The generic technology can be provided in operational modules of 20-150+ ktpa and so cannot only service the residual MSW from all Sub-Group councils (and other WSROC neighbours if requested) but can also fulfil an essential and cost-effective role in the management of regional C&I residuals as well (say 100 ktpa).

This generic approach to processing residual MSW, initially, via a basic VATS/AWT to produce:

- An organic stream for torrefaction/pyrolysis (Node 8);
- A high calorific (synthetics/plastics) for RDF and/or polymer recovery, and/or "black" power recovery (Node 7 and/or 9);
- Metals for sale to the scrap sector (Node 11C); and
- Inert materials for select civil applications (Node 11B);

will present different opportunities and benefits for each of the Sub-Group councils.

For HCC and BCC, such a facility could be fully operational by 2017/18 and start providing immediate landfill diversion benefits, significant S88 waste levy reduction, and a capping of waste disposal costs for the future.

For THS, when current contractual arrangements expire, having residual mixed wastes delivered for processing at such a regional facility would:

- Reduce and cap residual waste disposal costs;
- Significantly reduce S88 waste levy; and
- Reduce primary and secondary transport costs for residual wastes.

For PCC, such a facility could be available within the 2017/19 current contractual window and would:

- Thermally process current FOGO organics into highest value products for secure supply into the emerging bio-based fertiliser market (Node 5 to Node 8);
- Process current residual wastes (Node 5 to Node 7) for highest value products, and entrained biomass organics (Node 5 to Node 8) for co-processing with similar materials from HCC, BMCC and THS.

For BCC, current contractual arrangements with AWT (GRL – Eastern Creek) are proving satisfactory for the short to medium term. However in the new, rapid growth areas in the North West of the municipality, there could be an opportunity to allocate some minimum volumes of residual MSW from this region to trial the alternative approach to residual MSW processing as a basis for determining future long-term options.

All such options are addressed in Section 8 as a basis for scoping and sizing any future technology implementation and delivery plan.

v) Strategic Objectives Supported and Achieved

WARR:

- Optimising recycling by providing one last chance to recover recyclable materials incorrectly discarded at source, from both MSW and C&I streams;
- Optimising diversion from landfill – the core infrastructure item in ensuring >90% diversion;
- Providing opportunity to recover "problem wastes" for specialist treatment;
- Moderating authorised waste treatment costs insofar as such stimuli encourage illegal dumping; and
- Providing a cost-effective pretreatment option to isolating genuinely "residual" materials suitable only for subsequent EfW, in line with the current EPA policy.

Sub-Group:

- The crucial infrastructure platform for the achievement of >90% diversion;
- The crucial infrastructure platform for the capping of waste management fees for councils; and
- A processing option whose construction and operation could be readily contracted out to specialist operation and maintenance parties, or beneficial owner & operated by councils by councils without their being any undue exposure to process or market risk.

5.2.6 Node 6 – Drop Off/Hard Waste Management Sites

i) Node 6 Description

See Attachment D, Stream #4 for waste stream description.

In summary these materials are occasional discards (unlike the yellow and red bin materials that are generated weekly) that are too inherently **valuable**, too **toxic** or too **bulky** as to be able to be optimally processed by any of the other residential discard options.

The nature and scope of these materials (Attachment D, Table 1) is such that their subsequent value recovery and/or treatment and stabilisation can only be optimised where they are kept separate from each other, such that subsequent processing can be cost-effective, as such collection services can never be fully effective. Therefore, conveniently located and user friendly drop-off facilities to serve each community is the only practical service option. The provision of generic drop-off facilities is a specific EPA WARR program – **the issue is to build on this policy intent to ensure the actual outcomes envisaged**.

Research has shown that to be truly effective, and thus accept and encourage broad based community patronage, such facilities should be designed and operated to a universal design and level of service, and that whilst most people, most of the time, will be encouraged to bring such materials and items to such facilities in lieu of standardised kerbside collections, there will be times when pre-booked collections will be necessary for certain residents, in certain circumstances and/or for certain materials or items.

ii) Issues, Opportunities and Operations

To achieve genuinely optimised "circular economy" outcomes, the provision of post-consumer resource recovery systems must be developed as a collaboration between:

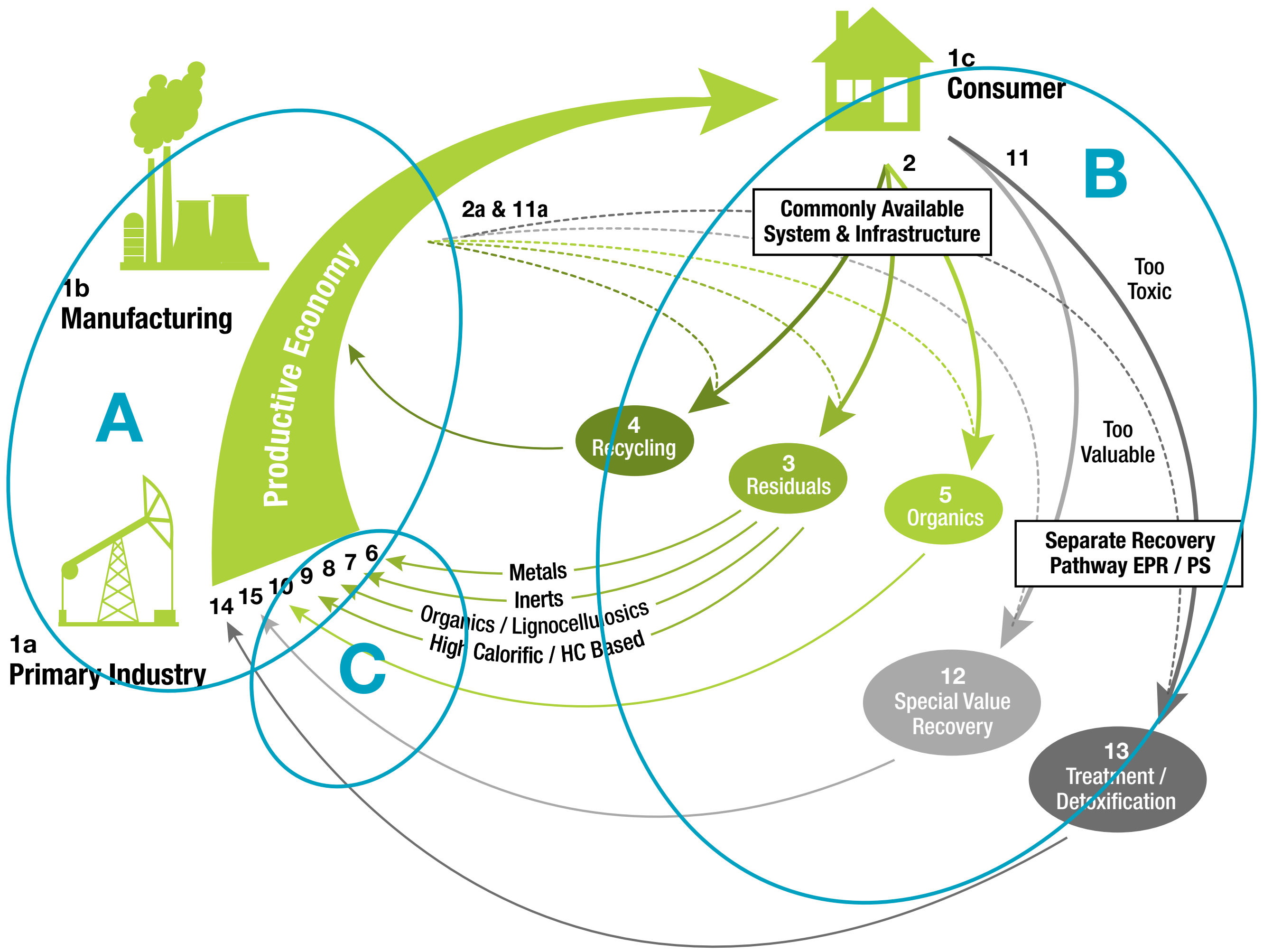
a) the original brands and manufacturers (Fig. 3-1A);

b) the recovered material end users (Fig. 3-1C);

c) the collective resource recovery sector (Fig. 3-1B); and

d) government at all these levels.

Figure 3-1 reproduced here for convenient reference at this point.



Key:

A = The brands, manufacturers and providers of all the essential goods and services used and consumed by the general community

B = **The Resource Recovery Sector** - the providers and operators of all the systems and infrastructure necessary to collect, sort and aggregate all the materials presenting in urban waste systems such that they can be usefully presented back for valuable application in the Productive Economy

C = The crucial point where recovered resources and energy are presented back for use in the Productive Economy to supplement/replace primary resources

At a national level, legislation to encourage and require "producer stewardship" responses to post-consumer issues now provides a framework to further foster and facilitate such collaboration.

The challenge is now presented to further develop this concept between parties A, B, & C (Fig. 3-1) as supported by State Government and implemented or coordinated at a community level by Local Government.

The NSW EPA has a specific program to assist councils to develop commonly branded drop-off sites, with a common level of utility and service. This proposal is only an initial, but most welcome step in the right direction.

The EPA's proposed drop-off facilities will only provide multiple receptacles for a limited range of the materials listed in Attachment D, Table 3-1. This has the potential to frustrate and confuse patrons who had hoped to drop off other materials listed in Attachment D – Table 1, and which previous research has demonstrated will be popular options for the community.

However, even an initial level of facility is a useful start.

The second deficiency in the current model is the lack of a systematic engagement with parties A & C Fig. 3-1 (the original brands and manufacturers and the actual material processors) to:

a) ensure that the reclaimed materials will find their optimal value recovery for treatment options; and

b) engage manufacturers (A) to support the provision of such a service with tangible/ monetary contributions;

since ultimately, the provision of a universal system of drop-off facilities is currently a publicly funded response to a privately generated need.

iii) Actions and RWS Responses

The establishment of conveniently located and commonly branded and operated drop-off facilities should be a systematic infrastructure and service response in the RWS, and the support available from EPA under current WLRM initiative applied for.

However, as described above, the current perceptions of facility adequacy are only an initial contribution to an eventual, fully integrated service offering, such that the design and location for such first stage facilities should be implemented so as to optimise the opportunity for further expansion of services without the need to demolish or relocate the initial facilities.

iv) Intended Benefits

A systematic response to the separate streaming and management of these materials has a dual benefit.

First, such drop-off facilities can substantially reduce the demand for current kerbside/hard waste clean ups. Drop-off centres can be operated to offer a limited "call out" service to select residents with very specific needs, but mostly recurring collection budgets should be re-directed to service the regional network of drop offs where the actual financial contributions from the original manufacturers (under national Product Stewardship arrangements) can take an ever increasing share of the operational cost burden.

With such nascent infrastructure in place the Sub-Group is then ideally placed to support broader initiatives to more fully engage with manufacturers at a national level via the appropriate representative bodies.

Finally, the removal of such valuable or toxic materials from any of the other residual, recycling or organic waste stream services could contribute markedly to the **quality and value of the products** from those streams respectively.
In all respects a vital contribution to keep total waste management costs for individual councils within budget.

v) Strategic Objectives Supported and Achieved

WARR:

– Facilities to optimise recycling as an additional option in a streaming/cascading system;

– Specific focus of programs to manage problem waste for fully integrated response;

– Supporting litter reduction programs;

– Providing a convenient alternative for potential illegal dumpers;

– Specifically supporting drop-off centre program in the current draft strategy; and

– Providing a convenient service platform for the design of Industrial Ecology initiative.

Sub-Group:

– Providing another crucial capability for the community in support of the goal to recover HNRV from all materials under management.

5.2.7 Node 7 – High Calorific Fraction (Secondary "plastics") Processing Options

i) Node Description

See Attachment D, Stream #3 (b) for waste stream description.

Return of materials to the productive economy — high calorific and hydrocarbon-based materials

This fraction of residual MSW is usually 15-25% by volume and consists of:

- unrecycled plastics
- unrecyclable plastics via the usual MRFs (Node 4)
- textile, clothing, footwear that wasn't recycled
- rubber, floor coverings, soft furnishings.

If it is derived by mechanical sorting, this fraction will often have a cross-over timber content.

Properly sorted and processed, it can present back to the productive economy as:

- recovered polymers
- petrochemical sector input or platform compounds
- carbon products (reductants)
- energy products for heat and power.

No systematic resource recovery pathways (facilities) exist for this fraction in Australia at present. However, subject to stringent environmental controls and host community support and with adequate sorting, decontaminating and processing these materials could be beneficially applied in the first instance to existing facilities such as kilns, power stations and certain industrial metallurgical plants.

These materials will need dedicated sorting and/or beneficiation to achieve their respective HNRV and for this product stream to fulfil its full potential in the overall "streaming/cascading" system.

This node could be a dedicated facility adjacent to VATS/AWT, or off-site, adjacent to a major end user or market. But either way, the basic functions stay the same.

The standard MSW materials processed via a proposed VATS/AWT facility will present to this Node 7 as generally described in Table 5-1.

Table 5-1: Approx. constituents of HCF stream (assuming 200 ktpa of original red bin MSW input this HCF fraction would equate to some 15-25% or say 45 ktpa)

Fraction	%	% Moisture	Grouping ktpa	%
Plastic film	18	25.0	36,900	82
Plastic rigid	14	15.0		
Textiles	12	30.9		
Miscellaneous synthetics	38	25.0		
Paper and cardboard (waxed etc.)	4-5	35.5	5,400	12
Garden/food residuals	5-8	65.0		
Inerts – glass/fines/non-combustible	4-6	18.0	2,250	5
Metals	1-0.5	14.0	450	<1.0
	100		**45,000**	**100**

ii) Issues, Opportunities and Operations

It's important to first appreciate the "residual" nature of this material stream in the context of the streaming/cascading framework adopted by the RWS.

a) All primary dry recyclables will have been directed via the yellow bin to a MRF for highest value resource recovery.

b) Dry recyclables incorrectly discarded to the "red bin" will have passed over the VATS/AWT picking line for further removal for highest value recycling where visible.

c) Primary removal of (<40 mm) organics will have occurred at Node 5.

d) Primary removal of metals and inerts will have occurred at Node 5. However, this initial VATS/AWT is a preliminary/basic sorting first step, and certain minimum amounts of non-synthetic/plastic materials will carry over in simple VATS/AWT plants – to be addressed in any subsequent Node 7 facility.

Option 1

Within the terms of the recently released EPA EfW policy, these materials would be considered as residual and suitable, from a resource conservation perspective, to be considered feedstocks into an appropriate EfW facility. Within such a facility, assuming full "burn out", the final ash volume for eventual disposal would be 15-18% of the input volume, from which further ferrous scrap recovery might be cost-effective – say some 3-4 ktpa. Subsequent reuse of this ash blended with the primary inerts from Node 5, for use in sub/road base or other such applications will be dependent on satisfactory TCLP tests and successful application to EPA for a specific waste exemption.

Option 2

Prior to presentation to an appropriate EfW facility, this material might be received at a specialist RDF/PEF manufacturing facility.

Such facilities traditionally receive similar materials from MSW, C&I and C&D streams and by screening, sorting, conditioning such feedstocks they produce a specific fuel product, to a specification that will exactly suit a final customer's needs and requirements.

This approach will incur additional processing costs, but can greatly expand the number of new or existing end use markets, especially where certain crucial contaminants have been removed or controlled. These secondary plastics could also be suitable for gasification (e.g. City of Sydney proposal) and subsequent gas modification for eventual supply back into the gas grid, or supplied as a direct NG replacement to existing large NG customers.

Option 3

Pre-processing of this material stream could identify and recover certain generic polymer types and materials for higher value recycling before the residuals are presented for Options 1 or 2.

Option 4

These mixed residual plastics have the potential to be processed (usually pyrolysis) to render the various polymer types down to a common root molecule such as naphtha, methane or methanol, or other. (Such a platform chemical is well-recognised and commonly used as a petrochemical industry input (currently traded at approx. $2000/t).

This option is not currently available in Australia, since no such processing facility has ever been established, in large part, because no long term and reliable supply of such mixed plastics has ever been available. **The assured supply of such plastics from some 80% of the Greater Sydney Area would be required (or as supplemented from elsewhere inter or intra state) to make such a HNRV option a sustainable long-term option, and could take some 3-5 years to eventually coordinate and implement**. However, the purpose in mentioning the future possibility at this time is to help fully inform short, medium and long-term planning for such materials and to provide a basis for improved returns to Sub-Group councils over time; which is a specific function of this strategically focused document.

iii) Actions and RWS Responses

Options 1, 2 and 4 can, at best, only be medium to long-term options, and Option 3 would be most cost-effectively introduced as a pretreatment step if and when Options 1, 2 or 4 were ever implemented. So the following short to medium-term strategy is recommended to provide short-term certainty, whilst maintaining the option to initiate or participate in more advanced outcomes over time. The following steps should form the basis for the ultimate financial modelling of the RWS.

Step 1

- Initially plan to simply bale and monofil, or store in an area of the landfill that doesn't impede normal landfill activities, but enables a commercially and operationally significant resource to accumulate in support of the commissioning of Node 9 below, and/or the emergence of Options 1, 2 or 4 above.
- Such material should be "non-putrescible" after processing via Node 5 and so the resultant "bale fill" will, in effect, be an inventory management capability – to store materials as they present as wastes so as to eventually provide an assured source of input material that any subsequent value adding process, which, in turn, could be relied on as a crucial contributor to the "supply certainty" necessary to capital justify the new facilities.
- This step will ensure that all materials received and reclaimed from Node 5 will be safely managed – since the default position is that they are in a landfill and placed very efficiently with respect to air space conservation and the provision of environmental protection. But unlike normal landfill, the resource value of these materials is still accessible if needed.

Step 2

- If Node 9, Modular EfW facility, is implemented as proposed, withdrawals from this stockpile would be available if certain minimum levels of feedstock certainty is required to justify such a facility, which it is envisaged Node 9 would be primarily justified for the processing of residuals from Nodes 2, 5 and 8 materials for which no other higher resource use can be identified, other than to be converted to energy prior to residual ash presenting for filling land (civil uses) Node 10.

Step 3

- Whilst those materials are being safely and sensitively handled (Step 1) the Sub-Group (or their nominated agent) will be able to actively participate in third party discussions or negotiations for the adoption of options 1, 2 or 4 on a regional, GSR, intra or interstate basis; all with the objective of maximising returns to the region from materials without incurring any additional operational cost or risk.

iv) Intended Benefits

To provide immediate processing and materials handling assurance at least cost, whilst leaving open the opportunity to initiate or participate in outcomes that will require much wider stakeholder collaboration to achieve, but which will ultimately return the maximum benefit to the region.

v) Strategic Objectives Supported and Achieved

WARR:

- Optimising recycling and overall resource recovery;
- Optimising the ultimate diversion from landfill;
- Supporting typical Industrial Ecology strategies and outcomes;
- Supporting sustainable EfW outcomes; and
- Providing a platform for ongoing collaboration with neighbours and regions as the basis for specific facility development that few regions could ever justify on their own.

Sub-Group:

- Providing a strategic platform for the assured diversion of >90% from landfill;
- Providing a framework to contain and reduce waste service charges to residents and minimise any S88 levy payments; and
- Providing a crucial component of the overall streaming/cascading objective.

5.2.8 Node 8 – Regional Biomass Management Facilities

i) Node Description

Biomass processing function (BioHub) to generate HNRV products from the full range of materials presented/available from within the region.

This node describes a generic capability and therefore need not be developed and implemented as a single technology or a suite of technologies on a single site. However, certain valuable synergies (labour allocation, heat/power sharing, final product blending etc.) will be created where the various process plants are co-located, or at least adjacent to each other. For ease of description in the RWS it will be assumed that all functions do actively occur on one site.

Such a biomass processing capability/facility is proposed to assume the "route-to-market" for the MSW derived biomass organics (the concept described 3.5.1 above) by providing an installed biomass processing capability, capital justified to service the generic biomass sector, so that once established the capability is available to process MSW derived organics for HNRV; an outcome that could not be justified if the facilities had only MSW derived biomass available as a feedstock. This is a classic Industrial Ecology methodology and approach.

The biomass feedstock received from Node 3 would be as described in the ECS report[5], and as proactively procured by the management of such a facility.

The organics stream from Node 5 can be anticipated to contain generic fractions as shown in Table 5-2.

[5] *ECS report*

Table 5-2: Approx. constituents of Node 5 <40mm organics stream (assuming 200 ktpa of original red bin MSW input which would equate to some 55% or 110 ktpa for all Sub-Group councils)

Fraction	%	% Moisture	Grouping ktpa	%
Plastic film	<1	25.0	4,400	4
Plastic rigid	<1	15.0		
Miscellaneous synthetics	<2	25.0		
Paper and cardboard (waxed etc.)	19	35.0	88,000	80
Garden/food residuals	61	65.0		
Inerts – glass/fines/non-combustible	15	18.0	16,500	18
Metals	1	14.0	1,100	1
	100		**110,000**	**100**

ii) Issues, Opportunities and Operations

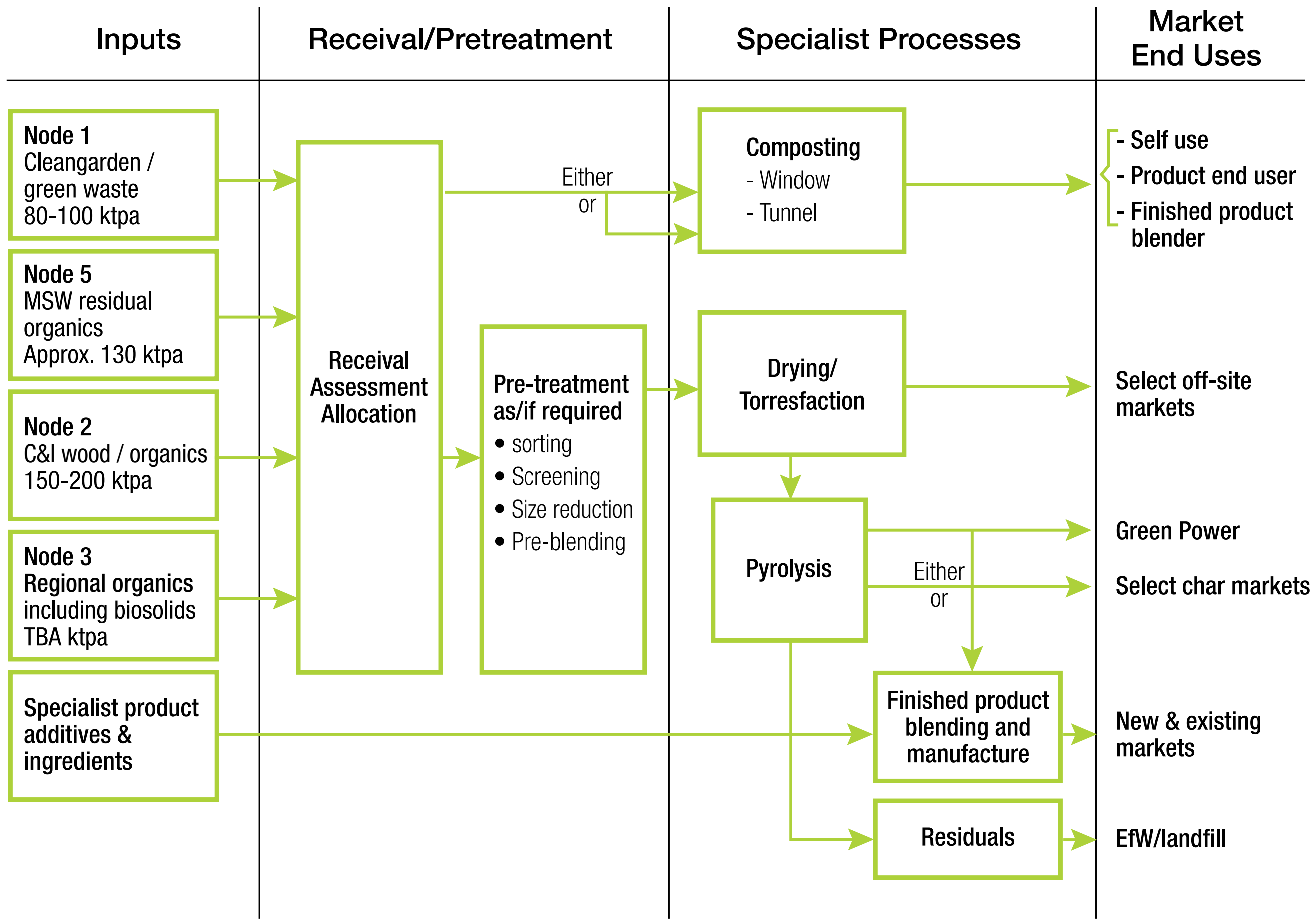
Attachment E outlines the generic issues and opportunities in the emerging biomass processing sector.

Section 3.5.1 describes the proven and adopted route-to-market for materials reclaimed from wastes and Section 1.2.4 describes the need for and operation of a streaming/cascading operational framework.

To reiterate, the route-to-market for the MSW derived organics (Table 5-2) is very limited where these materials present in isolation, and in fact, apart from some composting of source separated garden wastes, the HNRV for such materials may be little more than EfW. However, in the streaming/cascading system proposed, and where a specialist biomass processing sector has been encouraged, developed or is operational, such MSW derived materials can be co-processed (shandied) into such end products, so as to optimise values for optimum return for the Sub-Group.

See Box 5.2.

Figure 5-2: Concept flow diagram for proposed Node 8 – Regional Biomass Management Facility



NB: Residues from such a biomass processing facility would be envisaged to be either "inert" dirt, soil etc. which would be managed with the similar materials emerging from Node 5, or will be suitable inputs to Node 9 – EfW.

Proposed Node 8 functions:-

Inputs:

– Node 5 organics approx. 110ktpa -+ 50ktpa

– Node 2 wood/organics 150-250 ktpa

– Node 1 garden wastes 80-100 ktpa

– Node 3 regional organics TBA ktpa (including regionally sourced biosolids).

Process:

On receipt, all incoming organics are assessed for quality, quantity and sustainability status of origin:

- **Quality**, informs moisture values and best and highest end use/markets for the materials (subject to prevailing product market prices and demand) and directly incoming materials to the relevant processing area.
- **Quantity**, informs payment/gate fee arrangements and informs inventory management issues on site.
- **Identification of origin of the incoming material** is a vital consideration for many downstream markets that, for regulatory or marketing purposes, must be able to establish the certifiable sustainability of the biomass yield (e.g. C.F.I. program, biochar base fertiliser markets, metallurgical charcoals etc.).

After assessment, materials are directed to any of the potentially available processing options where installed:

1. **Windrow composting** – basic garden wastes;
2. **Tunnel composting** – materials with source separated food waste component;
3. **Drying/torrefying** (up to 280-300°C) – either as preparation for subsequent pyrolysis for chars and bioenergy or to facilitate further screening (glass removal etc.) prior to forwarding to specialist end users/blenders off-site;
4. **Pyrolysis** (up to 500°C) – to produce finished quality biochars (soil productivity improvers) and/or metallurgical charcoals (industrial smelting applications) and bioenergy/power;
5. **Pretreatment** – all materials entering the site may require further sorting, blending, size reduction before being presented to any of the Options 1, 2, 3 or 4 above. This would be a common facility.
6. **Third party supply** – as this biomass processing sector develops nationally, third party specialist biomass processors will emerge to produce, for example, biocrudes or liquid biofuels and it is anticipated that a fully integrated biomass facility, as proposed in the RWS, will have the option to provide pre-prepared biomass materials to such plants, creating value for Sub-Group councils by providing assured/contracted supply certainty to such complex and capital intensive facilities. The supply to such end markets will be a useful tool for overall inventory management between materials received and avoiding "supply push" of final products into markets with defined appetites. The capabilities installed for functions 1-5 above will provide whatever processing capability this Node 8 might require to support this potential third party supply opportunity. As such, this opportunity simply presents in the overall streaming/cascading, HNRV realisation framework as an opportunity not to be missed if and when the market emerges.

iii) Actions and RWS responses

Develop a detailed scope for such a facility to service the Sub-Group councils as described herein.

Use the assured supply of the organic fraction of the residual MSW stream and potentially a suitable site (South Windsor) as the basis for attracting detailed Expressions-of-Interest (EoI) from specialist facility developers to build, own and operate such a facility at their own risk, cost and initiative and **where actual markets have been identified**.

iv) Intended benefits

To provide a secure and HNRV end use for all biomass/organics under Sub-Group management, including source separated "green bin" materials where higher returns to councils can be demonstrated.

The development of a specialist and best-of-type biomass processing capability in the region, demonstrating growth and employment.

v) Strategic Objectives Supported and Achieved

WARR

– Optimising biomass reuse, recycling and reprocessing outcomes.

– Diverting the until now, problematic residual MSW organic materials from landfill (or even EfW).

– Adopting the methodologies and practices of Industrial Ecology to achieve HNRV outcomes.

– Optimising the production of tailor-made soil productivity improvement products and services on both a local and regional basis.

– Providing a systematic opportunity to recover and realise the full inherent value of all biomass/organic materials under management as a basis for providing only genuinely residual materials to any subsequent EfW process.

– Establish a regional capability that could also service neighbouring councils that are limited by space considerations from developing their own such facilities.

Sub-Group

– Establishing the essential capabilities to achieve >90% diversion.

– Realising the HNRV from the biomass/organics under management as the basis for ensuring the capping of service fees to ratepayers.

– Avoiding process or market risk to councils by collaborating with the emerging biomass processing industry.

– Leaving open the opportunity for councils to participate in operational and equity structure of such fully commercial facilities if they have the specific appetite to do so.

5.2.9 Node 9 – Energy from Waste Facility for Residual Wastes

i) Node Description

NSW EPA recently published their EfW policy.

The key areas of principle include:

a) EfW options should only be developed to receive and process residual materials, materials from which recyclable or higher value resources have already been recovered. Thus, the inputs to such an EfW facility might include the residues from yellow bin MRF operations, or red bin AWT facilities, C&I MRFs or even green bin biomass processing sites.

b) Within the traditional hierarchy, EfW will be positioned to recover residual energy values from materials that would otherwise be simply lost to landfill.

c) Emissions from EfW facilities must at least meet EU's "Waste Incineration Directive 2000/76/EC (WID)" and/or its subsequent update "Industrial Emissions Directive 2010/75/EU (IED)".

The strategic role proposed in the RWS for EfW (Node 9) is entirely compatible with the three broad policy positions above.

The function is to efficiently recover energy from residual material flows. The resultant energy is unlikely to qualify as "renewable" and this will need to be sold into standard "black" or fossil fuel power markets, without any available premium to the price for this heat, steam or power.

ii) Issues, Opportunities and Operations

Potential inputs to such an EfW plant:

a) Residues from VATS/AWT – Node 5;

b) Residues from C&I and C&D MRFs – Node 2, (including entrained painted, engineered, treated timbers);

c) Off-spec products that may occur from time to time from organics processing – Node 8;

d) Potential RDF/PEF from Node 7 if no higher value markets are identified; and

e) Possible "by-pass" function to receive putrescible materials from VATS/AWT in the unlikely event of short-term mechanical failure at higher value process nodes.

It is recommended that such an EfW facility operate in close collaboration with the ultimate receiver of last resort – the landfill – Node 10. In this collaboration the various residual streams (a to f above) should be received, evaluated and directed to the most appropriate facility.

For example, where a residual stream, such as might occur from Node 7 (since all combustible material is likely to be consumed at Node 7) or Node 8 (since residues from this capability are likely to be only inert, fully mineralised materials) has little or no inherent calorific value (CV), there is no point exposing it to a specialised thermal process prior to eventual landfill.

Functional requirement for this proposed EfW facility must include the absolute certainty to meet the imposed emission limits as a non-negotiable feature, and to operate at a level of thermal efficiency that (a) complies with any operating licence conditions, and (b) optimises the realisation of all inherent energy values.

Since the outputs of EfW are only commodity valued heat, steam or power (and fully mineralised ash) the capital justification for such a facility will be predominantly the "gate fees" charged to accept the residuals from the other higher value resource recovery activities. These higher value resource recovery activities will, however be motivated to minimise the actual flow of materials they need to present to EfW and landfill. These issues inform the development of a functional specification for this EfW facility.

To deliver the required thermal efficiency and absolute control of emission standards, such facilities need to operate in continuous steady state mode, for perhaps 8000-8500hrs/pa.

However, by operating in close collaboration with a landfill, an initially installed facility can be sized to address a **minimum volume of residual waste anticipated** (with any surplus being by-passed to the landfill). As increased volumes of residual wastes are identified and procured such a facility can then be incrementally increased. This requires a modular implementation approach, rather than an initial oversize facility, that might establish a commercial driver to attract materials that still have higher residual values.

As a result, a fixed capacity initial module would give preference to process any putrescible or biologically active materials (Node 5 and/or 2) with stable and storable materials (wood waste or RDF etc.) processed as a feature of overall inventory management. This approach ensures that such an EfW facility is able to run in continuous steady state operations whilst accommodating variable input flows. To support this outcome, although waste is technically an indeterminate raw material, statistically gross flows are remarkably consistent where adequate buffers and inventory management techniques are employed.

Certainly the VATS/AWT operators will be able to realise value by being able to offer the EfW operators a level of contractible supply certainty.

iii) Actions and RWS Responses

Because reliable supply of residual wastes will be essential to capital justify, what will be a very technically sophisticated facility, it is recommended to initially implement the RWS with landfill capacity only for the receipt of upstream processing residuals. At such time as the overall strategy and material flows can demonstrate the necessary levels of reliability, the eventual EfW facilities can be scoped and procured to directly address the identified need and opportunity.

iv) Intended Benefits

To include a residual waste EfW option at such time as (a) all EPA policy objectives must be fully met, whilst (b) to ensure a commercially viable EfW facility can be capital justified on normal commercial terms.

This proposed residual waste EfW capability has also been scoped to directly address two of the initiating concepts that were adopted to inform the development of the RWS, in particular to enable the achievement of "Criteria for (RWS) Success":

2.1 (b) – capping waste management service charges for the community – or therefore achieving optimised resource recovery outcomes within substantially the same cost structures as at present, by reallocating the operating cost of disposal (landfilling) and the related S88 levy costs towards the capital and operating costs of basic resource recovery systems and infrastructure; and

2.1 (g) – adopting a "streaming/cascading" regime to optimise the realisation of the Highest **Net** Resource Value for all wastes under management (see Attachment B).

In short, the presentation of residues to this simple EfW node should be for materials that have **no higher resource value than to be applied for their inherent CV**.

The streaming/cascading regime provides that all higher value materials will present further up the process/value chain, such that their higher potential market returns can fully justify the extra effort, and certainly provide an outcome for the materials that are **too valuable** to be applied for **only** their inherent CV.

All such energy recovered from this Node will present as "black" power that could not attract a price premium over standard "fossil" sourced power from the grid, other than with a "decentralised" premium if available, but may be best marketed as heat/steam if possible.

v) Strategic Objectives Supported/Achieved

WARR

– Sustainably optimising the diversion of materials from landfill.

– Providing a secure end-of-life capability for materials that have no higher resource value than to have their inherent CV realised efficiently.

– Proposing EfW capabilities that can sustainably manage residual wastes in preference to landfill.

– Providing a regional capability that may well be of considerable value to neighbouring council or regions.

Sub-Group

– Crucial facility to ensure >90% diversion.

5.2.10 Node 10 – Residual Waste Landfill

i) Node Description

Unlike much of modern waste management practice, where the first point of receival for waste collection trucks is the nearest (cheapest) landfill, the RWS positions landfill as the failsafe, last resort for genuine residual wastes after an integrated streaming/cascading system has optimised resource recovery outcomes for all waste collected in the region.

The role identified for landfill in the RWS involves:

a) Providing **failsafe certainty**, that in the event of any process failures or market collapses, or that for any reason waste cannot be processed for sterilisation and optimised resource recovery (Nodes 1-9), the landfill will always be available on an "it's there if and when you need it" basis to ensure that public health protection outcomes are never jeopardised. To achieve this role the landfill must have at least a basic class three putrescible waste receival capability, and the capacity to operate this capability as an "on demand only" status. However, in this proposed RWS streaming/cascading framework, such a putrescible receival capability would present only in fulfillment of this proposed "receiver of last resort" function; such a capability would not be used in normal conditions.

b) Providing a **"surplus materials handling, management and temporary storage capability"**. This role is essential in every community because in the productive economy there is no logical reason why just because secondary resources become available from time to time, that the optimum market or reuse opportunity will be immediately available concurrently. (e.g. the quite abnormal surfeit of demolition waste and vegetative material that is currently presently in the Blue Mountains as a result of the recent fires. A similar situation has been extensively recorded after the SE Queensland floods.)

   Some of the most cost-effective and durable long-term markets for reclaimed resources may in fact require demonstration of an actual feedstock inventory/stock pile before such a higher value application can be capital justified. For example, short to medium-term accommodation of HCF/synthetics from Node 7.

c) **Eventual landfilling of absolute residual wastes**, anticipated to be < 90% of current landfill volumes when this proposed RWS is fully implemented. Such materials are expected to be non-putrescible, but may contain certain hard waste/clean up materials for which secure Product Stewardship end uses have yet to be negotiated. This absolute residuals management function might also involve preparing certain materials received to be returned for blending with certain generic outputs from Nodes 2 and 5. In this role the landfill would actually be performing a proactive regional inventory management role.

ii) Issues, Opportunities and Operations

To meet the three key functions (a-c above) the RWS can only be implemented sequentially and iteratively, as certain Sub-Group councils incrementally roll over existing/expiring contractual arrangements over the short to medium term. Thus, landfill will continue to take a more traditional role, in the short term, as Nodes 5 and 8 are developed in parallel with Node 6 roll out and Node 2 engagement.

However, in the medium to long term an existing landfill's function is expected to reduce to providing only the three core services above.

iii) Actions and RSW Responses

If the core recommendations of the RWS are adopted and progressively implemented, the actual role and functional specification of the existing landfill will change and a programmed projection could see an initially adequate facility lasting in perpetuity, rather than filling up with daily waste delivery and requiring complete replacement over time.

iv) Intended Benefits

Supporting, enabling and underpinning the broader objectives of the RWS rather than presenting as a solution to existing waste management operations.

v) Strategic Objectives Supported/Achieved

WARR

– Providing the essential enabling and failsafe option that makes the rest of this proposed streaming/cascading RWS possible from a flow management and process risk perspective.

Sub-Group

– Providing the failsafe option that underpins the practical possibility of implementing all other high level resource recovery systems and options and thus minimising ultimate exposure to S88 waste levy.

– A vital facility to ensure that the entire integrate RWS proposals can actually achieve the cap on waste management charges for Sub-Group councils.

5.2.11 Node 11 – Reclaimed Resources Markets and End Uses

Market Descriptions

Introduction

The following section reviews the issues and opportunities and sustainability of proposed markets and end use options for each of the currently identified points at which the various recovered material streams could re-enter the productive economy (Fig. 3-1c).

A. Drop-off/Product Stewardship Materials

– This proposed initiative in the RWS is the primary response to the WARR objective of "managing problem wastes better". The term "problem wastes" is fully described in Attachment D, Stream #4. The benefits of systematically addressing these materials include not only:

– Recovering the full resource value of occasionally discarded materials and items; but also

– Reclaiming toxic items and materials for specific treatment; and thus

– Avoiding such materials contaminating the more readily processed streams 3, 4 and 5 (Fig. 3-1); and

– Simultaneously providing the most cost-effective operational capability for brands and manufacturers (Fig. 3-1A) to achieve the post-consumer fate for their products and/or packaging **that they originally planned at the moment of product inception**; and

– Providing the operational capability for the implementation of Industrial Ecology methods and practices.

The current EPA WARR strategy is keen to promote the establishment of Drop-Off centres – but the current policy is entirely publicly funded, with regard to material aggregation, with little systematic thought given to:

a) What to do with all the aggregated materials.

b) Fully engaging with the respective manufacturers or product sectors to bring the full "shared responsibility" precept to bare and provide for the originally planned post-consumer fate.

c) Sustainably managing all materials that might present at such limited drop-off facilities, but for which no on site discard option is available.

This last issue is likely to operate in direct opposition to the actual WARR objectives of "reducing litter" and "reducing illegal dumping" and is thus of major concern within the scope of this proposed RWS.

The provision of a systematic and universal response to these issues must ultimately be of national concern (even international in some discreet product groups). As such the recommended actions in the RWS include:

- Maintaining existing programs to support the "reduce litter" and "reduce illegal dumping" to at least be able to monitor the status quo;
- Actively engage with and support appropriate programs, initiatives or dedicated bodies that are proactively pursuing national resolution of these issues; and
- Designing and locating any initial drop-off facilities such that they can be readily expanded to fulfil the ultimate function when national solutions and agreements are developed.

A fully functioning Drop Off network would provide the system operators to channel recovered materials:

- as directed and paid for by the respective brands or product sectors;
- forwarded for specific treatment/stabilisation as directed and paid for by the originating brand or product sector; and
- to end markets for profit.

Whilst EPA is making certain arrangements at its own cost (i.e. the general public) for the management of select materials, any initial Drop Offs established by the Sub-Group councils will incur operating and disposal costs that should be negotiated with EPA until such time as a fully integrated national arrangement is negotiated and implemented.

Certain initiatives are currently available for Sub-Group councils to consider engaging with to further the ultimate success of this Drop Off initiative:

a) Waste Management Association of Australia – Resource and Energy Recovery Division (WMAA – RER) has recently initiated a national program of stakeholder engagement in this specific area;

b) The Australian Industrial Ecology Network – has adopted this particular topic as a specific program for this year, and a major conference topic for November 2014; and

c) The new Ministerial Council that has replaced the Environment Protection and Heritage Council (EPHC) programs and initiatives.

Until such time as a fully functioning drop off/ product stewardship system is operating nationally, much of the material collected at any initial drop off facilities will be destined for simple landfill and this volume of material should be negotiated with EPA to be exempt from S88 levies since every effort within the Sub-Group's control will have been taken to divert such materials and only issues within EPA's primary control will be preventing the preferred outcome.

B. Civil Applications

The inert materials from Nodes 2, 5, 6, 8 and 9 should present as non-putrescible and available to be processed into the existing C&D concrete/ masonry processing sector (by being shandied into established specifications) to find secure, sustainable and HNRV end uses in civil works, as, clean fill, sub-base materials or general purpose aggregates.

The implementation action required will be for the Sub-Group, or a nominated spokesperson to directly engage with the existing C&D processing sector to arrange terms, specifications and/or conditions.

Box 5.3

A current initiative promoted and supported by NSW OEH via their Sustainable Advantage program has brought Stabilco P/L to prominence. Stabilco is an excellent example of a company currently manufacturing first-grade road building materials from such residual "inert" materials.

C. Metal Scrap

The metal scrap (Fe and non-Fe) is fully operational and available and ready to engage productively to realise HMRV from all metals recovered by the full implementation of the RWS.

D. "Plastic", Synthetics, HCF Materials

A full description of the marketing issues for those materials is included 5.2.7.

E. Traditional Dry Recyclables

At Section 5.2.4 the apparent security of the markets for these traditional dry recyclable yellow bin materials (paper/cardboard, polymer sorted plastics, colour sorted glass and metals) is addressed. Currently the MRF operators manage inventory, process and market risks, and reflect these risks in the gate fee payable for the directly collected materials. For the initial implementation stage of this proposed RWS this status quo provides an adequate level of offtake certainty, but many MRF operators are also finished product or packaging manufacturers and are naturally incentivised to apply the reclaimed materials to their primary manufacturing operations at the lowest price.

The proposed streaming/cascading framework of the RWS does provide a basis for fully exploring the optimum value proposition for rate payers within the natural collection contract cycle, as discussed in Section 5.2.4.

F. Compost

The RWS advocates for clean source separated garden/food type wastes to be composted, where full and fair value for the initial biomass, **and its dedicated collection systems**, can be recognised in the sales value of the final products.

Quality composts have numerous applications in domestic gardens, public space maintenance, horticulture and even more general agriculture and forestry etc.

Quality composts can deliver substantial benefits to soil quality and productivity, nutrition and provide "mulching" benefits, and even provide short-term carbon management advantages, but in recent times the general compost markets have tended to be "supply pushed" and offered poorly differentiated products. Often as a direct result of being implemented more as an extension of the waste management sector, rather than as a sector manufacturing products for clearly defined needs and markets and therefore selling on performance rather than price.

Within this streaming/cascading framework, the RWS provides alternative uses and outlets for all biomass/organics under management, so that rather than the region needing to be a "price taker" for any resultant composts, the opportunity is available to allocate available biomass materials to a HNRV product range, as described in Section 5.2.8 (initial receival function (biomass triage!)).

Certainly composts have a considerable potential to represent lasting value to Sub-Group councils due to the relatively low capital and operating costs as compared with other process options (G below), but this context **relies entirely on the end user paying a price for the product commensurate with the full range of benefits provided**.

Composts made from wastes have tended in recent times to be priced-to-clear, rather than priced as a direct measure of the benefits provided, since the processors have come to rely more on the gate fees available for receiving the wastes rather than the income potentially available from the products carefully made and sensitively applied.

In the event of the full implementation of the RWS, the Node 8 operator will have the opportunity to allocate all biomass received for HNRV and be less constrained by inventory concerns.

G. Biomass Processing Employing a Thermal Gradient

Biochars are torrefied/pyrolysised biomass materials that retain the carbon and mineral content (including mineral nutrients and trace elements) inherent in the originating materials, but mass and energy concentrate these properties into a semi activated porous structure that is an ideal ingredient into future tailor-made soil productivity improvers, fertilisation and carbon sequestration products.

Whereas composts are bulky and moist, and so need to be "made locally/used locally" products, biochars present as relatively high value products ($150-$300/t vs $30-$50/t) that can afford the transport to wherever are most needed and valued.

Biochars can be applied to soil for immediate benefits, but their greatest value is into the manufacture of high value fertilisation products, where a blend of biochars, with different properties and trace elements and even some high analyse fertiliser products and clays and binders etc. make up the final product.

This is a highly specialised area, but now well established and growing fast, especially as such products are expressly encouraged under the Federal Government Carbon Farming Initiative.

At such time as a detailed feasibility study is undertaken for the establishment of BioHub – Node 8, such market/offtake opportunities may have emerged in the Sub-Group region (see ECS report), but existing projects in Western NSW exist now that could beneficially use all biochar materials that Node 8 could produce until such time as regional opportunities are established.

A further market is emerging in Australia and internationally in the area of metallurgical charcoals. These are materials that are produced to a range of detailed specifications to produce existing coke and coal direct replacement, "drop in" products in the national metals smelting sectors – especially iron and steel production.

Such materials are best manufactured from selected hardwood materials that could present in the regional waste streams especially from C&I and C&D streams.

Whenever pyrolysing biomass, approx. 50% of the inherent CV of the input materials will present as syngas and heat and be available for export as heat, steam and "green" power products.

Ideally, an adjacent industrial application would be available to use this energy as direct heat/steam, or a natural gas (NG) replacement/supplementary fuel, but if not, the conversion to power would be facilitated by Sub-Group councils offering to purchase such green power in response to their respective carbon management programs. Some 10-20 MW could be available depending on the final product mix selected for Node 8.

H. Black Power

The power generated by Node 9 will have been sourced from predominantly non-biomass feedstocks, and so will not qualify for "green" status. This power will need to be sold into the grid in direct competition to standard fossil fuelled power. Perhaps the optimum use of this energy could be as heat/steam to support Nodes 7 and 8 for drying and conditioning if satisfactory grid connection arrangements cannot be negotiated.

Summary of Actions and RWS Responses

Node 1 – (5.2.1) Interaction with, and education of, the community

- Engage with the community to engender support for programs or initiatives that promote the thoughtful purchase of goods and services with a view to:
  - a) Increasing the community's understanding of the whole of life and sustainability credentials of the various brands and products.
  - b) Increasing the community's awareness of post-consumer waste/resource recovery options.
- Educate for the optimised compliance with the four major discard options available.
- Consider the proposed Decision Making Matrix in the design of discard/collection services for green and hard waste.
- Provide system feedback and performance information to maintain and increase community support.

Node 2 – (5.2.2) Review options to optimise processing and product synergies with C&I/C&D collection and processing sector

Node 3 – (5.2.3) Review options to optimise processing and product synergies with regional biomass generating or using operations

Node 4 – (5.2.4) Review options to optimise sustainable resource recovery and the return of full and fair value to the community

Node 5 – (5.2.5) Develop VATS/AWT facilities as the "signature" initiative to optimise sustainable resource recovery from residual (red bin) waste streams

Node 6 – (5.2.6) Develop systematic, cost-effective and widely adopted systems and infrastructure to optimise resource recovery and service provision to the community for hard waste, clean up and "product stewardship" materials

The establishment of conveniently located and commonly branded and operated drop-off facilities should be a systematic infrastructure and service response in the RWS, and the support available from EPA under current WLRM initiative applied for.

However, as described above, the current perceptions of facility adequacy are only an initial contribution to an eventual, fully integrated service offering, such that the design and location for such first stage facilities should be implemented so as to optimise the opportunity for further expansion of services without need to demolish or relocate the initial facilities.

Node 7 – (5.2.7) Develop staged strategy to realise the optimum resource value from the dry high calorific materials (predominantly plastics/synthetics) by engaging with other regional initiatives

Options 1, 2 and 4 can, at best, only be medium to long-term options, and Option 3 would be most cost-effectively introduced as a pretreatment step if and when Options 1, 2 or 4 were ever implemented. So the following short to medium-term strategy is recommended to provide short-term certainty, whilst maintaining the option to initiate or participate in more advanced outcomes over time. The following steps should form the basis for the ultimate financial modelling of the RWS.

Step 1

- Initially plan to simply bale and monofil, or store in an area of the landfill that doesn't impede normal landfill activities, but enables a commercially and operationally significant resource to accumulate in support of the commissioning of Node 9 below, and/or the emergence of Options 1, 2 or 4 above.
- Such material should be "non-putrescible" after processing via Node 5 and so the resultant "bale fill" will, in effect, be an inventory management capability – to store materials as they present as wastes so as to eventually provide an assured source of input material that any subsequent value adding process, which, in turn, could be relied on as a crucial contributor to the "supply certainty" necessary to capital justify the new facilities.
- This step will ensure that all materials received and reclaimed from Node 5 will be safely managed – since the default position is that they are in a landfill and placed very efficiently with respect to air space conservation and the provision of environmental protection. But unlike normal landfill, the resource value of these materials is still accessible if needed.

Step 2

If Node 9, Modular EfW facility, is implemented as proposed, withdrawals from this stockpile would be available if certain minimum levels of feedstock certainty is required to justify such a facility, which it is envisaged Node 9 would be primarily justified for the processing of residuals from Nodes 2, 5 and 8 materials for which no other higher resource use can be identified, other than to be converted to energy prior to residual ash presenting for filling land (civil uses) Node 10.

Step 3

Whilst those materials are being safely and sensitively handled (Step 1) the Sub-Group (or their nominated agent) will be able to actively participate in third party discussions or negotiations for the adoption of Options 1, 2 or 4 on a regional, GSR, intra or interstate basis; all with the objective of maximising returns to the sub-region from materials without incurring any additional **operational cost or risk**.

Node 8 – (5.2.8) Support for/participation in regional biomass processing/bioproducts manufacture capabilities

Develop a detailed scope for such a facility to service the Sub-Group councils as described herein.

Use the assured supply of the organic fraction of the residual MSW stream and potentially a suitable site (South Windsor) as the basis for attracting detailed Expressions-of-Interest (EoI) from specialist facility developers to build, own and operate such a facility at their own risk, cost and initiative and **where actual markets have been identified**.

Node 9 – (5.2.9) Encourage the development of appropriate RDF production capabilities and/or best practice residual waste receiving EfW facilities

Because reliable supply of residual wastes will be essential to capital justify, what will be a very technically sophisticated facility, it is recommended to initially implement the RWS with landfill capacity only for the receipt of upstream processing residuals. At such time as the overall strategy and material flows can demonstrate the necessary levels of reliability, the eventual EfW facilities can be scoped and procured to directly address the identified need and opportunity.

Node 10 – (5.2.10) Ensure convenient and cost-effective access to landfill to service "last resort" residual wastes in the long term and secure "by-pass" capabilities in the short to medium term as the other systematic resource recovery options are progressively implemented

If the core recommendations of the RWS are adopted and progressively implemented, the actual role and functional specification of the existing landfill will change and a programmed projection could see an initially adequate facility lasting in perpetuity, rather than filling up with daily waste delivery and requiring complete replacement over time.

Node 11 – (5.2 11) Develop systematic "support" programs to encourage the development of existing markets and the emergence of preferred markets for products made from even a proportion of the Sub-Group waste streams

All these actions and RWS responses are discussed in more detail in Section 6 to address actual or expected implementation issues and suggested completion risk mitigation measures.

6. Discussion of Actual RWS Task Implementation Issues, Strategic Approaches and Risk Mitigation Measures

6.1 Introduction

This Regional Waste Strategy aims to collate and address the future needs and ambitions of the five WSROC Sub-Group councils in the context of some pre-agreed objectives, underpinning philosophies and strategic approaches, including:

a) If wastes are not to present for wasteful disposal alone, they will need to be processed so that they can re-enter the Productive Economy at their respective Highest Net Resource Value; and

b) Achieving the complex route-to-market for all the materials presenting in MSW is a complex value chain that involves processes and actions that are outside of the core area of expertise or capability for each Sub-Group council acting alone.

For the Sub-Group councils to achieve their respective and collective goals, the RWS must propose and advocate for a wide spectrum of actions and initiatives that are outside of direct purview or operational capability of councils alone. Such tasks and actions are therefore much more difficult to achieve since they are dependent on the cooperation, collaboration or compliance of third parties. The RWS is therefore **not a direct action plan** over which councils can exert direct control, but a **strategy** which clearly articulates preferred objectives and outcomes, but requires third parties, acting in their respective, fully informed self-interest, to provide the services and capabilities necessary for such outcomes and objectives to be achieved.

The following section addresses a selection of the specific actions and recommendations identified in Section 5 that will require this level of collaboration with third parties to achieve and proposes:

a) The actual actions and influences that the Sub-Group could adopt to achieve such outcomes, direct and indirect approaches; and

b) The measures that could reduce completion risk.

It is informative to compare the complexity and thoroughness of the approach adopted in the RWS with the much simpler approach required by the NSW WARR strategy. This much simpler approach focuses on six specific program areas (Section 1.1.2) which, if achieved, will all deliver significant environmental advantages, but fails to identify that without a clearly articulated route-to-market for all materials "…diverted from landfill", the project goals and targets will just remain unrealised.

In this regard, NSW EPA, and NSW Government policy in this area generally, faces the same challenge as individual or groups of councils, and that is that the systems, facilities and product development activities necessary to actually achieve optimised resource recovery outcomes (and by default, the Sub-Group's stated strategy objective Section 2) requires the targeted collaboration with specialist private sector third parties.

The following section seeks to provide a systematic pathway to the integrated achievement of these goals and outcomes with particular attention to those outcomes that are less within the direct control of councils to achieve, and more focused on encouraging third parties to collaborate.

6.2 The Main Action Items/Tasks proposed in Section 5 with the Proposed Measures to Reduce or Minimise Completion Risk for Each

6.2.1 Interaction with, and Education of, the Community

Task – Optimising the proactive participation of the community in the achievement of the RWS objectives.

Control – Individual councils have the direct ability to communicate, direct and inspire the community to proactively participate at at least two levels.

<u>First</u>, at kerbside. To directly influence material discard behaviour; selecting the appropriate bin or drop off, or bring-back option and thus make all subsequent resource recovery systems and infrastructure activity as cost efficient as possible.

<u>Second</u>, and less directly, is the opportunity to educate and influence original purchase decisions. Consumers can use the act of procuring goods and services to consider:

a) the need for performance of the acquisition;

b) the reputation of the manufacturer and the materials of construction and packaging, with regard to the function and benefits provided; and

c) the post-consumer impacts of the product and/or packaging and the options to minimise overall resource use.

In relation to this latter issue/opportunity, just being aware of the issues and maintaining coherent messages when directly communicating the primary "kerbside" message will be beneficial.

Importance – Without informed and proactive participation of the community at kerbside, at the moment of material discard into the designated and most appropriate option and/or receptacle, there would be just one heterogeneous mixed MSW stream, which would make any subsequent resource recovery activities less efficient and less likely to recover HNRV from the materials under management. Also, the community would be less involved in resource use and sustainability issues, which might turn out to be the greatest loss.

However, the community has embraced the opportunity to "recycle", so councils cannot only support this community demand for elevated levels of service delivery, but make the resultant resource recovery efforts more cost-effective at the same time.

Effects/Outcomes – This community engagement issue represents an important opportunity to optimise the RWS outcomes, but non-compliance would not be fatal in the modern era and with current and emerging technical sorting advancements. The consequence of wholesale non-engagement/compliance by the community would result in lower levels of HNRV resource recovery, but the outcome would only be an incremental reduction of RWS outcomes.

However, since the community is already so proactive and involved, the probability of majority non-participation is most unlikely and wholly within the respective councils' skill sets to support and encourage.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Almost certain**
- Impact of RWS non-achievement: **Moderate**
- Result: **Medium risk to successful RWS implementation**

6.2.2 Optimise Processing and Product Synergies with Regional C&I and C&D Sector

Task – Optimise processing and product synergies with regional C&I and C&D sector.

Control – Councils are directly responsible for the management of domestic MSW arisings and in some instances this can extend to the provision of related collection services to small businesses. In the case of HCC, the C&I/C&D sector can use the HCWMF, which creates a regular point of contact with those sectors, but mainly, the provision of collection, processing and waste disposal services from the non-domestic urban waste sector is a private contract relationship between the waste generators and their selected service provider.

This relationship is very price sensitive and, especially in the C&I sector, resource recovery is not a primary concern of the respective parties, even where (landfill) disposal charges are constantly increasing. This is usually explained as being a lack of critical mass or coordinated planning in that:

- The collectors must be continually price competitive to retain customers, and the provision of resource recovery options can require increased collection fees; and
- Individual businesses seldom produce enough of any particular type of waste to justify resource recovery programs on their own.

However, the range of specific materials in domestic MSW and C&I, and even C&D are very similar, even if the individual material types present in different proportion in the three waste types.

The opportunity canvassed in Section 5 is that if the Sub-Group organised to develop and operate common resource recovery facilities, systems and infrastructure, possibly centred on HCWMF, much of the material presenting in the regional C&I and C&D waste flows could be processed by much of the same equipment and contribute to many of the same resultant products. Such as:

- Putrescible waste processing
- Dry recyclables recovery
- Hazardous waste removal
- Wood waste processing
- Biomass recovery and value adding generally
- Green and black energy production

To explore these potential synergies, the regional C&I/C&D sectors would need to be engaged on a mutual interest/advantage basis since the Sub-Group has little or no direct control of the C&I/C&D sectors (other than as mentioned above), but the intention to develop systematic resource recovery facilities at HCWMF would certainly create interest if any such alternative could enable private collectors, collaborating with the Sub-Group, to offer higher value services at competitive prices. And for the Sub-Group, the extra volumes processed could deliver cost advantages to ratepayers.

Importance – Exploring the potential resource recovery and cost-effectiveness advantages of actively engaging with the C&I/C&D sector is not crucial to the successful implementation and completion of the RWS, but cost advantages of at least 10%-20% could be achieved by processing the extra volumes through basically the same systems and infrastructure established to service the domestic sector, and such collaboration might open up productive arrangements for the funding and operation of such facilities.

Effects/Outcomes – Exploring potential operational and collaborative engagement with the regional C&I/C&D sector should positively impact the overall cost/benefit of RWS as proposed, to an extent too valuable to ignore, once the Sub-Group has established the management of systems to progress the RWS to even a pre-feasibility stage.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Likely**
- Impact of RWS non-achievement: **Minor**
- Result: **Medium risk to successful RWS implementation**

6.2.3 Optimise Processing and Product Synergies with Regional Biomass Generating, Processing and Using Sector

Task – Identify, scope and engage with regional biomass generating, processing or using sector.

Control – This sector may well represent a significant economic and commercial benefit to the regional economy as it is, but Sub-Group councils may have no direct relationship or influence over this sector (other than in the administration of council regulations and bylaws etc.). However, a major requirement for the full achievement of the RWS objective requires the biomass fraction of the domestic waste streams to be recovered and converted to the HNRV products and uses possible.

Supplying genuine customers and sustainable market opportunities requires making products that exactly suit the needs and specifications of such markets, and this will require selecting a range of materials, virgin and recovered, to ensure final product quality, and therefore secure long-term outlets for the full range of reclaimed biomass materials.

In this context, the realisation of the inherent value of biomass materials recovered from domestic/council sources needs to integrate with the greater regional biomass processing sector. This could be achieved by councils directly, or as a coordinated Sub-Group or via an engaged/selected third party.

Importance – The default outcome for residual biomass entrained in domestic wastes streams will be only landfill or low value EfW, if the proposed value adding, in cooperation with the regional biomass sector, is not achieved. Both such options are likely to present as lower value resource recovery options, which will reflect in higher service charges to ratepayers.

Effects/Outcomes – A starting philosophy for the RWS is to reallocate the current landfill costs and the related S88 waste levy towards servicing the increased capital and operating costs of systematic resource recovery, and so generate the optimum income from sale of recovered materials and products.

The net effect of this approach is proposed to support the original strategic objectives (Section 2.1 b and c) in relation to stabilising net waste management costs to ratepayers. These outcomes are substantially reliant on significant progress on this particular RWS objective (see also Section 6.2.8).

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Possible**
- Impact of RWS non-achievement: **Significant**
- Result: **High risk to successful RWS implementation**

6.2.4 Ensuring Full and Fair Value Returned to the Community from the (yellow bin) Dry Recycling Service

Task – To optimise the community's investment in the dry recycling discard (yellow bin) infrastructure systems.

Control – Councils have almost complete control of this household discard option; from specifying and tendering the service delivery on a regular cycle and by being the primary conduit of information and advice to the community on the benefits and obligations of having such a service universally available. This (yellow bin) dry recyclables discard option is the primary landfill diversion/resource recovery technique and is now well established from household, to the point where the recovered materials re-enter the productive economy. For this reason, now is an excellent time to:

a) Explore what other material/product types might now be added to the list of currently recycled materials.

b) Confirm that the risk/reward/responsibility spread of the service as it is now operating is producing full and fair outcomes for the community.

Importance – Improvements to these existing arrangements may only demonstrate incremental benefits, or may reveal that the community is well served by the current integrated (collection, sorting, reselling) systems, but just as likely, the value offered for the reclaimed materials may not currently be fully recognised in the usual offset provisions in the tenders for the collection services.

Effects/Outcomes – The necessary detailed economic and cost benefit research may prove to be too onerous for any one council, but the Sub-Group, or WSROC as a whole, may well be in the best position to explore these issues. In so doing, the final value attributed to the reclaimed materials would warrant specific analysis of not only what are the current market prices for these materials within the tightly held reuse industries, but also, from first principles, what such materials could be worth and what steps could/should be taken to progress such higher value possibilities.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Possible**
- Impact of RWS non-achievement: **Minor**
- Result: **Medium risk to successful RWS implementation**

6.2.5 Develop VATS/AWT Facilities as Vital First Stage in Achieving Optimised Diversion and Systematic Resource Recovery Outcomes from (red bin) Residual Waste Streams

Task – Undertake Pre-Feasibility Study (PFS) on VATS/AWT proposal to secure Sub-Group (and specifically HCC) concurrence with the recommendation.

Control – HCC alone and the Sub-Group in support, could have complete control of the proposed PFS process. And other than requesting EPA MRRI funding to support the research, no outside influences need hamper the initiative.

The scope for any such PFS would need to include the potential markets and uses that the proceeds of such a plant would generate; to fully assess and report on the benefits of such an approach; and the options available to minimise an ultimate completion risk to the Sub-Group.

Importance – Without systematically addressing the residual (MSW) waste stream and providing a low (technical and commercial) risk platform to support subsequent recovered materials processing for highest net product value, efforts to achieve >90% diversion cannot be achieved, other than by basic EfW approaches. However, NSW EfW policy requires every effort to have been made to recover resources before presenting such residual wastes to a binary EfW fate. As such the proposed PFS seems like an essential and very achievable (and safe) next step.

Effects/Outcomes – The completion of an accurately scoped PFS would provide essential information on the value and practicality of most of the key recommendations of the RWS.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Likely**
- Impact of RWS non-achievement: **Significant**
- Result: **High risk to successful RWS implementation**

6.2.6 Develop Systematic, Cost-Effective and Widely Adopted Systems and Infrastructure to Optimise Resource Recovery and Service Provision to the Community for Hard Waste, Clean Up and "Product Stewardship" Materials

Task – Collaborate with national initiatives to harmonise and institutionalise systems and infrastructure offerings to optimise resource recovery (and best manage toxic or overly valuable materials) from these "hard waste" discard flows.

Control – Currently discard, recovery and treatment options for these materials (Attachment D – Stream 4 Table 1) vary within every council in the country, and the Sub-Group is no exception.

Such materials currently present in one or all of the following discard channels:

i) discarded to (red bin) MSW collection service

ii) put out for hard waste/clean up service

iii) taken to industry specific drop-off/bring back centres

iv) brought back to council/EPA sponsored drop-off facilities (at landfills, transfer stations, other)

v) discarded to (yellow bin) collection service

vi) taken to/collected by charity operations

vii) other/miscellaneous.

Against these totally inefficient and ineffective recovery options, that vary from council to council, and thus confuse the material discarding community, there is now (nascent) national Product Stewardship legislation at a Commonwealth level. At this level, a national impetus to harmonise approaches to this particular discard stream is emerging.

Because ultimate success in this sector will require proactive collaboration and commitment from all the respective brands and manufacturers and importers of goods and services, this issue must be led by the Commonwealth for greatest system efficiency and effectiveness. This means that apart from participating in the NSW Government's fledgling "drop-off" centre program, the main breakthrough must come at the national level. The RWS recommendations are more in the nature of participating and encouraging such national initiatives via the most appropriate association, trade bodies or NSW Government initiatives.

Importance – If the VATS/AWT recommendations are adopted, the largest volume of "residual" wastes presenting for landfill will emanate from this "hard waste" stream. This stream contains some of the most toxic elements of domestic MSW, which, if removed, would greatly improve the potential product quality of the other MSW material. This stream also contains products and materials that contain, in aggregate, some of the most valuable and non-renewable elements in urban wastes.

Effects/Outcomes – To not systematically address this waste stream is to:

- Ensure <90% diversion in the future; and
- Pass up the opportunity to realise the considerable inherent value in these materials; and
- Condemn the main MSW processing facilities to manage toxic elements that could/should have been removed, prior to MSW processing, within industry supported schemes.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Likely**
- Impact of RWS non-achievement: **Moderate**
- Result: **Medium risk to successful RWS**

6.2.7 Promote Development of a Specialist Processor of HCF Materials (Node 7) to Service the Sub-Group Region at least

Task – Identify and encourage the development of value adding facilities for the HCF/synthetic/plastic fractions separated out from residual MSW waste flows via VATS/AWT and MRF facilities servicing the Sub-Group region.

Control – The actual development or ownership/operation of such facilities is most unlikely to be pursued as direct or core business for councils.

Such facilities are likely to emerge initially as RDF/PEF production facilities under the current EPA EfW policy. And such facilities will in turn require the identification of secure markets for the resultant products. This issue represents a complex value/supply chain from original residual MSW collection, processing and secure end market identification.

In isolation, this level of iterative and integrated project initiation and development is unlikely to be pursued by any one council in isolation, or even as a Sub-Group, unless the overall RWS is approved and a dedicated resource allocated to manage whole-of-supply-chain outcomes on behalf of the Sub-Group – or even WSROC as a whole.

A staged implementation plan would need to be developed and implemented, such that each subsequent stage of value adding is promoted after each previous stage is commissioned, and the outputs from one stage secured as inputs to a subsequent stage.

Importance – A focus of the RWS is to identify that the current net cost of waste management service provision to the Sub-Group community is sufficient to capital justify a systematic, streaming/cascading suite of processing options that will be essential to achieve the RWS objectives (Section 2) and 6.14 below.

However, to achieve this much more complex, even if cost-effective outcome, the RWS will need complete endorsement from the Sub-Group councils and dedicated staff allocated to co-ordinate and implement the proposals. It may be that a specialised private sector operator could be identified and appropriately contracted to develop and deliver such a novel program.

Effect/Outcomes – The effect of not promoting the development of such (Node 7) capabilities to service the region will be to condemn the final fate of such materials to landfill or basic EfW without the opportunity to realise the potential HNRV of the HCF materials. The actual economic, strategic and commercial impacts would be logically investigated as an integral task in a VATS/AWT PFS recommendation.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Possible**
- Impact of RWS non-achievement: **Moderate**
- Result: **High risk to successful RWS implementation**

6.2.8 Support for, and Participation with, a Regional Biomass Processing Capability to focus especially on the Processing of Regionally Sourced Biomass for Maximum Value to Local and Intra State Markets

Task – Encourage specialist private operators to establish Node 8-type facilities to service and value add regionally sourced biomass materials.

Control – Such a "Node 8" facility would be an entirely privately developed facility, but secure flows of materials from the Sub-Group councils could be a crucial "supply" factor to make such a plant a reality. As such, "control" could be created for the region and a very symbiotic relationship established; all as discussed in the Staged Strategy outlined 5.2.8.

Importance – The biomass materials presented in the domestic waste stream range from clean source separated garden waste, to biosolids and the organic fraction of residual MSW processing. All have different properties and different HNRV end use potential, but none will produce an assured quality finished product on their own. All will need to be processed to an agreed standard so that they can present as specific "ingredients" to be included in the mix and blending of actually customer driven, tailor-made, fit-for-purpose end products. Thus, to actually commit to process all the various sources of biomass under Sub-Group management and control into HNRV end products the proposed "Node 8" capabilities in the region will be vital.

Effect/Outcomes – The establishment of such facilities in the region will have immediate benefit to the Sub-Group councils in the achievement of the RWS, but will also generate quality employment and development opportunities for the benefit of the region. Without access to "Node 8" facilities in the region, materials unsuitable for anything of higher order than simple composting will default to landfill or basic EfW, wasting resource value, limiting the opportunity for the region to be an active participant in the emerging biomass economy, and missing an opportunity to optimise product income to ensure the ultimate implementation of the RWS.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Possible**
- Impact of RWS non-achievement: **Moderate**
- Result: **High risk to successful RWS implementation**

6.2.9 Establish secure pathway for suitably processed residual wastes to have at least their inherent calorific value recorded

Task – Secure a "non-landfill" EfW outcome for pre-processed residual materials via either the indirect route of RDF/PEF manufacture and/or direct presentation to a suitable EfW facility.

Control – The direct commissioning of such RDF/PEF facilities, or a dedicated and complying EfW facility, will be a private development opportunity, as with Node 7, but the potential supply of secure volumes of such materials originating from the Sub-Group region will be a commercially attractive opportunity for such facility developers, and, as such, the Sub-Group will play an important role to enable the creation of such facilities.

Importance – Without such facilities, the high calorific fraction of residual wastes will be destined for landfill disposal only, and so jeopardise the fullest achievement of the RWS and the strategic objectives (Section 2).

Effect/Outcome – Without such "Node 9" type facilities, the ultimate achievement of the RWS goals will be jeopardised commercially and up to some 15%-20% of potential landfill diversion lost.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Likely**
- Impact of RWS non-achievement: **Moderate**
- Result: **Medium risk to successful RWS implementation**

6.2.10 Ensure Convenient, Reliable and Cost-Effective access to Landfill to Underpin Last Resort "by-pass" Risk for the Ultimate RWS Residuals

Task – Ensure that the region always has reliable and cost-effective access to ultimate landfill disposal for:

a) "Last resort" residuals; and

b) As a "by-pass" capability to manage ultimate process risk from all the prior, technology-based processing facilities.

Control – At HCWMF, the Sub-Group would have unique control of this basic service provision, more so than most other councils in the GSR.

Importance – Having direct access to a regional facility could be a vital strategic and logistic strength and advantage.

Effect/Outcome – Access to such an asset opens up the possibility of assisting third party private facility developers with essential (if conditional) back up/by-pass capabilities, which could be converted into significant commercial advantage for the region in general and HCWMF in particular.

RWS COMPLETION RISK STATUS

- Likelihood of RWS achievement as proposed: **Almost certain**
- Impact of RWS non-achievement: **Moderate**
- Result: **Medium risk to successful RWS implementation**

6.2.11 Achievement of HNRV for all Recovered Resources

The following commentary on the issues and risks involved in the Sub-Group actually achieving full and fair market value for the resources/materials proposed to be recovered is focused to address the core issue of whether the RWS as proposed could meet the crucial objectives established Section 2. Where appropriate, approaches or programs are suggested to enable or improve the chances of success as anticipated in Section 5 (and 6.4 below).

A. Drop-Off/Hard Waste/Product Stewardship materials

The assumption in the high level commercial viability of the RWS (6.3) is that materials recovered via an eventually, fully functioning drop-off system will offset capital and operating costs as a minimum.

Initially, certain scrap and recyclable materials can be sold for a profit, but materials collected as part of a proposed widespread partnership with the brands and manufacturers (via voluntary, co-regulatory or compulsory Product Stewardship arrangements), to at least recover the costs for drop-off operators is still problematic.

EPA is currently engaging for the forwarding of some specific products (e.g. E-Waste) with emerging Product Stewardship schemes, but these programs still have a long way to develop before a minimum position of cost recovery is achieved for councils, and certainly, the eventual goal of running community drop-off facilities as a commercial service for brands and manufacturers is not yet an assured outcome. Proactive engagement (6.2.6) is the essential activity necessary to optimise this situation for councils and the Sub-Group as a whole.

RWS ultimate completion risk is **Medium** (Likely & Moderate) and the default position will result in more material to landfill disposal than need be. However, the potential benefits to fully achieving the RWS objectives makes efforts to encourage national developments a positive activity in the short to medium term, at this time, when the opportunity to influence productive outcomes is available. Perhaps active involvement in a collective initiative (LGSA or WMAA etc.) could be most cost-effective. Certainly, if the RWS is eventually accepted and progressed by the Sub-Group, a dedicated representative would be a valuable initiative to pursue this issue.

B. Civil Applications

The pathway to optimising the productive reuse of reclaimed inert materials is now well established in the market place. Options exist through in-house uses by councils themselves, and through specialist road base supplies (e.g. Stabilco Pty Ltd etc.).

The ultimate completion risk for achieving a positive net value for such materials is **Low** (Almost Certain & Minor).

C. Scrap Metal

These markets are well established and the ultimate completion risk for the RWS to achieve a positive net value for such materials is **Low** (Almost Certain & Minor).

D. Plastic/Synthetic/HCF Materials (Node 7)

The development of specialist facilities to recover HNRV from these materials could be developed as an independent facility or as a "pretreatment" capability for an EfW facility (Node 9). The emergence of the highest value products from this stream of material may well depend on many other council areas producing similar materials to make such focused value adding feasible, and therefore the likelihood of such an opportunity arising in the medium term is only "possible", and, as such, the ultimate completion risk for the entire RWS is **high** (Possible & Moderate). However, the default position of EfW and black power production is "likely" and together the default position is "non-putrescible" landfill, hence the consequence of not achieving this HNRV for secondary plastics is only moderate, although the potential sales value is very high compared to many of the other reclaimable materials (6.3).

E. Existing Dry Recyclable (Yellow bin) Materials

Current markets for these materials all exist and subject to suggested actions 5.2.4 and 6.2.4, their respective pathways back into the productive economy seem assured at at least current levels, thus ultimate completion risk to the implementation of the RWS is considered **Low** (Almost Certain & Minor).

F. Compost

The processing of "clean" source separated garden organics/biomass is a well established activity in the region, and the finished products are all finding beneficial end uses as mulches and soil productivity improvers, or even as blended into more refined proprietary products, so the ultimate completion risk for the RWS is **Low** (Certain & Moderate). However, many existing compost products are not realising their full and fair value in the market place due to "supply push" factors. This suggests that with the full scale operation of a specialist (Node 8) facility, quality compost producers will be able to achieve more reward for their efforts.

G. Specialist Bio-Products Manufacture (Node 8)

The high value markets for biobased "drop in" alternatives, for applications currently supplied from "fossil" coal, oil or gas, is emerging systematically across OECD countries generally, and in Australia as promoted within the Commonwealth's Direct Action framework, especially to agriculture via the CFI.

Some governments have initiated their own programs in this regard (e.g. ACT) and markets currently under development derive their ultimate viability by providing higher levels of performance than the alternatives, rather than simply relying on any government-initiated incentive program to achieve market acceptance.

However, all these high value market opportunities are medium-term prospects, which present their ultimate completion risk for the RWS as **HIGH** (Possible & Moderate) in the short term, **MEDIUM** (Likely & Moderate) in the medium term and Low (Almost Certain & Minor) in the long term.

Since, even if the RWS was adopted and actioned during 2014, it would be in the medium term before Node 8 was established, against the long-term objectives, the risk to the RWS implementation is considered **Medium** (Likely & Moderate) for the purposes of current evaluation.

It is worth noting that since many of the prospective biomass sources will be considered as "mixed" in origin under the current EfW policy, a program to apply for and achieve either a specific or a general exemption under the POEO Amendment Act (2005) will be required, and project proponents should be assessed on their confirmed ability to address this issue at the time.

H. Black Power

The role of any resulting EfW facility will be defined by the ability to generate energy from certified residual wastes. The process of converting such residual materials for their inherent energy is now defined under the recently released NSW EPA EfW Policy Statement.

Such facilities will provide a valuable diversion service for waste generators, but the actual energy they produce will need to be sold into a static or declining market for "black" power which will influence eventual plant viability.

However, actual sale of such black energy, as either heat/steam or power can be safely achieved, so that the ultimate completion risk for the RWS is only **Medium** (Almost Certain & Moderate) in the medium to long term.

Summary

The achievement of the strategic objectives (Section 2) in general, and b) and c) in particular are predicated on:

a) Incrementally reallocating the current costs of landfill gate fees and S88 levy payments to servicing the CAPEX and OPEX costs of installing systematic, streaming/cascading resource recovery capabilities (6.4); and

b) Optimising the receipts from the reclaimed materials and resources.

To this end Table 6-1 outlines the first order risk assessment of the probability and impact of actually achieving HNRV for all reclaimed resources over time.

Table 6-1: Potential relative HNRV from recovered materials

Generic products available from a fully implemented RWS	Risk of achievement as proposed	% of entire regional waste stream	Potential first order value $/pa	Assumed net baseline market value $/tonne
A Drop-off products	Medium (Likely & Moderate)	4	0	Net diversion benefit
B Inerts/civil	Low (Almost Certain & Minor)	6	0.2M	Quarry products substitute, say $10/t
C Metals	Low (Almost Certain & Minor)	2	0.4M	Say average $80/t
D Secondary plastics	High (Possible & Moderate)	7	9.1M	Say average $650/t – 65% yield
E Traditional dry recyclables	Low (Almost Certain & Minor)	23		As existing
F Compost	Low (Certain & Moderate)	10	0.5M	Say average $12.50/t + power
G Bio-products	Medium (Likely & Moderate)	35	4.3M	Say average $120/t
H Residual EfW	Medium (Almost Certain & Moderate)	13	0	Net diversion benefit
		100	**$14.5M**	**Potential HNRV receipts over and above current situation**

Commentary on Table 6-1 – Assumptions and Outcomes

A Drop offs – All commercial modelling available at the time of preparing the RWS indicates that a systematic network of commonly branded drop-off facilities can be established so as to produce a commercial rate of return on the capital employed, if the full potential of this service offer is catered for. The full potential value is achieved when the facilities respond to the needs of not only councils, but also the community generally and especially the original brands and product manufacturers. However, such an outcome will require national leadership and coordination, and as such, the benefit of a fully implemented RWS is proposed as break even in terms of net cost and servicing of capital employed, and the net benefit being the net diversion benefit from landfill and S88 levy payments.

B Inerts/Civil uses – The technologies and markets exist for these materials to be applied as replacements/supplements in the regular quarry products markets. This is seen as a likely outcome and a provisional value of $10/tonne has been assumed to make such materials attractive to end users and pavement specifiers.

C Metals – There is a low risk of non-achievement since scrap metal markets are well established and accessible. An average end value of $80/tonne across the full range of ferrous and non-ferrous metals that would be recovered has been selected as a baseline or conservative assumption.

D Secondary plastics/synthetics processing for HNRV – Whilst the default position is that these materials would present for landfill or residual EfW inputs, without such a Node 7 type facility, the potential commercial benefit of thermally processing these secondary plastics, to produce common petrochemical industry feedstocks and precursors is only limited by the will to make it happen, and a sufficiently secure supply of such feedstocks being available from multiple regions.

The risk of such an outcome occurring is put as **High** because so many factors need to be addressed simultaneously, but commensurate with the risk is the potential value that could conservatively be achieved. This particular proposal should be a focus for any duly scoped techno/economic analysis that should follow if the potential identified in the RWS is considered worth progressing.

E Traditional dry recyclables – The recovery of these materials is now well established, and represents some 23% of the potentially recovered resources if the RWS is fully implemented as proposed. However, the relatively low net value recovered to offset the cost of collection would benefit from a detailed economic review as recommended in Section 5.2.4.

F Compost – The potential to process some 10% of materials under management by simple composting of the clean source separated materials will present as an important regional capability; but the relatively low price achieved in the market due to "supply push" factors will, to a significant level, be addressed by establishing higher value, thermally processed bio-products (G below) by absorbing surplus biomass inputs and reframing compost operators to be manufacturers of highly specified, "market pulled" products, and receiving the bulk of their revenue from sales rather than gate fees.

G Bio-products manufacture – As with D above (Secondary Plastics Processing), such facilities do not yet exist in Australia, but unlike D above, some 6-10 such facilities are in various stages of development at the time the RWS is being prepared, and so this function can be presented with a much higher probability of occurring.

Of note is the 35% of total materials under management represented by this biomass fraction in the event that the RWS is fully adopted. This reinforces (Section 1.2.5) the focus on biomass.

Whilst the risk of ultimate completion success is rated as **Medium**, mainly because no such facilities can yet be inspected, the parallel development of such facilities throughout NSW opens the opportunity to collaborate with these initiatives, rather than the need to initiate such options from first principles, and the potential product value from the resultant bio-products (approx. $4.3M/pa) makes pursuing this option by a subsequent techno/economic review (as part of a general RWS Pre-Feasibility Study) a recommended approach.

H Residual EfW – The assumption in the RWS is that no net value would present after sale of "black" energy other than the avoided landfill and S88 levy benefits.

Summary to 6.3 – Completion Risk for RWS

Table 6-1 indicates that some 41% of the potential volume of HNRV products that could be achieved from a fully implemented RWS represents some 7-8% of the potential value expected at a low risk of not being achieved. A further 52% of the same volume could represent some 30% of the potential receipts at a medium risk of not being achieved. Only 7% of the volume presents as a high risk of not being achieved, but these materials could represent some 63% of the potential HNRV income from the fully implemented RWS.

For the next section (6.3) market risk will be considered as **Medium**, and the main risk mitigation action will be direct and proactive engagement by a suitably representative party, on behalf of the Sub-Group, to positively prosecute these agendas, rather than rely on passive encouragement to achieve these important, but often complex outcomes.

6.3 Summary of Completion Risk Assessment for this Fully Implemented RWS

The RWS has sought to identify breakthrough actions to systematically progress the transformation of existing waste management approaches to achieve genuine and lasting resource recovery, as the embedded outcome in the medium to long term.

This is a strategy document. The major issues, barriers and opportunities have been identified and discussed, but by definition, all new actions, programs and initiatives proposed are not currently being enacted. This results in the recommendations in the RWS running the risk of not being approved or prosecuted as proposed, with the result that all or many of the anticipated benefits and/or objectives would not be realised. This then requires the completion risks implicit in the proposals and recommendations to be understood as a vital stage in reviewing, assessing and approving the RWS.

To assess these risks, the analyses in this section have been evaluated against the matrix Table 6-2, registering the impact of:

a) The likelihood of a program being actually achieved; versus

b) The consequence of the non-achievement.

Table 6-2: Likelihood/consequence matrix

Likelihood of achievement as proposed in RWS	Unlikely	Medium	High	High	Critical	Critical
	Possible	Medium	Medium	High	High	Critical
	Likely	Low	Medium	Medium	High	High
	Almost certain	Low	Low	Medium	Medium	High
	Certain	Low	Low	Low	Medium	Medium
		Insignificant	Minor	Moderate	Significant	Major
		Consequence of non-achievement as proposed in RWS				

Table 6-3: RWS completion risks reviewed

#	Risk description	Likelihood	Consequence	Unmitigated rating
1	Maintaining and encouraging proactive community participation (5.2.1 & 6.2.1)	Almost Certain	Moderate	Medium
2	Fully engaging with C&I and C&D sectors to achieve optimised processing synergies (5.2.2 & 6.2.2)	Likely	Moderate	Medium
3	Fully engage with regional biomass generating and using sector (5.2.3 & 6.2.3)	Possible	Significant	High
4	Confirming full and fair value realised from dry recyclables collection and processing systems (5.2.4 & 6.2.4)	Possible	Minor	Medium
5	Establish VATS/AWT facilities as vital first stage in optimising systematic resource recovery from (red lid) residual MSW (5.2.4 & 6.2.4)	Likely	Significant	High
6	Develop systematic approach to value recovery from drop-off/hard waste/PS materials (5.2.5 & 6.2.5)	Likely	Moderate	Medium
7	Promote establishment of facilities to recover HNRV from secondary "plastics"(Node 7) (5.2.7 & 6.2.7)	Possible	Moderate	High
8	Promote establishment of specialist bio-products manufacturing facilities to serve the region (Node 8) (5.2.8 & 6.2.8)	Possible	Moderate	High
9	Support development of suitable EfW facility to process regional residual wastes (Node 9) (5.2.9 & 6.2.9)	Likely	Moderate	Medium
10	Secure cost-effective access to landfill as "safety net" for the whole RWS (5.2.10 & 6.2.10)	Almost Certain	Moderate	Medium
11	Achievement of HNRV from generic product streams anticipated by RWS (5.2.11 & 6.2.11)	Likely	Moderate	Medium

It is considered that since all these actions are important/crucial to the full achievement of the RWS goals and objectives, Table 6-4 proposes the specific actions to mitigate the risks in Table 6-3, where possible to Low, and if not, then identify the remaining issues that would need to be more formally addressed in any subsequent techno/economic and/or Pre-Feasibility Study.

Table 6-4: RWS completion risk mitigation measures

#	Risk	Proposed mitigation /management measure	Original risk rating	Revised risk rating
1	Community engagement	To address the "moderate" consequence, the quality of the community engagement will be a direct result of management focus and commitment.	Medium	Low
2	Linking with C&I/C&D sectors	If a dedicated RWS implementation team is established that reports to a steering committee, consisting of all five Sub-Group councils, this issue, if approved, would be proactively pursued.	Medium	Low
3	Engage with regional biomass generating and using sector	If a dedicated RWS implementation team is established that reports to a steering committee, consisting of all five Sub-Group councils, this issue, if approved, would be proactively pursued.	High	Low
4	Reviewing dry recycling systems	Will require other parties/councils/regions to collaborate, but a dedicated RWS implementation team would readily achieve this outcome once scoped and resourced.	Medium	Low
5	Establish VATS/AWT facilities	This is a signature recommendation of the RWS which, if not approved for at least Pre-Feasibility Study review, would render RWS achievement problematic.	High	High
6	Encourage the development and implementation of drop offs	This program is complex to deliver in its optimum form. Dedicated RWS implementation resources would be best placed to progress this program for little cost to the Sub-Group but considerable benefit once achieved.	Medium	Medium
7	Secondary "plastics" processing	A dedicated RWS implementation team will be able to identify specialist facility operators if program approved for encouragement in light of the considerable product value that could be achieved.	High	Medium
8	Regional bio-products processing facility	Unlike 7 above, development of such facilities is active in the NSW marketplace and could be readily engaged to achieve this outcome.	High	Low
9	EfW facility for ultimate residual wastes	Such a facility may well be proposed by a specialist developer with a view to servicing the needs of more than one region. Perhaps such a facility will be proposed outside of the Sydney air shed. In such circumstances, a dedicated team implementing the RWS will be in an excellent position to achieve this outcome for the Sub-Group region.	Medium	Low
10	Secure "last resort" access to landfill	With the Sub-Group approval of the RWS, the arrangements with HCWMF (or any other suitable site identified by the Sub-Group) will have been scoped.	Medium	Low
11	Achievement of HNRV from generic product streams	This should be a core objective of a dedicated RWS implementation team.	Medium	Low

Initial RWS Completion Summary

None of the risks reviewed above present with significant technical, market or economic risks, if prosecuted in an orderly, systematic, coordinated and adequately funded manner. This issue is covered in more detail Section 6.4 below.

However, most of these integrated implementation issues cannot succeed as proposed if left to market forces generally, or the hope of unsolicited offers emerging without:

a) This high level strategy being fully understood and endorsed– sufficiently to proceed with;

b) A techno/economic evaluation of the strategy – as an essential first stage in the production of a thorough Pre-Feasibility Study.

There are a number of integral tasks and programs that can be pursued by councils independently and/or as the Sub-Group as a whole, but the full social, economic and environmental benefits and objectives (Section 2) will only be achieved if the specific programs and end benefits can be pursued with centralised and specialised RWS implementation. Once the basic commitment to the strategy is apparent, much of the resultant funding for the proposed processing Nodes (2, 3, 5, 6, 7, 8 and 9) can be sought from suitably qualified private sector parties.

The only specialised waste processing module that will remain at a higher risk of full scale implementation is the (Node 7) secondary plastics processing capability. In isolation, such a proposal might never occur due mainly to "critical mass" issues. But the concept has the potential to generate a disproportionately significant sales value for the strategy as a whole. So, as above, if the balance of the strategy is progressed, the secondary plastics reprocessing proposal will present in a much more positive context.

6.4 First Order Assessment of RWS Commercial Viability

Figure 6-1 represents a consolidated representation of the core waste flows and processing functions identified in Fig. 5-1 (p. 27).

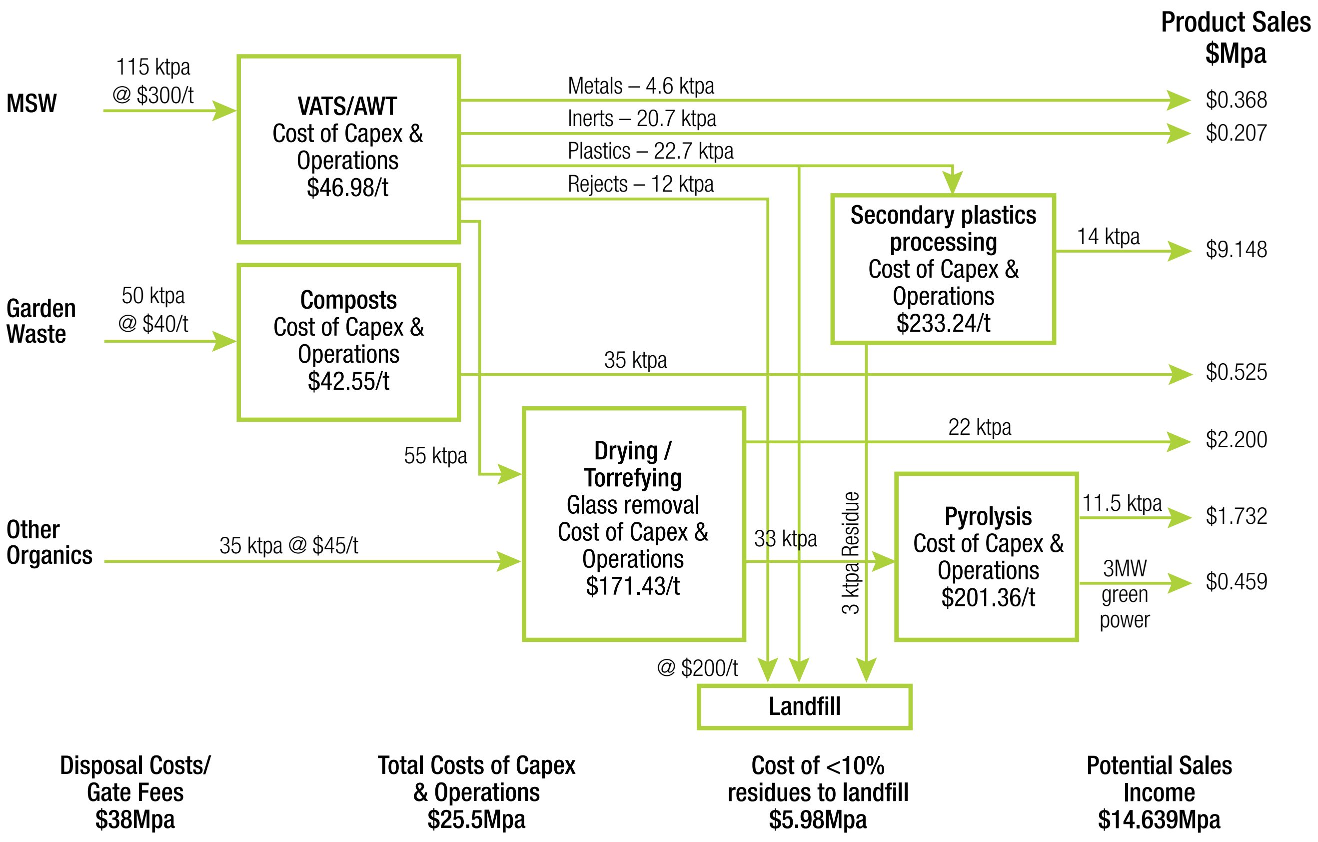
Certain features of Fig. 5-1 have been omitted in Fig. 6-1 to simplify the basic viability assessment, for example:

- **Node 2 – C&I/C&D inputs –** Their value to the fully operational RWS is a) to provide greater volume and throughput, to make MSW processing more cost-effective, and b) to specifically address C&I and C&D issues as requested by the EPA Guidelines, but these waste flows are not essential for the achievement of the Sub-Group strategic objectives (Section 2) and would only be added where they improved the overall RWS viability, but should not represent a vital factor in achieving such demonstrable viability.
- **Node 6 – Drop offs –** These could and should be developed to demonstrate a profit on funds employed, which would only improve the overall RWS viability, rather than be a condition of it.
- **Node 4 – MRF (yellow lid) dry recyclables –** This material flow is mature and established and will occur anyway, and so isn't critical to the establishment of first order RWS viability.
- **Node 9 – Residual EfW facility –** Such a facility will be capital justified on landfill avoidance (with some black energy sales) at a later stage of RWS implementation, but the energy sales will not be a determining factor, and so should not feature in a first order RWS viability assessment.

The functional nodes in Fig. 6-1 are all proposed to realise the optimum resource value from the materials under management and are the key elements that should demonstrate the economic and commercial viability of a fully implemented RWS.

Whilst Fig. 6-1 represents a fully implemented RWS, in reality, the systems and infrastructure could be implemented in stages, but such detail would be developed and scoped in any subsequent techno/economic review, as a preliminary stage to the completion of a full Pre-Feasibility Study.

Figure 6-1: First order viability of fully implemented RWS



NB: Supporting data and analysis Attachment F. Any discrepancies between Fig. 6-1 and Attachment F may be due to rounding errors.

The actual viability of the RWS after full implementation will need to be the subject of a detailed techno/economic review, which is proposed as the first stage of an overarching Pre-Feasibility Study. However, the basic information provided in Fig. 6-1 demonstrates that the strategic objectives (b) and (c) Section 2 and the initial philosophy of the RWS justify such extensive further review and research.

Currently the Sub-Group councils allocate some $38Mpa of ratepayer funds towards meeting the cost to dispose of wastes to landfill, including the S88 levy. The RWS proposes reallocating this funding towards the systematic recovery of resources from the same waste flows, such that <90% of this funding is no longer needed for landfill or S88 levy payments.

Then, if the RWS was fully implemented, some $140Mpa of income could be achieved.

To establish the systematic resource recovery facilities as proposed, some $25.5Mpa would be required for the cost and operations of the alternative processing and resource recovery facilities, and some $6Mpa would still be required for ultimate disposal.

Thus total funding available to justify a systematic resource recovery approach:

	$Mpa
Avoided landfill	$38
Receipts from sales	$14
Sub Total	**$52M**
Less cost of new facility	$25.5M
Residual disposal	$6M
Sub Total	**$31.5M**
Positive balance to cover profit and development contingencies	**$20.5M**

For example, if the secondary plastics processing (Node 7) never happened for some reason, this material would default to residual EfW (Node 9) with no significant increase in disposal costs but a loss of some $9Mpa; reducing the positive balance from $20.5Mpa to perhaps $10Mpa.

But this still leaves a significant benefit and contingency buffer, and the net effect (refer 1.3) will only be (Section 2 (c)) that the potential for "…downward pressure" on waste management costs in the medium to long term might be delayed, but not that Objective 2 (c) will not be achieved.

To put this outcome into perspective, the potential to generate a $10Mpa (min.) to $20Mpa (max.) improvement in the economics of sub-regional waste management would seem to justify the cost of a subsequent Pre-Feasibility Study which included a detailed techno/economic evaluation of the assumptions derived from Fig. 5-1 (and Attachment F).

6.5 Summary of RWS Enabling Actions

6.5.1 Introduction

The largest risk factor to the proposed RWS being implemented as proposed, in a staged but fully coordinated manner, will essentially be commitment and the allocation of dedicated resources to follow through on the full range of objectives.

The initial premise (related to strategic objectives 2.1 (b) and (c) and 1.3) was that the proportion of the community's funds currently spent on (landfill) disposal costs and the directly associated S88 levy costs, amounting to some $250-$300/tonne, be substantially reallocated to the construction and operation of systematic resource recovery facilities such that the value of the reclaimed resources and the avoided disposal costs would demonstrate net benefit to the community by avoiding future cost increases. The NSW EPA policy objective has been to keep increasing the costs of wasteful disposal until alternative and systematic resource recovery approaches became viable, and cheaper than Business As Usual (BAU). The first order assessment of RWS commercial viability (Section 6.4) demonstrates that such a watershed point has now been reached, and that systematic resource recovery approaches could now be adopted as a cost saving initiative for the future.

However, to achieve this strategic objective, the reclaimed resources that will result, need to be presented back into the productive economy, for HNRV reuse, to replace or supplement virgin resource use in the productive economy. This outcome requires the establishment of specific reprocessing systems and infrastructure that represent best available technology and dedicated investment by specialist private sector operators.

This highlights and scopes the biggest single challenge for councils generally, and the Sub-Group as a whole; that the outcomes and strategic objectives established by the RWS, and all as directly reflected in the policy objectives of NSW Government, cannot be directly delivered and procured by councils alone, as historical waste management services could be in the past. The RWS is just that; a strategy, and a strategy, which if adopted and pursued, can fully deliver against the original strategic objectives, but the efficient implementation will require councils individually, or the Sub-Group as a whole, establishing a dedicated resource, acting for and on behalf of the Sub-Group, so as to achieve strategic objectives (d), (e) and (f). The fully integrated approach requires councils to procure such outcomes and essential participants in a complex supply/value stream, rather than sovereign entities.

This will be essential if for no other reason than the achievement of strategic objective – the need to distance councils from process (technology) and market risk.

Whilst there could be a range of project delivery and management options, Table 6-5 identifies some key steps and possible strategies.

Table 6-5: Possible steps to full RWS implementation

• Current Sub-Group working group to question and refine Draft RWS to the point where a final document can be presented to the respective Sub-Group councils for approval to proceed in the existing or amended format.
• Collaborate to present the detail and benefits of the RWS to each council with a view to achieving agreement to proceed to at least Pre-Feasibility stage with the inclusion of specifically scoped techno/economic evaluation.
• Develop formal agreement between the respective Sub-Group councils as to how the collective process would be managed and coordinated through subsequent stages.
• With Sub-Group agreement (even if conditional) achieved, develop detailed scope for subsequent PFS and first order budget.
• Apply as a Sub-Group for an EPA PFS funding contribution.
• Engage expert PFS consultant, oversight the work and assess future steps based on the detailed recommendations of the final report.

Summary of Section 6 – RWS Implementation Risk Assessment, RWS Viability and RWS Implementation Steps

- The risks of the RWS being fully implemented have been analysed and the need for a dedicated resource to be allocated on behalf of the Sub-Group councils highlighted.
- Subject to a detailed techno/economic evaluation of the RWS, as the first stage in the preparation of a Pre-Feasibility Study, the actual technical and product marketing risks are seen as **Low**, if progressed with intent and sufficient expert resources.
- The economic viability of the RWS demonstrates that considerable advantage could accrue to the Sub-Group councils by progressing with the RWS, and the potential benefits would seem to justify the completion of the proposed Pre-Feasibility Study that would include the proposed techno/economic evaluation of the RWS proposals.

7. Summary, Conclusion and Benefits and Achievement of Strategic Objectives

7.1 Introduction

The five Sub-Group councils all had different reasons for wanting to explore the potential benefits that might arise by participating in the development of the RWS, but have a common history of collaboration in this region, and as they represent a collective population of >800,000, the Sub-Group represents a potentially self contained, “critical mass” (geography and waste volumes) that suggests a tailored Regional Waste Strategy might offer an ideal operational unit.

Whilst the timing for the development of the RWS was initially determined by respective contractual and/or operational needs, the NSW EPA has been encouraging councils to develop such RWSs in support of the WARR strategic objectives. These motives overlap, so this section will reflect first on the needs and drivers of both the Sub-Group as a whole, and from individual council perspectives as required.

The much broader and high level objective of the EPA initiative will then be addressed in the context of a RWS that has been tailored to the Sub-Group’s actual needs and objectives and meets or exceeds EPA requirements as a collateral benefit.

7.2 Key Themes, Philosophies and Objectives

The changing nature of MSW and the respective councils’ roles in the implementation and management of operational outcomes places this current RWS development process in a period of systemic change. Whilst managing waste used to be driven by public health concerns, and featured the linear material flow from production and consumption to disposal, the current objectives require a platform be established to enable and facilitate the realisation of a circular economy. In this emerging scenario, local government becomes a vital link in the supply/value chains created, rather than the arbiter of end-of-pipe outcomes.

Of course, waste management objectives are most efficiently achieved where such material streams are initially minimised or avoided, in the provision of goods and services to consumers, but where such an outcome is not possible/practical, all such materials that are generated are still destined for a linear/disposal outcome **UNLESS** the fully integrated pathways, systems and infrastructure are established, to actually present such materials back into the productive economy and in a manner that such materials are actually wanted and sought after.

The RWS has focused on thoroughly understanding the actual products that can be recovered from post-consumer municipal waste streams as well as the generic material types that would present in a streaming/cascading hierarchy. The generic processing nodes have been identified to stream materials so that they present as HNRV products. This approach has been demonstrated to not only achieve >90% diversion from “last resort” disposal, but to do so at less net cost to ratepayers than BAU (business as usual), in direct observance of the initial Sub-Group strategic objectives. In so doing, the approach adopted in the RWS greatly exceeds the minimum objective of the EPA requirements as a collateral benefit.

7.3 Key Strategies Adopted to Achieve Required Outcomes

7.3.1 Strategies

The RWS has adopted, promoted or recommended specific strategies, programs or actions that are proposed to be applied at various points along the supply/value chain for the production, consumption and reuse of materials that will ultimately pass through the post-consumer urban waste streams.

Some of these strategies, programs or actions can be undertaken directly by individual councils, some by the Sub-Group as an active entity, and some would require the Sub-Group to act through third party entities, such as WSROC, NSW State Government or selected industry associations, etc. But the objective is to suggest specific actions that can be taken to influence and assist with the optimised delivery of the RWS objectives as **an integrated approach**, and a very useful contribution to the establishment of a circular economy, whereby councils' costs and responsibility for waste management would be reduced to a minimum. For example:

- To influence the design of consumer goods, packaging and materials, the RWS proposes:
  - Participating in Industrial Ecology Forums;
  - Participating in industry and government initiatives to establish a dialogue around drop-off facilities.
- To influence the communities purchasing and discarding behaviour the RWS proposes:
  - Continued direct waste education programs.
- To improve processing cost-effectiveness and access to product markets, explore all practical options to collaborate with C&I and C&D sectors;
- Since >50% of the materials under management by the Sub-Group councils are biomass/organics, and this the largest fraction of material currently presenting for landfill disposal, the RWS proposes:
  - Collaborating with regional industrial, agricultural and forestry generators of waste biomass to develop common processing and value adding solutions
  - Encouraging proposals from expert biomass processors, who have developed secure HNRV markets for such bio-products, to establish operations in the Sub-Group region.

In observance of 2.1 (d) and (e), the RWS proposes that all the "new" processing capability (Nodes 2, 3, 4, 5, 6, 7, 8 and 9) would be owned and operated by specialist and private entities (with the possible exception of Nodes 5 and 6 under certain circumstances) and it is anticipated that the Sub-Group will reach a contractual understanding with HCC with regard to use of HCWMF for:

- the disposal of residuals;
- the siting of selected reprocessing facilities; and
- the inventory management of materials being processed by such new facilities.

7.3.2 Approaches

- The RWS demonstrates that the achievement of 2.1 (b) and (c) is only possible by focusing on processing wastes to achieve their HNRV as they re-enter the productive economy. Even though the processing capabilities may cost some $25.5Mpa to operate and service the capital employed, that is less than the $35.3Mpa currently spent on just landfilling and paying the S88 levy, and some $14.6Mpa of value is created from the sale of the high value, waste derived products. This outcome is only possible where specialist third parties are encouraged to provide the required reprocessing capabilities within an overall RWS delivery framework created by the Sub-Group councils acting in concert.
- The other signature approach adopted in the RWS is the concept of streaming/cascading whereby all materials under management are channelled to their HNRV application; but for those materials that are incorrectly discarded, a "next best" opportunity always presents to avoid the current binary situations whereby materials are either recovered or landfilled.
- A final feature of the RWS that is essential to ensue the original objectives are achieved, is the specific understanding that wastes are, by definition, "indeterminate" raw materials when applied to the manufacture of actual finished "products". This focuses the RWS recommendation to presenting reclaimed materials in a manner and to a standard that "product" manufacturers can use to supplement or replace virgin resources in the provision of quality assured goods and services.

7.4 Achievement of RWS Strategic Objectives

a) **When fully implemented, the RWS should be able to deliver >90% diversion (from landfill and/or S88 waste levy) for all wastes under management. 6.4 (including Fig. 6-1) indicates that a fully implemented RWS would divert >90% of wastes under management from landfill, thus saving both the landfill disposal cost and the related S88 levy liabilities.**

This is the long-term result of the fully implemented RWS which should be implemented in logical stages with selected private sector facility providers, and developed from (Fig. 5-1) Nodes 5-9/10 sequentially so that the outputs from one process node can be thoroughly assessed and quantified as the inputs into the next stage etc.

Perhaps three logical stages should be considered:

Stage 1 – Nodes 5 and 8 (13)

Stage 2 – Node 7

Stage 3 – Node 9

Nodes 4, 6 and 10 would be advanced incrementally and in parallel.

However, this is a strategy that provides a logical pathway to achieving >90% diversion, at a low risk of ultimate success if the subsequent development process is approached and resolved with conviction and purpose.

Currently councils can only achieve some 50-60% diversion with current systems and infrastructure, and whilst incremental improvement is possible, the major factors to achieving >90% diversion requires:

- Specific attention to channelling all biomass material for HNRV outcomes;
- Processing the secondary plastics for HNRV before applying EfW of residuals; and
- Focusing on the optimum sale value of materials under management.

b) **The eventual cost (waste service charge)/ratepayer (averaged across the Sub-Group councils) of all/any new systems and infrastructure proposed in the RWS should be no more than the current costs (target $340-$380/ratepayer, including the respective cost of collection services).**

Whilst the RWS identifies the need for dedicated plant and equipment to process wastes to achieve HNRV requiring some $25.5Mpa in operational and capital servicing costs, this will produce saleable material and energy worth some $14.6Mpa and allow some $30Mpa of landfill fees and levies to be avoided.

As the basic sensitivity analysis (refer to Attachment F) indicates, if the conservative cost estimates assumed in this analysis proved to be even 50% too low, the RWS as proposed would still achieve this basic objective of placing an upper limit on waste charges to the community.

c) **The new RWS should establish a sound commercial platform for the delivery of all future waste services by councils that can be budgeted with CPI certainty, (rather than the "hockey-stick" escalations that characterise waste management costs for councils at present).**

The RWS proposes a framework to present waste derived products back into the productive economy such that:

- Exposure to the ever increasing cost of landfill is avoided (>90% over time);
- Reclaimed materials are presented for HNRV; and
- Provides a structural framework and productive engagement with expert private sector service providers and end markets that will stabilise and even reduce waste management costs over time.

d) **Where new waste receival, sorting and processing systems and infrastructure is proposed, councils should be distanced from any subsequent process or market risk.**

   The RWS has proposed a position in the emerging circular economy for the Sub-Group as crucial stakeholders rather than final arbiters. The RWS allocates the primary process, technical and market risks to expert service providers rather than councils. Councils' critical role as providers of "supply" certainty would remain an essential element for councils.

e) **Where new waste processing facilities are proposed in the RWS, councils should have the basic option of just providing wastes to the expert providers of such facilities, for an agreed gate fee as the absolute limit of their financial exposure (in support of objective (d) above). However, where such facilities are run as profitable concerns, councils should have the opportunity to participate in the equity structure for such facilities where they have a commercial appetite for such investments.**

   The RWS specifically facilitates this objective.

f) **The establishment and/or procurement of all/any new waste processing facilities must be established in full compliance with any relevant local council tendering and/or asset procurement procedures and be able to demonstrate best value for money for residents.**

   This activity is proposed to be undertaken by a specialist RWS implementation and development entity, reporting to a Sub-Group steering committee against an agreed RWS implementation strategy and plan.

g) **Wastes under management, as proposed in the RWS, should be handled within a streaming/cascading regime, such that HNRV is achieved at all times.**

   This objective and approach is a core principle that has shaped the RWS and therefore ensured the satisfactory outcome.

h) **The community should be fully serviced with convenient and cost-effective waste management systems that cap Capex/Opex costs for councils, but also leave scope for optimised participation in the system to derive benefits for individual ratepayers and/or council as a whole.**

   The RWS accepts that the basic 2-3 bin kerbside system provides the community with the most convenient and cost-effective discard options, that facilitate the subsequent sorting and resource recovery activities at least cost (with future access to ever improving drop-off facilities over time). Thus the current levels of community service would remain, and ever more sophisticated drop-off facilities could emerge in the medium term.

i) **Whatever the proposed systems and infrastructure resulting from the RWS, the achievement of councils' overriding WHS obligations must never be compromised.**

   The RWS and its proposed implementation approach will entirely meet this objective.

Summary

The RWS can be seen to have not only met all the initial strategic objectives but provided a platform for the crucial diversion and cost to ratepayer objectives to be exceeded and even improved upon over time.

7.5 Specific Outcomes for Respective Councils

7.5.1 The Hills Shire Council

Issue 1: Council sought to secure a site for the processing of garden and food wastes.

Outcome: The RWS proposed HCWMF as a preferred site for composting and more advanced biomass processing options over time.

Issue 2: That council could be seen to have fully addressed the "…content and objectives…" of the WLRM initiative.

Outcome: The RWS not only meets or exceeds all such objectives insofar as they concern waste; it also explains, in detail, how to achieve such objectives.

Issue 3: That council explores beneficial opportunities to collaborate with "neighbouring councils" to achieve outcomes not possible or cost-effective by council acting in isolation.

Outcome: The RWS expressly responds to this objective and demonstrates how current waste management costs cannot only be contained in the future, but potentially reduced per ratepayer by directing investments towards systematic resource recovery and away from wasteful landfill and S88 levy payments.

Issue 4: "The Hills Future Community Strategic Plan" specifically identified the need to:

- Deliver safe, efficient and cost-effective waste, recycling, garden organics and clean up services;
- Manage hazardous waste to minimise environmental harm;
- Provide innovative education and communication programs that encourage community behaviour change to conserve resources and reduce waste generation;
- Develop and implement a Resource Recovery strategy;
- Investigate opportunities for the development of waste processing infrastructure in the NW of the region;
- Investigate regionally based resource recovery solutions; and
- Investigate feasibility to collect food and garden organics.

Outcome: The RWS specifically addresses all these issues within a framework that could reduce existing cost structures and that explains how such outcomes could be achieved.

7.5.2 Blacktown City Council

Issue 1: The current BCC strategy focuses on achieving the following objectives:

- Minimise waste generation including addressing consumption;
- Encourage reuse of items that are still useful;
- Maximise resource recovery;
- Collect waste in a manner that facilitates maximum reuse or recycling;
- Ensure safe, efficient and environmentally sustainable disposal of material that can not be reused or recycled; and
- Community engagement via the provision of information and a developed understanding of the community's needs as input into resource (waste) management services and to future planning of resource (waste) management and related services and programs.

Outcome: The RWS comprehensively addresses all these issues in a framework that could reduce waste management costs to ratepayers and details how such outcomes could be achieved.

Issue 2: BCC has time within its current contractual arrangements to plan in detail for future options.

Outcome: The RWS provides a platform for BCC to participate in sub-regional initiatives based on population growth in the NE of the council area and fine tune options for larger scale implementation when current arrangements expire.

7.5.3 Blue Mountains City Council

Issue: BMCC is looking to extend the life of the Blaxland facility for as long as possible by optimising systematic resource recovery and redirecting wastes to other, cost-effectively available facilities.

Outcome: The proposed facilities at HCWMF could provide one such opportunity, at least for wastes generated to the east of the council area in the short, medium and long term.

7.5.4 Hawkesbury City Council

Issue 1: December 2011 APC recommended that Council collaborates with neighbouring councils to defray the costs of developing HCWMF into a best practice waste processing and resource recovery facility, that would ultimately benefit HCC residents and provide a scale and complexity of facilities that Council could not hope to develop in isolation.

Outcome: The RWS details exactly how such an outcome could be achieved.

Issue 2: HCC identified potential benefits for "hosting" a regional facility:

- Favourable gate fees;
- Land rent; and
- Access to waste sorting and processing facilities (and their resultant end markets) that would be unlikely to be cost-effective for HCC acting alone.

Outcome: The RWS details exactly how such an outcome could be achieved.

7.5.5 Penrith City Council

Issue 1: Being approx. 50% through existing waste collection and processing contracts (expiring 2017–19,) Council wishes to begin the process to identify the best possible waste processing option for post 2017–19.

Outcome: The RWS provides a detailed framework in direct response to this need and objective.

Issue 2: Specific outcomes to be addressed in future arrangements to include:

i) The realisation of full and fair value from the kerbside collection of dry recyclables;

ii) The realisation of full and fair value, and market penetration, from the recovered (and composted) organics;

iii) Optimised resource recovery from residual wastes; and

iv) The most cost-effective resource recovery from hard waste/clean up materials.

Outcome: All these objectives are specifically addressed in the RWS, within a framework that should see waste management costs contained and even reduced, and all possible in the time available if collective Sub-Group action is taken straight away.

7.6 Achievement of EPA WARR objectives

Section 1.1.2 summarised the six areas that the EPA WARR strategy has identified for specific attention. The RWS addresses these as follows:

7.6.1 Avoidance and reduction of waste generation

The focus of the RWS is to address the issue of establishing the pathways, systems and infrastructure necessary to present any materials that do present in the urban waste streams back into the productive economy, at HNRV and least cost to the consuming community.

This outcome is seen as a crucial step in establishing a circular economy, which in itself, is aimed at conserving resources and dematerialising GDP.

Councils, individually, or even acting as sub-groups, can only **advocate** and **educate** for dematerialisation pre-consumer (7.3.1) but, by participating in the appropriate forums (public and/or private) can prosecute the avoidance and minimisation message.

7.6.2 Increasing recycling

The RWS demonstrates the practicality of achieving >90% landfill diversion and details the specific actions, facilities and infrastructure necessary to achieve this rather general objective.

7.6.3 Diverting more waste from landfill

The RWS demonstrates exactly how to divert wastes from landfill, to a level in excess of 90% and provides the detailed strategic initiatives necessary to achieve it.

7.6.4 Managing problem wastes better

Sections 5.2.6 and 6.2.6 refer.

The RWS features specific strategies to address the optimised management of materials that are **too toxic**, **too valuable**, **too bulky** or are **only occasional discard issues** via a fully (nationally) developed drop-off network and direct engagement at a national level within the existing product stewardship legislation and structures.

7.6.5 Reducing litter

(Sub-Group to insert as appropriate)

7.6.6 Reduce illegal dumping

The RWS presents a strategy that sees wastes processed as resources and presented back into the productive economy at HNRV.

(Sub-Group to insert extra as appropriate)

Summary

The RWS is founded on strong philosophies and shaped by economic realities. There are some notions that currently pervade high level policy development that are "sub-optimal" but that have been addressed in the RWS.

i) EfW

The current policy of converting residual waste, to at least recover any net inherent calorific value, fails the HNRV criteria established to inform the RWS. The product, if mixed wastes are concerned, will only produce "black power" for which the Australian market is saturated and prices are falling.

The RWS only proposes "last resort EfW" where the avoided landfill values (including S88 levies) can capital justify such a process.

ii) The achievement of >90% landfill diversion

Any approach to lift current best practice diversion much above 50–60% must include detailed and systematic resource recovery facilities as proposed herein **UNLESS** waste management charges to ratepayers are to continue their >CPI trajectory; an outcome that is economically very inefficient.

iii) The RWS has the potential to remove the need to manufacture and apply MSW derived "composts", with a significant net benefit to reprocessing costs and net soil quality.

Attachments:

Attachment A – Discussion Paper – EWDP 13-013R

Making Products from Urban Wastes

As society strives to minimise waste and wastefulness, and gradually seeks to dematerialise consumption and service delivery, the majority of materials presenting in urban waste streams will need to be productively reintroduced into the productive economy for use at, or close to, their respective Highest Net Resource Value. However, such materials are technically "indeterminate" raw materials and will require clear protocols and practices to be established between the traditional waste sector and those subsequent value adding activities that aim to produce quality assured products that include a proportion of the urban waste sourced materials in any final products.

As a matter of extended logic, the traditional waste sector will experience considerable challenges to existing business models as it seeks to present finished "products", manufactured predominantly from material recovered from urban waste streams, back into established wholesale and retail markets.

Whilst individual corporations may already acknowledge and address these issues in part or in full, they are nonetheless worth reviewing at a generic level to ensure that the emerging "biomass from urban waste flows into value added products" concept is developed for least risk and greatest level of completion assurance.

The generic waste sector is a fee-for-service sector that is paid to collect/receive urban wastes and that the cost of sales related to the receipt of the fee is transporting, processing, treating, disposing of the wastes collected in the manner prescribed by the waste generator/client and/or as required to comply with all relevant legislation, regulation, operating licences and the general "licence to operate" as conferred by the community in general.

In comparison, the manufacturer or supplier of a finished product to an identified market relies almost entirely on the income derived from the sales of their particular product to a customer, and the cost of sales includes the labour and material costs to input the respective manufacturing processes.

A comparison of the two basic business models demonstrates how the need to protect and optimise core income streams can present quite different value propositions to the markets in general and end customers in particular.

In the logical pursuit of self interest, a waste sector manufactured product will tend to be:

- Generic – produced to just meet or exceed relevant standards and be as high a quality as could be expected to be produced from the indeterminate originating resource materials;
- Priced to clear quickly, often heavily discounted or marketed so that the production chain has capacity to receive more fee-for-service wastes income;
- Supplied into a market established and currently serviced by parties who source virgin or quality assured raw materials and where the market generally has yet to fully appreciate the performance benefits of the branded product versus the generic or waste-based offering.

In comparison, a dedicated brand or product manufacturer will tend to:

- Differentiate their offering, often supported by the value proposition their brand has diligently created and promoted to best address an identified market niche or need;
- Price the product to reflect real value to the customer when compared with any other commercial offer that could achieve the same or similar benefits whilst maintaining the highest possible margin over cost of sales; and

- Establish a unique market or maximise market share and so set the benchmark for performance and customer satisfaction.

Initial comparison of the two business models and their inherent skill sets presents them as quite different, and suggests that to optimise entire value/supply chains, the two models need to be acknowledged and accommodated. And there is a strong precedent and track record for the two generic sectors combining for maximum advantage to both. For example:

- The waste sector is now expert at recovering paper/cardboard, but they don't make the new boxes and packaging that can beneficially apply such recovered materials to replace/supplement virgin pulp.
- Similarly, the waste sector is expert at recovering cullet – but they don't attempt to make new bottles and jars.
- Metal recovery is another area where there is clear differentiation between the collection, aggregation and preliminary sorting and processing of scrap – but specialist metal manufacturers now accept such inputs into the manufacture of new metal products such that the resultant products never need to "apologise" for their origins.

However, recent initiatives to recover resource value from the residual organic/biomass fraction of urban wastes have focused on composting as both a waste treatment technique and simultaneously as a product manufacturing process. This has presumably emerged because composting and subsequent land application seems much less technically demanding than the above examples in the more traditional recycling sectors. There has been much activity in the last 5-10 years for those with a "waste sector" business model and approach to enter the established composting and soil amendments sector, and the results have been, at best, mixed; presumably for the reasons outlined above, all of which starts to outline some project principles for success to address the current potential to recover the biomass fraction from urban waste streams for application in the highest value markets available.

Where a product manufacturer will support a potential customer with pre-production or representative samples, and then follow up with initial supplies that confirm the initial promise, and then have sufficiently secure product quality control procedures in place to be able to follow up at any subsequent time with supplies of the same material to achieve the same result, a waste sector generated product will be more challenged. Because the primary incentive is to process as much of the "waste" feedstock as possible, the actual quality of each batch of product can be heavily influenced by the quality, on the day, of the actual qualities of the indeterminate values of the original "waste" raw materials.

In the cardboard, glass and metals examples above, the original products were manufactured from virgin or defined raw materials and whilst these sectors have now developed the capability to maintain product quality whilst replacing and supplementing much of the virgin feedstocks with secondary resources from the waste sector (mostly for price reasons only), they could revert to virgin supply if the secondary stocks were unavailable, of unacceptable quality, or ceased to offer important price advantages. In comparison, the waste sector derived products can tend to be characterised as the best-quality-possible-with-the-materials-available-on-the-day, if this issue is not addressed comprehensively from the beginning of any such projects.

A difference between the two business models can also show up in pricing issues. The ultimate commercial viability of a specialist finished product manufacturer is entirely dependent on realising a margin on cost of sales to provide the particular product. A waste sector derived product will often be priced-to-clear so that the production chain is available to accept more fee-for-service income by collecting/acquiring more raw material.

This has been painfully demonstrated in recent years in the compost sector, where the introduction of priced-to-clear compost products originating from the waste sector have reduced much of the pre-existing landscape/agricultural supply sector to "commodity" pricing, and where the tangible benefits to end users are often not adequately reflected in the price paid for the product. In other words, the waste sector approach to selling finished products can result in potential value being "wasted".

Too often MSW derived "composts" are presented as the minimum quality necessary to demonstrate compliance with the relevant waste processing licence conditions rather than being directly related to an actual customer/market need. This is especially true in the bulk mine site remediation market or other less sensitive (non-food growing) bulk market sectors.

Since products made **solely** from "indeterminate" wastes will struggle to meet even a basic level of quality assurance for end users, such product manufacturing must be willing and able to source additional process input materials to achieve final product quality. Alternatively, the waste sector suppliers could contract with a dedicated finished product manufacturer who had access to all the additional input materials necessary to optimise final product value, as exampled by the cardboard, cullet and metal examples above.

Striving to achieve Highest Net Resource Value (HNRV) from Materials reclaimed or recovered from Urban Waste Streams

The fossil resource based sector, and in fact most primary or extractive industry sectors in an advanced modern industrial economy, have grown to thoroughly analyse and understand the innate properties and characteristics of each and every deposit as it is discovered, to understand what each deposit could be best used for and therefore the appropriate value/price each deposit should attract.

In the emerging resource recovery sector, such grading and evaluation of potential biomass resources are not as well understood, or valued or priced.

The immediate importance of this issue to the emerging resource recovery sector is that it could materially affect the viability of early projects. If "high value" resources are applied, and relied upon, to produce only low value or "commodity" priced products, the entire enterprise could flounder when alternative or later projects are set up to convert the same "high value" resources into high value products, and thus attract the feedstocks away from the initial converter.

One of the features of modern, capitalist industrial economies is the market mechanism to allocate resources by pricing the supply and demand dynamics.

This market-based mechanism is the best and most efficient framework for allocating resources that society has developed and adopted to date. But the mechanism works best with established and well understood commodities and resources. The contention here is that potential market failures can and do exist where new or not properly understood commodities come to the attention of nascent markets. Resources recovered from urban waste streams are case in point (see EWDP 13-013R).

The concept of Highest Net Resource Value refers to the practical philosophy of seeking to apply a particular resource to its highest (practical) end use application, net of acquisition, process and aggregation costs.

Such an approach is seen as vital in the early stages of the urban waste resource recovery sector to help to ensure that resource value and potential is not unreasonably allocated to some inappropriate end uses where:

a) The original investment could be jeopardised if and when a higher value market is established;

b) Higher value opportunities are frustrated by the inability to access reclaimed resources currently allocated expediently; and

c) The real value of currently unpriced externalities is not recognised.

As the market for recovered resources matures, these issues should self-regulate, but, until recognised standards and pricing matrices are established, immediate investments in this sector should pay particular attention to this issue, using LCA if necessary to help guide their risk assessments prior to investment.

An initiative hosted by the

Waste Management Association of Australia NSW Branch

Strategic Planning and Infrastructure Group (SPIG)

Discussion Paper No. 3

The systems and infrastructure needed to support a sustainable, recycling-minded and resource-efficient society

30 November 2006

Produced/published by the SPIG Steering Committee, C/- Co-chairs

Mark Glover
Tel: +61 2 417 224 919
Email: mark@ecowaste.com.au

and Dr Ron Wainberg
Tel: +61 2 418 427 481
Email: ronw@kemaro.com.au

Contents

1. Origins and objectives of SPIG

In the final plenary session of the Waste Management Association of Australia (WMAA) 2005 NSW Waste Conference, the delegates expressed frustration at not being able to make real progress towards a goal of sustainable recycling and resource recovery. The initial frustration was that the admirable vision and goals of the NSW Department of Environment and Conservation (DEC) waste strategy did not provide for sufficient stakeholder coordination and focused implementation.

Consensus emerged that the skills, needs and capabilities to implement the state targets rested with the collective membership of WMAA, the Local Government and Shires Associations (LGSA) NSW Branch members, the Boomerang Alliance (BA) of Australia's leading environment groups and the Australian Council of Recyclers (ACOR).

These groups later agreed to collaborate within the framework of a working group of the WMAA New South Wales Branch under the title of the Strategic Planning and Infrastructure Group (SPIG).

SPIG has met regularly over the past 18 months as a steering group to:

- express and reconcile the essential policy positions of the collaborating organisations
- develop agreed positions on vision and objectives for the SPIG initiative
- propose strategies for the group to stimulate and influence a paradigm shift in resource management outcomes from an unsustainable and wasteful society to a sustainable, recycling-minded and resource-efficient society.

For members of the SPIG steering committee see *Attachment A*.

1.1 SPIG vision

Australia is a wealthy and progressive first world country that should be a sustainable, recycling-minded and resource-efficient society whose use and application of resources have only minimal impact on climate change. Progress towards the achievement of this goal will generate a sustainable competitive advantage for Australia.

1.2 SPIG objectives

SPIG has three objectives:

- to employ the collective skills, expertise and capabilities of the collaborating parties to design, develop and stimulate the implementation of the systems and infrastructure that are needed to achieve the vision, so as to directly address the impacts of unsustainable resource use on climate change
- to develop a systems and infrastructure plan and facilitate its adoption and implementation in the greater Sydney region (GSR), in New South Wales and across Australia
- to recommend to government and the private sector the commercial, regulatory and legislative regime that is needed to implement the systems and infrastructure plan.

1.3 SPIG founding principles

In developing the systems and infrastructure plan, SPIG's deliberations will be guided by three principles:

- sustainability – not only as described in legislation but as adopted by WMAA, LGSA, BA and ACOR respectively
- highest net resource value (HNRV) – to ensure that the systems and infrastructure plan can support and encourage the allocation of new capital
- transparency and collaborative consultation – between SPIG and the respective organisations' memberships, third party stakeholder groups and the wider community.

2. What SPIG has done and agreed to date

The SPIG steering group has met five times over the past 18 months to advance the SPIG initiative. During that time it has:

- produced a number of discussion and working papers internally to reconcile the starting positions of steering group members
- commissioned an external consultant to develop a "Defining the Vision" paper based on a steering group workshop

- presented a technical session breakfast to solicit wider stakeholder input.

The steering group is now presenting this document, Discussion Paper No. 3, to the entire membership of the participating organisations for review and comment.

2.1 The problem – waste

Following is a description of the problem presented by the current wasteful use of resources. This has been synthesised and agreed as a result of steering group deliberations and working papers over the past 18 months, together with submissions made by the participating organisations to recent Productivity Commission hearings held in various national locations.

Currently 50,000 tonnes per day of discarded resources and complex manufactured materials from the metropolitan solid waste (MSW), commercial and industrial (C&I) and construction and demolition (C&D) waste streams are lost to disposal outcomes in Australia. This situation is unsustainable for society as a whole. It presents SPIG with a significant opportunity to address it systematically, transparently and inclusively.

ACOR expresses this economic loss in terms of an "over provision of disposal services" which in turn destroys the opportunity to provide:

- more than $3.5 billion of eco-services nationally per year
- the annual recovery of $912 million of commercial value
- the annual recovery of 68,400 GWh of embodied energy
- the direct creation of between 5,000 and 9,000 jobs.

The current resource recovery systems that have struggled to emerge from the prevailing wasteful paradigm are still failing to recover the optimum net resource value from the materials under management in that:

- residual wastes still contain significant recoverable resource and energy value
- kerbside and dry recyclables systems and resource recovery pathways are still supply-driven and sub-optimal
- organics recovery and processing systems and resource value recovery pathways are also supply-driven and failing to effectively recycle organic carbon back into the productive economy
- embodied and inherent energy recovery systems and infrastructure are nascent or non-existent.

There is a need for the design, development and implementation of specific resource recovery systems, infrastructure and capabilities in place of the suite of waste management systems, infrastructure and capabilities that currently prevail.

ACOR has described the current waste management and disposal approach as an indication of "poor system performances" in the overarching market-based economy and believes that such an outcome is "ultimately unsustainable".

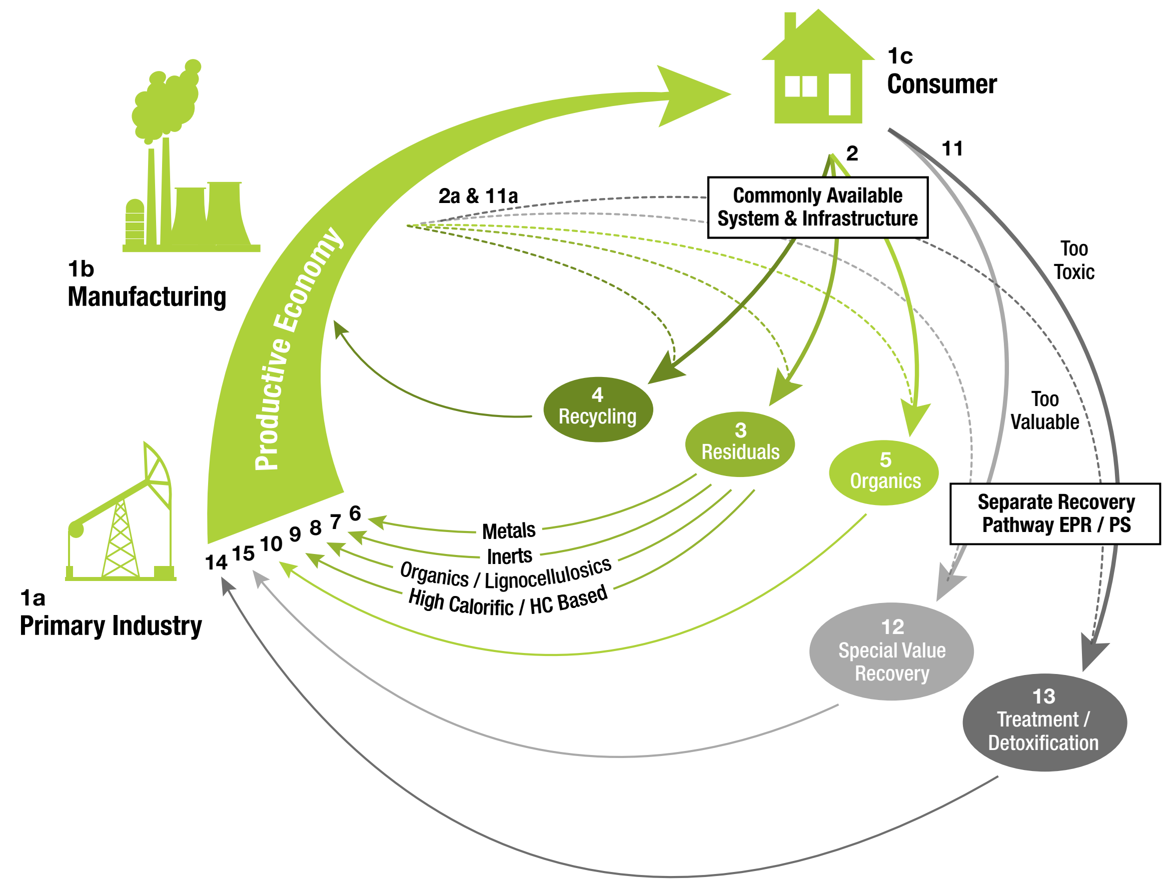
SPIG advocates for the design, development and implementation of specific resource recovery systems, infrastructure and capabilities as a complete replacement of the current suite of waste management systems and infrastructure that are delivering the wasteful outcomes that currently prevail.

Manufacturers and consumer service providers are being encouraged to "dematerialise" the provision of goods and services. However, these moves are often hampered or frustrated by a lack of post-consumer systems and infrastructure that would allow their products and services to be designed with the least possible life cycle impacts.

In a sustainable, recycling-minded and resource-efficient society, essential material needs and wants would be met without irrevocably depleting the Earth's natural resources or impairing the biosphere's ability to provide vital ecosystem services.

Therefore, an essential outcome of any nationally adopted suite of resource recovery systems and infrastructure would be to ensure that all spent, surplus or generally unwanted resources can be, and are, returned for reuse in the productive economy in their highest net resource value application (see Fig. 1).

Figure 1: Conceptualisation of zero waste physical and economic pathways



The actual installed capabilities, systems, infrastructure and "reverse logistics" needed to achieve this vital economic and strategic goal are as follows:

- the optimum size of the productive economy should be such that it fulfils community needs while avoiding over consumption or over production. Creating feedback loops within the current system will reduce the reliance on virgin natural resources. This will also result in environmental, social (public health) and economic benefits
- industry and domestic consumers and waste generators would be encouraged, incentivised or required to discard surplus, spent or otherwise unwanted materials to the appropriate and readily available channel or discard option, container or facility
- the provision of widely implemented and commonly available systems and infrastructure for systematic resource recovery would, by its operations, maintain strong commercial and societal signals up through the supply chain to:
  - encourage waste avoidance and minimisation (biomimicry) at all stages
  - support and encourage dematerialisation of services to society and encourage the move to service-based delivery of consumer needs and wants
  - discourage wanton consumption and wastefulness
- the focus of sustainable resource recovery systems and infrastructure would be to ensure that all surplus, spent or otherwise unwanted materials are streamed, collected, processed or treated so that they are all presented back into the productive economy in accordance with their highest net resource value (see Fig. 1). The cost for delivering such a service, net of the receipts from the individual purchaser in the productive economy, would be met from an equitable allocation of fees and charges to the generators of the secondary resources, as stimulated by market-based instruments introduced as an integral part of the paradigm change to sustainable resource use

- current initiatives to promote extended producer responsibility (EPR) or product stewardship arrangements are severely hampered by an almost complete lack of appropriate and cost-effective systems, infrastructure and sustainable resource recovery pathways for the post-consumer materials themselves (with the partial exception of kerbside recycling to support the objectives of the National Packaging Covenant).

  The SPIG initiative specifically addresses this issue in the context of separate resource recovery pathways for materials too inherently valuable or potentially toxic to be effectively recovered by the main resource recovery pathways (see Section 4 (11–15) and Fig.1).

3. What SPIG aims to achieve

3.1 Formation of a broad-based reference group

SPIG has been initiated by four organisations whose collective membership will be directly involved, influenced or supportive of all or any of the changes being developed and recommended.

As the ideas, strategies and recommendations of SPIG become more developed and refined, other important stakeholder groups will be invited to join the initiative.

The origin of the SPIG initiative (the WMAA 2005 NSW Waste Conference) demonstrated **not** that the prevailing state government strategies were necessarily inadequate, but rather that the quantum changes required to move from a waste sector, with some resource recovery at the margins, to a more holistic system of resource management incorporating resource recovery, involved a great many stakeholders of which the state government was but one.

The SPIG steering committee understands that the broadest societal change will be required to achieve its ultimate vision. By the four initiating organisations taking the lead, a nucleus will be created to think and act across boundaries or silos of narrow self interest.

With the release of Discussion Paper No. 3 to the entire membership of the four organisations, a platform will be created for informed review and comment on the ideas contained in the document. It is anticipated that the document will also elicit interest from a broad range of interested individuals who would be prepared to act as an Expert Reference Group (ERG) to the steering group.

Any individual volunteering to formally participate in such an ERG would review working papers and drafts of documents and ideas being developed by the steering group for detailed review and comment. Ideally this ERG would provide the widest possible input and advice to the SPIG steering committee and could have up to 100 committed participants.

Volunteers who wish to participate in the ERG or who wish to receive more information are invited to contact the SPIG co-chairs in the first instance.

3.2 SPIG next steps – what, how and who

The broad strategy of the SPIG initiative is to consult and develop consensus on what is needed and how to achieve it and then to promote this to stakeholder groups and the wider community.

The first step is to develop consensus on the generic systems, infrastructure and physically installed capabilities that are needed to provide the physical and economic pathways for sustainable, systematic resource management and recovery (see Section 4 and Fig.1). This consensus will be developed first from within the four member organisations and then taken to a broader audience and the community as a whole.

Once what is physically needed is better understood, the next step for SPIG is to turn its attention to the question of how to achieve it. This will involve a review of the legislative and regulatory regimes that would be optimum to achieve the vision and a consideration of the commercial and market-based signals that need to be created to gainfully engage the inventiveness, flexibility and enthusiasm of the private sector to actually deliver the outcomes.

Once the "what" and "how" are understood by the SPIG participants, the third step is to promote the outcomes to the widest possible stakeholder groups and the community as a whole.

3.3 Compatibility with possible national implementation

The recent Productivity Commission report into "Waste Management and Resource Efficiency" (see draft at http://www.pc.gov.au/inquiry/waste/draftreport/waste.pdf) identified considerable benefits if such waste management and resource recovery issues were:

- planned and coordinated nationally by the federal government, since the generators, end users and materials themselves were no longer respecters of state boundaries
- regulated and implemented by the state jurisdictions within a national framework of extended producer responsibility
- such a national framework of systems, infrastructure and common capabilities could then be supplied by appropriately funded councils and regional groups of local government, whose focus would be on collection and common levels of service provision.

The SPIG initiative and deliberations are entirely compatible and supportive of any such nationally planned framework.

4. Towards zero waste

The following is a high level conceptualisation of the physical and economic systems and infrastructures that are seen as essential to support the SPIG vision of Australia becoming a sustainable, conservation-minded, recycling-minded and resource-efficient society.

The SPIG steering group has been made aware that a number of jurisdictions have adopted zero waste stretch goals and are advocates for a biomimicry approach.

In comparison, the Productivity Commission takes an overly technical, thermodynamic position and rejects "zero waste" as even remotely possible.

The Boomerang Alliance adopts "Towards a zerowaste society: a vision for a national extended producer responsibility approach".

LGSA accepts the waste hierarchy as a "valuable and complementary tool" and prefers "upstream" solutions which avoid waste rather than overly complicated "end of pipe" solutions to divert or treat waste. LGSA advocates for resource efficiency which should result in "little or no residual waste". The LGSA's attempt to visualise a sustainable outcome is addressed in its "Beyond Recycling" (2004) publication.

ACOR supports a "net benefits" approach to choosing optimal resource recovery options.

Clearly there are aspirational goals adopted in the above that need clarifying and consolidating if they are to align with the achievement of the SPIG objectives.

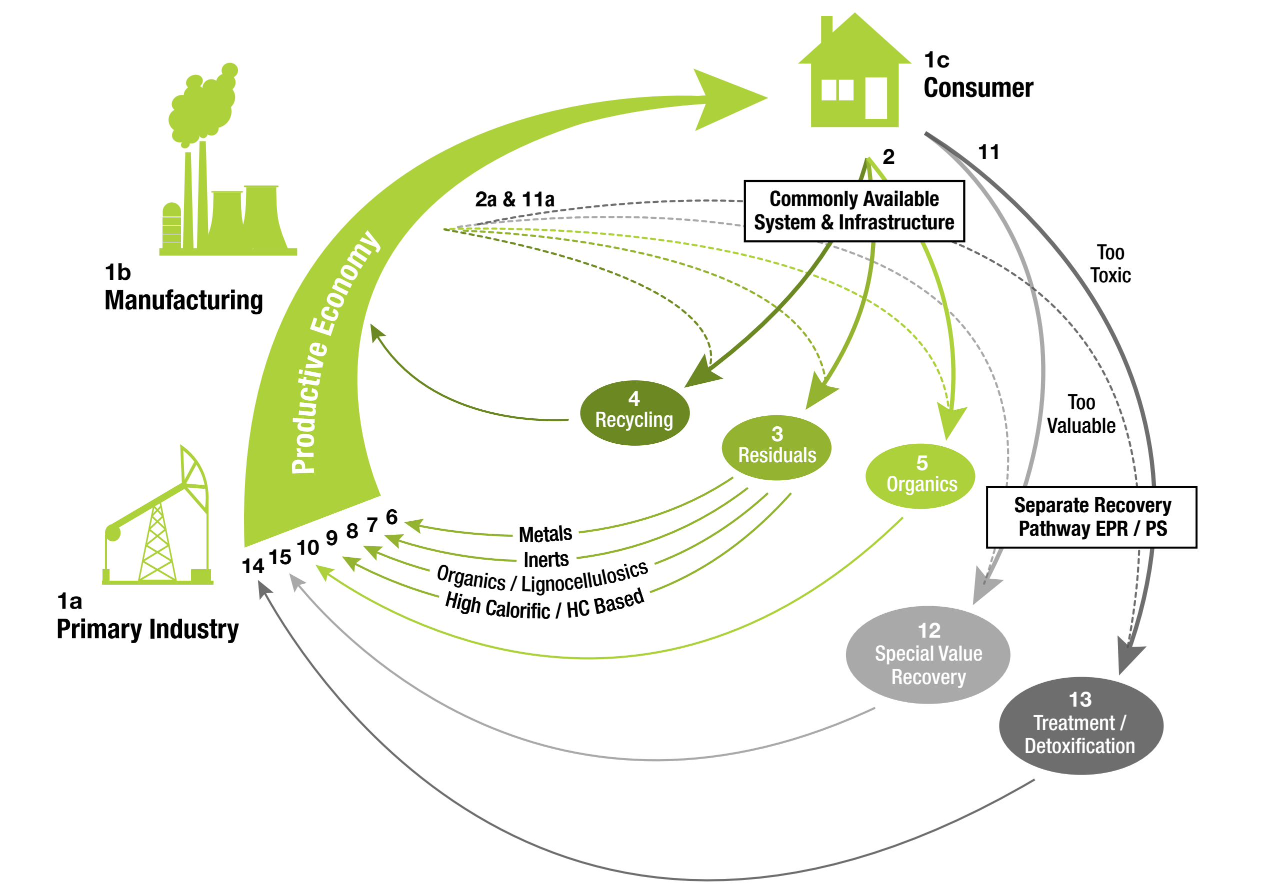
What follows is an attempt by the SPIG co-chairs to synthesise the hopes and aspirations of the collaborating parties into a more practical and workable description of what a zero waste or biomimicry future may look like.

Certainly, if SPIG can agree on the stretch goal, it will greatly inform the SPIG task of facilitating the transition from the prevailing wasteful paradigm to the "recycling and resource efficient society" as advocated in the SPIG vision.

Fig.1 is a high level and figurative concept of the material flow pathways needed to achieve a zero waste future. The numbers **1** to **15** relate to the brief explanations following the figure of the physical and/or economic conditions that exist at each point.

Most important is that if the member organisations can agree on the basic structure of the resource recovery systems, infrastructure and capacities needed as they are outlined below, the scoping and definition of the SPIG implementation strategies will be relatively straightforward.

Figure 1: Conceptualisation of zero waste physical and economic pathways



1. The productive economy – refers to all the collective activities that make up society's use or demand for goods and services as measured currently by GDP.

1a. Primary industry refers to all the primary or original inputs into the productive economy whether from farms, quarries or mines. Most, if not all, of these inputs require later transformation, value-adding or distribution systems to reach the consumer.

1b. Manufacturing refers to the various and aggregated converters, processors and value-adding processes, including their respective transport operations, that prepare the accumulated resources to present to the consumer in a form that is readily consumable.

1c. Consumer refers to both the individual consumer, and society as a whole, with needs and demands to be satisfied with material or resource-based goods and services.

2. Point of discard for metropolitan solid waste (MSW)

This post-consumer discard option refers to mainstream, regular domestic discards.

This activity is differentiated from **11** — the occasional discard of bulky, valuable or hazardous materials.

The individual consumer can make a big contribution to overall resource use and resource value recovery outcomes by being selective in their choice of goods and services. This is a vital decision-making point with regard to dematerialisation in the provision of goods and services. For example, the decision to use goods and services such as photocopiers, carpets, cars and so on without having to own them has a direct and reciprocal effect on the systems and infrastructure to facilitate or hinder the dematerialisation outcomes. In the supply and demand relationship between industry and consuming society, only those goods and services for which there is a clearly articulated and communicated demand or need will be made **(1b)**. In turn, this will affect the demand for primary resources **(1a)**.

The conscious act of discarding spent, surplus or otherwise unwanted materials by individual members of the community can significantly affect the level of net resource value recovered in any reverse logistics or systematic resource recovery system. It is therefore an important focus for education programs and must be supported by commonly available and easily used discard systems. The current commonly provided containerised, kerbside collection systems are a perfectly acceptable starting point.

The main residuals disposal channel **3** meets the statutory public health and safety obligations. The provision of a specialised discard option for dry recyclables **4** and organics **5** is only of net benefit if the consumer uses the receptacles as intended and the environmental, social and economic benefits outweigh the costs. Where a particular individual unnecessarily cross-contaminates the dry recyclable or organic containers, the quality of the stream and its net resource recovery value is lost or jeopardised.

Once discarded to the appropriate and available receptacle, the materials require collecting and transporting to the respective first points of receivals **3**, **4**, and **5**.

2a. Point of discard for commercial and industrial (C&I) waste

The manufacturing sector produces a range of wastes that share many mutual characteristics with the materials discarded by consumers. This results in potential synergies from processing or recovering the highest net resource value from these materials within the same systems and infrastructure. It therefore warrants detailed analysis.

A feature of C&I materials from individual generators is that they tend to be similar in characteristics week-in, week-out — e.g. a furniture factory generates timber waste or a clothing factory generates fabric scraps and so on. Because there are often inappropriate collection systems for these materials they are strong candidates to be value-added as by-products rather than being managed as mixed wastes.

3. First point of receival for residual MSW

The first point of receival for residual MSW is traditionally undertaken as discharge direct to landfill disposal or transfer station. At the transfer station the individual loads are consolidated for later transport to landfill.

Since there are problems with both simple disposal and consolidating loads in traditional transfer stations, both of these functions need to be completely replaced in a sustainable society. Under the SPIG vision the disposal activity becomes the new "filling land" activity (see **7** below), and the load consolidation (transfer) function is replaced by the first process stage in separation of the residual MSW into at least its generic material types — metals **6**, inerts **7**, biomass **8** and hydrocarbon-based fractions **9**. Whilst these separated fractions will require further processing at specialist facilities, any later transport stage is justified to aggregate like materials rather than unnecessarily increasing heterogeneity and causing mixture and cross-contamination problems.

This process stage is effectively the first definable function of what is now loosely described as alternative waste technology (AWT). Whilst some AWT sites may include first point of receival **3**, later material processing and final beneficiation **6**, **7**, **8**, **9** to the standard needed for optimum reuse back into the productive economy **1**, the functional specification for the first point of receival function is determined by catchment and collection vehicle run efficiencies. The optimum size and operating efficiency of the plant required to reprocess the individual streams, and final beneficiation **6**, **7**, **8**, **9**, is not derived by catchment but by issues of process efficiency. Such specialty process plants might receive specialty feed from a number of first-point-of-receival or primary separation sites.

The metals, inerts, biomass and hydrocarbon fractions will have residual cross-contamination when forwarded as semi-homogenous streams. This will facilitate more stream-specific processing on receival, especially the biomass and hydrocarbon fractions.

4. First point of receival for dry recyclables

The first point of receival for dry recyclables is traditionally the materials recycling facility (MRF) that will sort the materials into their generic types — paper, cardboard, plastics (by polymer)), glass (by size and colour), metals (ferrous and non-ferrous) and remove the contaminants.

Whilst this process could benefit from optimisation and de-bottlenecking, an installed processing capability is emerging in the larger urban areas/centres and cities that mostly requires only incremental development rather than the type of wholesale change that is needed for residuals **3**.

Most products from MRFs require beneficiation, either at the end user's facilities or before they are accepted at the end user's plant.

Further development in this sector is likely to emerge as more secure markets and outlets are defined. Returning the dry recyclables back into the productive economy at their most cost-effective highest net resource value or beneficial point needs to be developed in line with the recovered materials' inherent properties. At present many such materials are being captured as cheap inputs to the original manufacturing sector, which may not represent the HNRV outcome.

5. First point of receival for organics

Whether straight garden waste, or biowaste (kitchen scraps included), organics need to be sorted and decontaminated before being processed physically, aerobically, anaerobically or thermally (drying/carbon concentration).

The source-separated organics processing industry is an emerging one and as the market matures for its products the specific functions required for recovering the highest net resource value will become better defined.

Certainly the compost sector needs to be supplemented with other technologies, and products that can:

- concentrate the resource value available from the raw materials
- increase the resultant product value to facilitate wider geographic markets
- demonstrate greater value to end users and therefore optimise the return of these materials back into the productive economy.

6. Return of materials into the productive economy — metals

The metals recovery industry is a very advanced sector throughout the world that is based on high values of recovered metals (relative to extraction of new metals from virgin ore), meeting the specific needs of the market. The sector has established market organisations (LME, CBT etc.) and clear product specifications that allow or facilitate "unseen" trading. In most respects, the processes, systems and infrastructure developed and operated in the recovered scrap metals sector have many positive lessons for the future development of all the other product streams available from urban wastes considered by SPIG.

The partially processed metals emerging from the dry recyclable stream **4**, the processing of residual MSW **3** and organics **5** all require further processing, decontamination, sorting and preparing into recognised product grades. Existing scrap metal yards currently undertake these functions. Little other than incremental optimisation and occasional system de-bottlenecking would seem to be required to streamline the reintroduction of metals back into the productive economy.

7. Return of materials into the productive economy — inerts

Inert materials in urban waste streams are the biochemically inert, fully mineralised materials and residues that are usually ballistically separated such as dust, sand, gravel, masonry, ceramics, glass undersize and fines and miscellaneous building materials. In many cases these materials can be processed to produce civil aggregates and fill materials if fully separated from residual materials such as metals, biomass, organics and hydrocarbon-based materials.

At worst case, these materials may be applied to "filling land" in the highest net resource value introduction back into the productive economy. This application, "filling land" so that selected sites can be brought back into optimum beneficial use to the land development sector, is an entirely different outcome to the existing landfill disposal sector. Using these materials by presenting them as land-filling products produces remediated land that itself will have a much broader range of productive uses.

As the WMAA NSW Landfill Working Group presented in its submission to SPIG *(Draft Discussion Paper – Rev 3 20/09/02)*, landfill has only four legitimate functions in a sustainable society:

- **filling land** — to remediate extractive industry voids or to be used in civil projects
- **storage** — to manage the inventory imbalances of suitable materials whose current rate of presentation is in excess of the prevailing market's current needs
- **remediation and stabilisation of putrescible material streams** — to ensure minimum public health outcomes are maintained until the alternatives are systematically available. Remediation and stabilisation of putrescibles is a traditional function for landfill in the current waste management paradigm. Its ongoing need and cost-effectiveness needs to be objectively benchmarked against alternative waste treatment and resource recovery options. This needs to include a detailed valuation of the lost opportunity cost inherent in these operations. As SPIG strives to achieve its vision, this application for landfill will be relegated to a transitional function
- **failsafe** — to provide a last resort disposal option. Since the optimum resource recovery systems and pathways depend largely on the availability of mechanical or process pathways and market dynamics to maintain reliable outcomes, absolute system disruption or failure could occur. Since the rate of urban waste generation is disconnected from the markets for recovered resources, a last resort outlet for the materials must be available.

These four functions for landfill present their own specific performance specifications which in turn inform the outcomes for (re)engagement with the productive economy. However, none of them includes the current practice of wasteful and unsustainable disposal.

8. Return of materials to the productive economy — mixed organics and biomass

Mixed organics and biomass traditionally comprise 50–60% of residual MSW by volume and weight. They consist of:

- contaminated paper and cardboard
- recyclable paper and cardboard that was not discarded to the dry recycling channel
- garden waste that was not discarded to the organics channel
- food and kitchen waste that was not discarded to the organics channel
- wood and woody materials.

This material gives the residual MSW its putrescible properties and generates the majority of the potential impacts that require residual MSW to be treated in the interests of public health.

By recovering this fraction from the mixed residual MSW stream, there will initially be certain physical and chemical contaminants that:

- need to be physically removed where practicable
- need to be chemically measured and assessed
- will determine what beneficial end uses the material can be put to.

Composting can stabilise the material and produce a product suitable for application to land — subject to residual levels of physical and chemical contamination.

Digestion can also stabilise the material and produce an energy (biogas) product and digestate that could also be applied to land. Again, this is subject to the residual levels of physical and chemical contaminants.

Where the quality of the material is unsuitable for composting or digestion, other drying or carbonising processes may be appropriate to not only stabilise the material, but to produce concentrated (organic) carbon-based products for industrial or other land application uses.

These materials are more problematic than those derived from source-separated organics **10**. However, in a carbon-constrained world, these renewable biomass sources have a wide range of potential uses and present opportunities for introduction back into the productive economy.

9. Return of materials to the productive economy — high calorific and hydrocarbon-based materials

This fraction of residual MSW is usually 20–30% by volume and consists of:

- unrecycled plastics
- unrecyclable plastics via the usual MRFs **4**
- textile, clothing, footwear that wasn't recycled
- rubber, floor coverings, soft furnishings.

If it is derived by mechanical sorting this fraction will often have a cross-over timber content. Properly sorted and processed, it can present back to the productive economy as:

- recovered polymers
- carbon products (reductants)
- energy products for heat and power.

No systematic resource recovery pathways (facilities) exist for this fraction in Australia at present. However, subject to stringent environmental controls and host community support and with adequate sorting, decontaminating and processing these materials could be beneficially applied to existing facilities such as kilns, power stations and certain industrial metallurgical plants.

10. Return of materials to the productive economy — source-separated organics

By the nature of their dedicated discard **2** and later streaming and processing, the products manufactured from source-separated organics are likely to be uncontaminated and suitable for application to land as quality soil conditioners and fertilisers.

As composted products, they are likely to be light, bulky and have in excess of 50% moisture content. In the current market, these materials have difficulty justifying the transport needed to reach distant markets. This in turn places emphasis on the balance between the supply and demand for such materials within any particular locale. Such composts produced in excess of the local demand will need to be significantly value added to facilitate the viable presentation in more distant markets.

11. Point of discard — occasional, bulky, valuable or hazardous materials

As a quite defined fraction there is a wide range of items and materials that by their nature and usage patterns are not discarded by the regular **2** MSW channel, and that currently present:

- as bulky or hard waste council collections
- dropped off by individuals to disposal or transfer facilities
- inappropriately discarded with regular MSW materials
- as charity donations
- to special collection sites and events.

These materials include:

- household hazardous wastes such as paints, oils, fuels, garden and pool chemicals, smoke detectors, batteries
- electronic appliances such as communication appliances, computers, entertainment equipment
- white and brown goods including appliances and furniture.
- soft furnishings/bedding and household textiles
- household bric-a-brac such as books, games, clothing, tools and toys
- light building materials such as doors, windows, kitchens and timber
- scrap metals such as large quantities of various metals, batteries and motor vehicle parts
- garden refuse comprising organic material from residential gardens, gardening contractors and tree loppers that missed the organics collection
- traditional dry recyclables such as paper, cardboard, glass, plastics, liquid paperboard, metals and textiles in excess of the dry recyclables collection system
- other light building materials such as aggregates, clean fill, glass, spoil and rubble
- council cleanup items comprising a mixed variety of discards.

These materials retain the following features or defining characteristics:

- they are occasional or discretionary discards
- they are specifically prohibited from regular MSW discard options **2**
- if processed with regular MSW their full inherent resource value will not be realised or their toxic characteristics will degrade the quality of the products available from MSW materials **6**, **7**, **8**, **9**. Because of this they are often most suitable as candidates for product stewardship or extended producer responsibility schemes.

In a dematerialised, service-style economy many consumer services can only be delivered by the provision of certain material content — floor covering services need carpet, climate control services need air conditioning units, beverage provision needs containers and so on. If these service-style offerings are to achieve their highest material resource use, they will need common resource recovery systems, infrastructure and pathways.

The prevailing discard options for these materials are not available with the same degree of uniformity as for MSW **2**. A systematic and reliably available resource recovery pathway is a major potential outcome from the SPIG initiative.

11a. Point of discard — valuable or toxic C&I

The same manufacturers that produced the materials presenting as **11** are likely to produce wastes and by-products of their own that could stimulate the value recovery or treatment capabilities that could beneficially process the post-consumer sources of the same materials (e.g. household hazardous waste and waste electrical and electronic equipment, batteries).

Or vice versa, the value recovery or treatment capabilities that are established to accept post-consumer materials could process the similar by-products that arise from the originating manufacturing processes.

Where product stewardship and extended producer responsibility strategies are adopted, the eventual processing and resource recovery options may address both the MSW and C&I sources.

12. Special value recovery facilities

Material such as appliances, furniture, electronic items, building materials and metals cannot be discarded or processed by the regular MSW **2** resource recovery option. Even if they could, their full inherent resource value would not be realised by that style of processing. It is therefore necessary for special value recovery facilities to be established.

13. Treatment and detoxification facilities

If they are discarded with regular MSW **2** and processed with them, materials such as household hazardous waste and some electronic items will contaminate the simple products available from such materials **6**, **7**, **8**, **9** and threaten the opportunity to specifically treat or recover value from the materials.

Treatment and value recovery of these materials is optimised where critical volumes are available to justify the facilities, which requires an integrated "reuse logistics" framework to supply materials for treatment from multiple point sources.

Such facilities do not currently exist for this specific application other than some nascent single issue schemes and arrangements.

14. Return of materials to the productive economy — treated toxics and household hazardous

The treatment of metals in electronics and chemicals in household hazardous waste is a highly specialised area. These materials require highly specific pathways back to the productive economy.

Market forces are establishing that mineral oils require only two to three facilities to service Australia. The consumer battery sector has identified that one specialised facility is required for its purposes. These facilities require cost-effective reverse logistics pathways to be established from discard to processing to make them viable.

In the event that systems and aggregation pathways for these materials are not established:

- the materials will continue to present as critical contaminants in a wide range of other MSW and C&I recovered product streams
- the inherent value in the materials themselves will be lost
- environmental degradation is bound to ensue in some form or another.

Once satisfactory return pathways have been established — preferably through a collaborative product stewardship and extended producer responsibility scheme — the originating manufacturers and appropriate regulators will have established a firm basis for the design of future products.

15. Return of materials to the productive economy — special value recovery

Of the materials that are recovered in some form or other via charity or opportunity shops, clothing bins and localised drop-off facilities, the current process is not systematic, streamlined or cost-effective.

Whether for reuse, parts, disassembly or resale, the opportunity exists to streamline and systematise this pathway.

4.1 Summary

The Preliminary Gap Analysis begins the process of identifying specific systems and infrastructure items and capabilities that are needed if Australia is to become a "recycling-minded and resource-efficient society". Whilst this preliminary gap analysis can substantiate the need for a wide range of actions and initiatives, it does throw up some major fixed infrastructure requirements to achieve the SPIG objective of developing a systems and infrastructure plan and facilitating its adoption and implementation.

Preliminary gap analysis of systems and infrastructure needed for sustainable resource recovery

Node #	Function	Unsustainable feature of existing service provision	Features required to facilitate sustainability	Focus for SPIG initiative – action list
1	**Productive economy**	• Predominant focus on one-way consumption of primary resources • Nascent, inefficient or non-existing reintroduction of recovered resources and energy back into productive economy as reliable inputs • Unsustainable wastefulness of post-consumer materials and resources • A prevailing waste management and disposal paradigm rather than a primary focus on systematic resource recovery as the primary focus	• Establish purpose-designed resource recovery, reverse logistics systems and infrastructure so that MSW and C&I materials can present back as quality-assured inputs to the productive economy without needing to apologise for their origins • The cost of such an optimised system, net of the resource value created to substantiate the "service fee" or waste management charge (if any) to be recovered from consumers, ratepayers, taxpayers as is most cost-effective	• Scope, design and specify the systems and infrastructure needed to achieve the SPIG objective • Facilitate the presentation of quality-assured recovered resources as reliable inputs back into the appropriate entry points in the productive economy
1a	**Primary industry**	• Currently providing all or most of the resource and energy inputs	• To supplement the provision of primary resources to the greatest extent practicable and cost-effective with recovered resources and energy	As above
1b	**Converting and manufacturing**	• Provision of the widest range of goods and services to the consuming society with insufficient regard to: – the defined actual need – the depletion of primary resources to meet the demand – the optimisation of potential by-products from materials currently presenting as wastes – the sustainable post-consumer fate of the goods and services provided	• Post-consumer resource and energy value recovery systems and infrastructure to minimise life cycle impacts • Goods and services to be designed to facilitate the optimum resource and energy value recovery via the available resource logistics systems and infrastructure	As above
1c	**Consumer**	• Over-consumption of resources and energy • Sustainable societal wants and needs not accurately provided for by the providers of the goods and services • Lack of available options for even the conscientious consumer to discard spent, surplus and unwanted resources to optimise the recovery of the inherent resource and energy values	• Provide the full suite of convenient and cost-effective discard options and resource recovery pathways to minimise the sustainability impact for each individual and society as a whole	As above

2 & 2a	**Regular MSW and C&I discard option**	• Most metropolitan residents have access to dry recycling, residual MSW and source-separated organics discard options, but inter-jurisdictional variations exist that confuse residents and mitigate against universal and appropriate usage	• The widespread availability of dry recyclable, residual MSW and source-separated organics discard options for residents and industry to be systematised and made universally available • Advocacy for appropriate and universal use	• Analyse operational needs for similar materials whether sourced from C&I or MSW • Advocate for common levels of service provision to optimise participation and product quality • Particular emphasis on increased access and availability for source-separated organics discard
3	**First point of receival and processing for residual MSW**	• Current landfill disposal is a focus of SPIG to avoid • Current transfer stations further degrade the material by increasing heterogeneity and cross-contamination	• Phase out landfill disposal until only legitimate landfilling is practised **7** • Completely replace existing transfer station technologies with initial sorting and streaming technologies	• Assess residual capacities at landfills to meet revised requirements • Scope and design "value adding" transfer station technologies and network • Facilitate introduction of sustainable new systems
4	**Resource recovery at MRFs**	• Existing discard options and MRF systems and infrastructure are well established • Markets for recovered materials are limited in scope and value	• Incremental optimisation and de-bottlenecking of the systems • A wider range of products and grades need to be developed to supply a wider range of end uses	• Facilitate optimisation and streamlining of existing systems • Identify and develop a wider range of markets
5	**Organics receival and processing**	• Current collection is not universal • Processing is focused on simple composting • Market is supply-pushed and does not reflect or reward product quality sufficiently	• Introduction of a greater range of processing options, leading to a greater range of quality-assured, value-added, biomass-based products • High value products to expand the marketing range and potential from such renewable resources • Development of concentrates and carbon derivatives	• Facilitate the development of alternative markets for biomass-based materials
6	**Metals return to the productive economy**	• Very advanced sector in terms of market mechanisms, systems, infrastructure and capabilities	• Increased extraction of metals from all streams of MSW for presentation to the existing scrap industry	• Learn from the metal sector to develop systems, infrastructure and marketing of recovered resources back into the productive economy
7	**Inerts return to the productive economy**	• Currently lost to expensive putrescible landfill, adding economic cost for little value and consuming hard-to-replace landfill air space	• Landfilling or disposal of MSW and C&I wastes to be phased out	• Adopt the revised roles for landfill **7** • Advocate the position on landfill to third parties

8	**Mixed organics and biomass return to the productive economy**	• These potentially valuable renewable resources usually present as costly wastes to be remediated and stabilised before being lost to disposal	• The highest net resource value from these materials needs to be realised by the removal of contaminants and the provision of systems and technologies to make products that recognise their renewable qualities	• Facilitate the separation of this fraction from MSW and its processing into sustainable products and energy
9	**High calorific and hydrocarbon-based materials return to the productive economy**	• Most of these materials are lost to landfill disposal without any systematic recovery of their inherent resource or energy values	• These materials need to be separated from the general MSW materials and streamed to specialised facilities that will recognise and recover their inherent resource values	• Facilitate the separation and streaming of these materials to resource and energy recovery options • Facilitate the development of facilities and markets for the products available from these non-renewable resources
10	**Source-separated organic products return to the productive economy**	• A limited range of facilities and technologies available to fully exploit the market potential from these resources • Sector is supply-pushed with a detrimental impact on market prices	• Increase range of facilities and technologies to produce a wider range of organic carbon-based materials and products	• Facilitate the development of a wider range of biomass-based products and services • Seek to redress supply and demand dynamics to see more market pull and less supply push
11, 11a, 12 & 13	**Discard of bulky, valuable or hazardous items and materials from MSW and C&I where appropriate**	• Currently most such materials are: – discarded inappropriately to residual MSW – collected by occasional council kerbside services for disposal to landfill – returned to charity or opportunity shops • No convenient, systematic disposal and value recovery pathway exists	• Scope and develop a cost-effective network of drop-off facilities that can also act as hubs for local collection services in conjunction with: • product stewardship and extended producer responsibility schemes • local government charities • product manufacturers and retailers	• Scope and develop the drive-through or convenient drop-off network facilities • Facilitate their introduction • Advocate for their adoption of 'drive-through recycling facilities'
14	**Recovered metals and chemicals from treated toxics and hazardous materials return to the productive economy**	• Some limited, special-occasion collections or bring-back services • Mostly lost to residual MSW as degrading contaminants with potentially harmful environmental consequences	• Facilities and capabilities to convert these materials into recognisable products and materials for beneficial input back into the productive economy	• Encourage and facilitate the development of highly specialised processing facilities
15	**Special value recovery and return to the productive economy**	• Existing drop-off, charity, opportunity shop resource recovery pathways are barely cost-effective	• New drive-through and drop-off facilities to be scoped and delivered as a coherent network	• Work to include existing operators and operations into the new network of specialist drive-through and drop-off centres

4.2 Major systems and infrastructure capabilities and practices

The following list highlights and summarises the major or most significant areas of change identified in the Preliminary Gap Analysis.

Node 1 — Manufacturing

- Appropriate assignment of extended producer responsibility to manufacturers, requiring them to take life cycle responsibility for the impact of their products and services.
- Rigorous regulatory provisions which use economic incentives and impose sanctions as required to encourage/mandate industry accountability.

Node 3 — First point of receival and processing for residual MSW

- Review existing landfill capacities in any particular region to ensure the availability of the revised services required (Node 7).
- Scope and design "value adding" transfer station technologies, both where operated in isolation and where operated in conjunction with subsequent processing plants — for one or more of the four streams generated.

Nodes 5 (& 8) — Organics processing and marketing

- The traditional composting of such materials is limiting the market potential for products derived primarily from such inputs.
- Notwithstanding the cost-effectiveness of the composting process to produce products of tangible benefit as soil amendments and fertilisers.
- The markets are geographically constrained due to compost's inherent value/bulk density issues.
- The low entry cost into the compost sector has seen a "supply pushed" industry development that has established unsustainably low product pricing in the market.
- The fit-for-purpose/net product benefit balance equation for customers has not been established sufficiently as to provide a reliable base for simple marketing initiatives.

Knowing the inherent properties of both source separated and MSW derived organic streams, products need to be developed that defined markets actually want/need and that they will pay a premium for. Such products must not be transport constrained.

Node 9 — High Calorific / Hydrocarbon materials marketing

Once these materials can be systematically separated (at Node 3) so as to present as a reliable stream of resource, the potential markets/ end uses can be stimulated including:

- The potential for polymer recovery.
- Facilities to beneficiate the materials to produce proprietary fuel products for kilns, power stations and/or metallurgical processes subject to stringent environmental controls and host community support (see WMAA EfW Sustainability Guide and Code of Practice for possible framework).

Nodes 11, 12, 13, 14 and 15 — The development of a network of drive-through recycling centres

Provide (or initiate) the focus to develop and refine the systems and infrastructure and stakeholder participation that will eventually become the network of facilities that will manage all the valuable, toxic or occasional discards that are currently lost to disposal for the lack of a systematic resource recovery channel.

This initial and high level comparison between existing and required resource recovery systems and infrastructure demonstrates:

i) That considerable more work is required in the detail, to scope and refine the definitive network of systems and infrastructure needed

ii) That SPIG cannot deliver such an ambitious program alone.

This suggests a revised program delivery strategy for SPIG.

5. Suggested steps to progress the SPIG initiative

The following suggested action plan seeks to build on the collective strengths and capabilities of the participating organisations and to produce tangible results at each stage.

Now that the size of the task is coming into focus, SPIG needs to leverage off this initial work to stimulate broad community agreement that:

- there is a problem
- new systems and infrastructure are essential to produce a lasting and sustainable outcome
- the SPIG proposals are the most cost-effective solution.

The preliminary gap analysis highlights the multi-million dollar investment needed in systems and infrastructure and the fact that little other than speculative investment will occur without a clearly articulated and coordinated plan being established. SPIG could strongly influence the emergence of such changes.

In addition, SPIG would need considerable funding to deliver this ambitious outcome. Such funding will not be available until there is widespread stakeholder agreement and engagement in the concept and project.

The suggested SPIG implementation model builds on existing capabilities and strengths as a platform for future project expansion and implementation.

The following step-wise approach is proposed.

Step 1 — SPIG steering group takes the necessary steps to reach broad agreement on the systems and infrastructure needed for Australia to become a "recycling-minded and resource-efficient society".

Step 2 — The four current separate SPIG participating organisations canvass and debate individually and collectively the concepts agreed by the steering group in Step 1.

Step 3 — The steering group develops an agreed systems and infrastructure plan as the basis of:

- an invitation for other important stakeholder groups to join the SPIG initiative. Examples of potential groups are the Department of the Environment and Heritage (DEH), industry manufacturing groups, Australian Local Government Association (ALGA), specialist product groups (batteries, WEEE, Household Hazardous Waste).
- attracting funding for ongoing program development and implementation.

Attachment A: Steering group membership

Name	Representing
Tony Wilkins	Publishers National Environment Bureau (PNEB)
Tony Kanak	Compost NSW
Ron Wainberg (co-chair)	Alternative Waste Technology Derived Organic Rich Fraction (AWT/DORF) Committee
Mark Glover (co-chair)	Waste Management Association of Australia Energy from Waste Division
Nav Brah	Landfill Division
Mike Ritchie	Waste Management Association of Australia NSW Branch (WMAA)
John Cook	Biosolids
Jeff Angel	Total Environment Centre (TEC)/(NPC)
Dave West	Boomerang Alliance
Bob Verhey	Local Government & Shires Associations (LGSA)
John Lawson	Australian Council of Recyclers (ACOR)

References

Documents submitted to or prepared with the SPIG Steering Group:

WMAA NSW Landfill Working Group, *Draft Discussion Paper – Rev 3*, 20/09/02

Mark Glover, *SPIG Working Paper 1*, April 2006

Warnken Industrial & Social Ecology (WISE), *Australia as a Recycling and Resource Efficient Society: Defining the Vision*, August 2006

Publicly available Productivity Commission submissions **(http://www.pc.gov.au/inquiry/waste/subs/sublist.html)**:

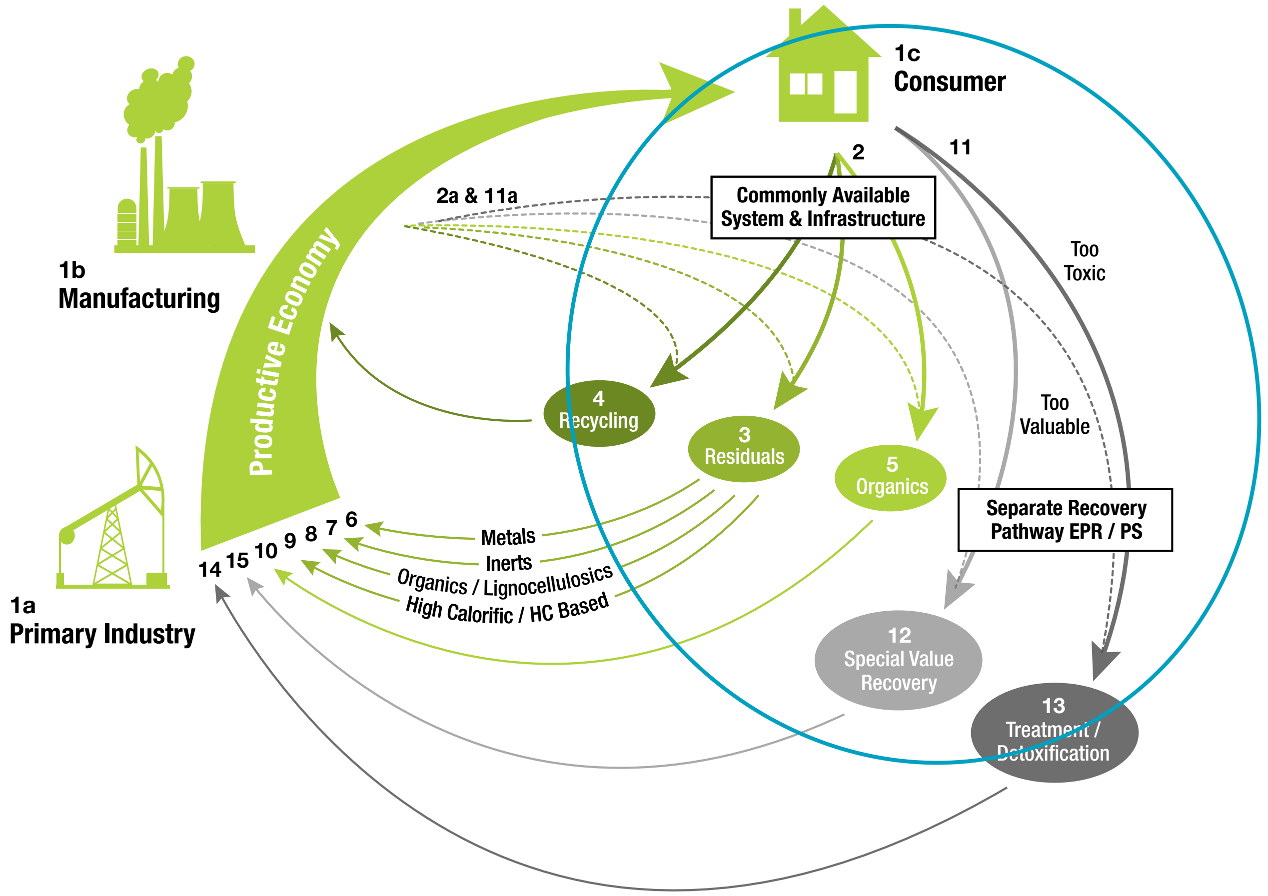
LGSA of NSW	– Submission No. 98
The Boomerang Alliance	– Submission No. 54
ACOR	– Submission No. 40
WMAA NSW Branch	– Submission No. 1
WMAA SPIG	– Submission No. 76
WMAA EfW Division	– Submission No. 82

Attachment D

Description and Definition of Generic Post-Consumer Waste Flows

Fig. 1-2 is reproduced focusing on the established post-consumer discard Options 4, 3, 5 and 11 (12-13) or, the four main discard options for residents.

Figure 1: The established post-consumer discard options to be optimised in this RWS



Understanding these four (4) basic streams will be crucial to identifying areas for improvement or new systems and infrastructure in the final RWS.

Stream #1 – Traditional Dry Recyclables (2 & 4) – (Yellow bin)

a) Definition of stream

Traditional "grocery", packaging and ONP materials that are regular household discards and readily recognised for dedicated discard, including:

- Glass – bottles and jars – all colours
- Paper/cardboard
- Fe and Non-Fe metal containers
- Plastics – usually PE/PP/PS/(rigid – not film).

b) Characteristics as presented

– Usually commingled in one container at kerbside, but often supplemented with "drop-off" facilities in public spaces.

– Potential community confusion over:
  - Non-container glass (and ceramic bottles etc.)
  - Other plastics (ABS, PVC, common films)
  - Waxed cardboard/soiled paper
  - Non-container metals.

c) Current handling methods

Kerbside collection for delivery to regional MRFs where materials are sorted (and beneficiated) to meet the quality standards established by the end users.

NB:

– Waste sector collects and sorts.

– Finished products sector supplements/ replaces virgin resources in their respective manufacturing process.

– MRF sorting creates residues that need a cascading reuse option (VATS/AWT) (Fig. 5-1).

– Existing systems and infrastructure could accept more material if presented by households.

– Existing systems could be adapted to accept a greater range of grocery and packaging material in the face of sustained demand from new end users.

– Existing systems could be adapted to include other items of interest, (e.g. dry cell batteries will come off on the magnets – as a community service if promoted).

d) Current/prevailing initiatives/waste avoidance and resource recovery approach

– WARR keen to optimise this resource recovery channel.

– This stream is exempt from S88 levy.

– Primary "streaming" approach to realise highest resource value from these materials – similar materials discarded into any other channel will only "cascade" down to a "next best" use or resource recovery outcome – but should not default to disposal options (see "red" bin residual MSW pathway).

e) Proposed strategic approach

– Optimise community/resident accurate participation.

– Identify expanded range of materials that could beneficially be managed via this channel.

– Attract much greater levels of brand and fast-moving-consumer-goods manufacturing sector support and involvement in outcomes.

f) Long term functional objectives

– Minimised presentation of all such materials as litter, or in residual MSW.

– Optimise public place recovery.

– Achievement of fair price for materials re-entering the productive economy.

g) Future systems and infrastructure needs arising

– **Systems**

All councils have existing "yellow" bin systems.

– **Infrastructure**

Existing.

Stream #2 – Garden Organics (with or without food waste) – (Green lid and/or kerbside collection and/or drop off)

a) Definition of stream

Biomass/organics (started life as vegetation) originate at each household as:

1. Garden waste – from lawn clippings to trees
2. Food waste
3. Soiled cardboard/paper
4. Nappies/sanitary waste
5. Biosolids (via local STP)
6. Wood waste.

b) Characteristics as presented

– **Garden waste** presents as an occasional/ seasonal discard; sometimes just lawn clippings and prunings etc. (small garden), and sometimes large herbaceous/tree/woody material.

– **Food waste** presents daily as food preparation residues, and/or actual left over/ spoilt food.

– **Residual waste** includes food wrapping and soiled boxes, wrappers and containers (paper/cardboard).

– **Nappies /sanitary waste** – it is a growing fraction, including not only infant-sourced items but also incontinence products for all other age groups are becoming more common.

– **Biosolids** are <u>**not usually**</u> an immediate council MSW issue (except HCC), and are usually treated at regional STPs. However, these materials can often be beneficially treated/value added in combination with the other materials for value added products.

– **Wood/timber/stumps** are occasional arisings. Could present as contaminated (paint/CCA etc.) or heavy/oversize.

c) Current Handling Methods

Council \ Handling method	Green bin	Clean up collection	Drop-off Self haul	Residual organics	Biosolids to manage
Blacktown City Council	–	–	–	AWT	N/A
Blue Mountains City Council	–	✓	✓	–	N/A
Hawkesbury City Council	–	✓	✓	–	✓
The Hills Shire	240L fortnightly	✓	–	–	N/A
Penrith City Council	240L (FOGO) weekly	–	–	AWT	N/A

d) Current/prevailing initiatives/ waste avoidance and resource recovery approach

– THS – proposing to introduce FOGO

– WARR:
  - Focus on source-separated compost (FOGO); and
  - "Reduce materials presenting for landfill" (with EfW emerging as an option)

– S88 levy can be extinguished if residues are processed energy or char products.

– In parallel, "industry" shaping to address the carbon-constrained economy by converting available biomass into HNRV products.

e) Proposed strategic approach

The provision of a basic (red lid) waste collection service is all that's required to meet councils' basic public health protection obligations. The introduction of additional recycling and/or organics collection services is a political and economic response to the community's preference for optimised resource recovery outcomes, where cost-effectively provided.

The processing of the organic fraction into stable and useful products (usually composting) is greatly facilitated if these materials can be presented for subsequent processing as uncontaminated as is practicable, since the presence of non-organic or chemical contaminants can greatly devalue any final product, and can be problematic to screen out or remove.

Ultimately, the quality and value of collected organics will be in direct proportion to the level of attention to such issues by each individual member of the community, at the actual moment of discard into the provided collection system; and not all members of the community will behave with the same levels of attention to detail and willingness to proactively participate.

Table 1 is an example of a possible program designing matrix that matches respective waste streams with regional demographic data. The goal is to help design an organics collection program that will actually reward the cost and effort of a non-essential, resource recovery dedicated collection system ideally tailored to each community's circumstances.

Table 1: Green/Garden Waste Management Options Assessment Matrix

Demographic Survey Data / Waste Audit Data	Home			Multi-Occupation		Council owned parks and gardens
	Conscientious, motivated, active	Conscientious, motivated, inactive	Can't be bothered	Conscientious and motivated	Can't be bothered	Conscientious and motivated
	30%	40%?	30%?	50%?	50%?	100%?
Mixed putrescible (…)%?						
Vege food preparation (…)%?		Likely Quality/Quantity Assessment*				
Small garden (…)%?						
Large garden (…)%?						
Wood/stumps (…)%?						

*Potential values to be then compared with the status quo and the cost/benefit of the alternative schemes.

Likely outcome:

- Garden waste as collected/dropped off completely uncontaminated – to compost.
- All other material to torrefaction/pyrolysis as ingredients into regional char/charcoal/green bioenergy production (see Node 8, Fig. 5-1).

f) Long-term functional objectives

– The inherent carbon and nutrients in **all** the biomass/organic materials to be recovered for HNRV land application as soil productivity improvers (potential for hard woods to be converted into metallurgical grade charcoals).

– Once this fraction is comprehensively processed to recover full value, the balance of the waste stream is effectively "non-putrescible".

– All the wood/biomass presenting in regional C&I and C&D waste streams could also be processed via this approach (potential for hard woods to be converted into metallurgical grade charcoals).

g) Future systems and infrastructure needs arising

– **Systems** – to be developed and coordinated (Section 6).

– **Infrastructure** – thermal processing capability to be promoted with specialist third party operators.

Stream #3 - Residual MSW – (Red lid)

a) Definition of stream

All spent, unwanted and discarded materials that a household needs to discard from time to time that:

- Can physically fit into the receptacle provided; and
- Has not been channelled into any other discard option provided by council (or other) such as:
  - Dry recyclables services
  - Organics receptacle/service or drop off or home compost/worm farm, or insinkerators etc.; and
  - Specialised HHW drop off or hard waste or kerbside options.

b) Characteristics as presented

The residual waste collection service, provided by councils, is the cornerstone of the essential public health protection obligations that councils have to ensure putrescible materials are removed for safe and hygienic treatment/disposal.

The foundation of efforts to recover resources from household wastes all start (currently) with providing alternative discard receptacles/options.

As a raw material, this residual MSW stream is technically indeterminate in that there are few, if any, controls on what materials could present in this material stream. However, with so much material under management (OECD countries), continuous audits of this material have established that residual MSW does present, in aggregate, with remarkable certainty as to generic proportions:

- 40-60% biomass/organics (materials that started life as living organisms) – only marginally reduced where FOGO services are adopted;
- 3-5% metals – Fe and Non-Fe;
- 15-25% synthetics – (plastics etc., or materials that started life as oil or fossil fuels); and
- 15-25% inerts – fully mineralised materials such as ceramics, dirt and fines, rubble and minor building materials.

NB: In a streaming/cascading resource/HNRV recovery hierarchy, the processing of these "residual" materials presents the "last resort" opportunity to realise tangible value. The default position for these materials will be least harm disposal – usually lost to landfill or EfW/incineration.

c) Current handling methods

Council	Current handling method
Blacktown City Council	Processed at GRL AWT – Eastern Creek
Blue Mountains City Council	Landfill – Blaxland site
Hawkesbury City Council	Landfill – South Windsor site
The Hills Shire	Landfill – Woodlawn via Clyde TS
Penrith City Council	Processed at Sita AWT – Kemps Creek

Outcomes

- For MSW delivered directly to landfill, there is no opportunity to recover resources from the material prior to disposal (other than LFG or subsequent mining!)
- For MSW delivered to a traditional transfer station, not only is there no opportunity to systematically recover resources from this material prior to disposal in subsequent landfill, the very act of consolidating all such material for subsequent bulk transport renders the original MSW even more mixed and intermingled so that any potential sorting processes would be even more difficult.

Existing AWT plants seek to:

- Recovery recyclable materials.
- Remove hazardous materials where they can be identified;
- Isolate the biomass fraction for subsequent composting to a) stabilise the material and b) to create a product that can achieve at least the minimum standards as to permit application to land – and thus avoid landfill (and the S88 levy).

As identified (b) (above), residual waste presents in at least four major inherent material types, and technologies to achieve such initial separation are now readily available (Fig. 2 below).

d) Current/prevailing initiatives/ waste avoidance and resource recovery approach

– WARR keen to "reduce materials presenting for landfill".

– Processes to convert the generic material fractions in residual MSW can all be presented to avoid S88 levies.

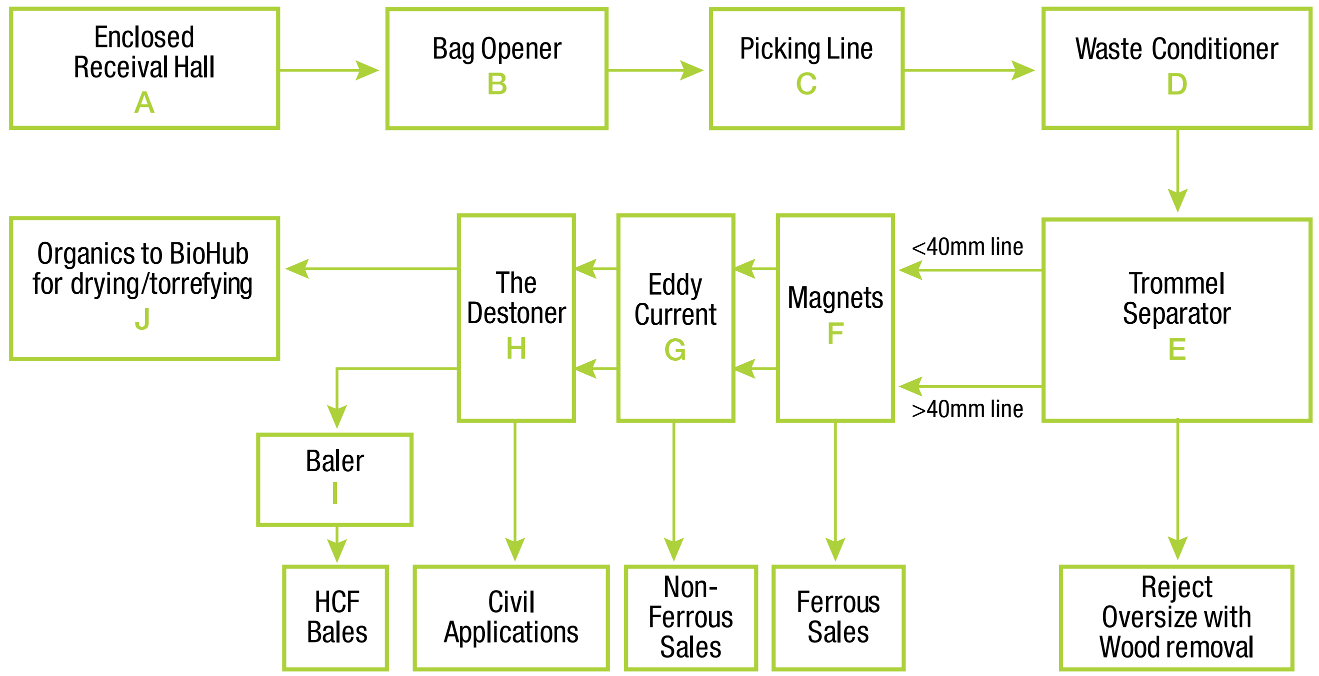
– The policy platform to adopt thermal treatments and even EfW are now crystallising and will present as viable options in a RWS proposed for implementation over the next five-15 years.

– Current AWT processing of some councils' residual wastes or FOGO materials are currently presenting as "suboptimal" in terms of the philosophies and objectives of this RWS and should be considered as a baseline only for what should be achievable in the next five-15 years.

e) Proposed strategic approach

Base RWS around the requirement for all residual MSW to be received at a Value Added Transfer Station (VATS)/AWT (draft functional specification Section 5.2.5).

Fig. 2: Minimum generic processes required at proposed "VAT/AWT" to support subsequent resource recovery



Key:

A **Enclosed Receival Hall** where incoming material is checked by small front-end loaders (FELs) for gross contaminants before being pushed onto the in-floor plate feeder which will convey materials to the Bag Opener. MSW and select C&I materials accepted.

B **Bag Opener** where materials are released and exposed for the subsequent picking line.

C **Picking Line** – this capability is proposed to remove any obvious Household Hazardous Waste materials and recover any obvious dry recyclables that were not more correctly discarded via the kerbside "yellow bin" service or originated in the Commercial and Industrial (C&I) stream.

D **Waste Conditioner** – by managing moisture, feed rate and particle attrition, the materials can be conditioned without shredding in preparation for subsequent trommel screening.

E **Trommel Separator** process the conditioned materials such that the <40mm material will be predominantly the organic fraction (including conditioned cardboard and paper etc.), the <40mm to 150mm material will be predominantly the "plastic" High Calorific Fraction (HCF) and the >150mm oversize fraction will present for wood recovery from what otherwise will be a reject/inert fraction.

F **Magnets** remove ferrous metals from both the <40mm and >40mm lines.

G **Eddy Current** removal of non-ferrous metals from both the <40mm and >40mm lines.

H **The Destoner** or ballistic separators remove inert materials such as glass, ceramics and masonry fragments from both the <40mm and >40mm lines, which being now separated from the putrescible, organic fractions, will be suitable for select civil applications.

I **Baler** preparation of HCF for transport for sale or storage.

J **Organics Interim Storage** or inventory control, will balance the urban waste derived biomass **inflow** with the subsequent drying/ torrefying process **outflow** as an inline process to avoid the aerated organics generating potential odours.

NB: Such generic technologies are available in process modules from 50-150 ktpa for a capital and operating cost commensurate with traditional "push pit" transfer stations.

Such a facility would be the penultimate resource recovery option in the integrated streaming/cascading system. Residues from the proposed VATS/AWT would be suitable only for EfW and/or landfill.

f) Long-term function objectives

- Only the landfill fraction would attract S88 levies (and the EfW ash might not be included).
- Landfill diversion of more than 90% is readily achievable via this approach.

g) Future systems and infrastructure needs arising

- Systems – existing.
- Infrastructure – (see Section 5, Fig. 5-1).

Stream #4 – Hard Waste – Occasional Discards

a) Definition of stream

Those bulky, durable, HHW, WEEE (even garden waste) household items that are too valuable, toxic or bulky to be able to be collected in standard bin systems (Table 2 attached for potential list of items and materials that could present in this stream – segregated to allow HNRV outcomes over time – as systems and end uses develop).

b) Characteristics as Presented

- All these materials are occasional/discretionary discards, when compared to the red and yellow bin materials, which need discarding weekly.
- From a resource recovery perspective, all these materials present as:
  - Too bulky
  - Too toxic
  - Too inherently valuable; and
  - Too erratically available;

  to be managed by any other alternative, council provided collection system.

- Most of these materials are over represented on any government list of materials that are being considered for Product Stewardship arrangements.
- Since they are all usually presented at kerbside or drop offs or landfill as mixed disparate loads, the opportunity to receive and aggregate these materials like-with like, and so create potential reprocessing opportunities, is currently squandered.

Table 2: Range of hard waste materials that should ultimately be beneficially handled at drop-off facilities

Waste Stream		
No.	**Name**	**Sub Group**
1	Clothes/Textiles	Reusable/rags
2	“ “	Fabrics/manchester
3	Mixed metals/complex scrap	
4	Furniture	Reusable
5	Furniture	Scrap
6	Soft furnishings	Reusable
7	Soft furnishings	Scrap
8	White goods/appliances	Reusable/repairable
9	White goods/appliances	Scrap
10	TVs/Monitors/CRTs/WEEE	Reusable/repairable
11	TVs/Monitors/CRTs/WEEE	Scrap
12	Brown/Electronic	Reusable/repairable
13	Brown/Electronic	Scrap
14	Hand-held appliances	Reusable/repairable
15	Hand-held appliances	Scrap
16	Sports goods etc.	Reusable/repairable
17	Sports goods etc.	Scrap
18	Garden implements	Reusable/repairable
19	Garden implements	Scrap
20	Bric-a-brac/collectables	Resellable
21	Bric-a-brac/collectables	Scrap
22	Commercial take back	Reusable (service for specific PS clients)
23	PVC	Pipe/cable
24	Used building materials	Timber (de-nailed) – reusable
25	Used building materials	Joinery items – reusable
26	Used building materials	Fittings/appliances – reusable
27	Plasterboard	Clean
28	Plasterboard	Mixed
29	Insulation	
30	Asbestos	Bags/sheet (not wanted – but inevitable)
31	Garden waste	Clean – Secondary option
32	Garden waste	Contaminated – Secondary option
33	Wood waste	Clean (Grade A)
34	Wood waste	CCA/treated/painted
35	Fe scrap	
36	Inert/MSRM	Civil reuse
37	Carpets	

38	MSW (discouraged)	(will present – must handle)
39	Oils/fuels	Recyclable lubes
40	Oils/fuels	Oily water
41	Oils/fuels	Vegetable oils
42	Oils/fuels	Fuels/solvents
43	Batteries	MV (wet)
44	Batteries	Standard dry cell
45	Batteries	Ni Cd (rechargeable)
46	Batteries	Other
47	Lighting	Fluorescent tubes
48	Lighting	Miscellaneous bulbs
49	Lighting	Ballasts
50	Lighting	Fittings
51	Paints	Water-based
52	Paints	Solvent-based
53	Paints	Unknown
54	Chemicals	Misc. Household
55	Pharmaceuticals	Misc. Household
56	Tyres	4 No. Max.
57	Motor parts	Fe
58	Motor parts	Non-Fe
59	Paper/cardboard	ONP/OMG
60	Paper/cardboard	Clean cardboard
61	Paper/cardboard	Clean mixed paper
62	Paper/cardboard	Files/binders
63	Liquid paper board	
64	Plastics	PET clear (1)
65	Plastics	PET coloured (1)
66	Plastics	HDPE clear (2)
67	Plastics	HDPE coloured (2)
68	Plastics	PP (5)
69	Plastics	PVC (3)
70	Plastics	Other/thermo sets
71	Aluminium	UBCs
72	Aluminium	Other
73	Glass	Containers – clear
74	Glass	Containers – green
75	Glass	Containers – brown
76	Glass	Mixed plate
77	Glass	Mixed MV

c) Current handling methods

- Kerbside collections
- Drop offs
- Landfills
- Charity facilities

with the exception of some garden waste and ferrous scrap, (some charity reuse) most of these finish up in landfill.

d) Current/prevailing initiatives/ waste avoidance and resource recovery approach

EPA is promoting drop-off facilities to be established throughout the community. However, these facilities are only proposed to receive and aggregate select materials. Still undetermined is:

– How the full capital cost will be met;

– How the full operating costs will be met;

– Who will pay the costs of aggregated material treatment, disposal (or reprocessing); and

– How the originating industry sectors will be engaged to contribute to the cost of handling their materials.

The EPA's current approach[1] is that establishing some facilities is an important first step. Then, with a level of capability established, industry can be engaged as a subsequent stage.

e) Proposed Strategic Approach

– To channel any/all available EPA funding to establish the essential footprint for a much expanded and profitable drop-off network in the future.

– To develop strategies to engage with and promote much more direct engagement with the manufacturers of these materials.

– Eventual engagement as:

a) WSROC
b) NSW
c) nationally

over time will attract the appropriate service fee from industry in the shortest period of time and relieve local ratepayers of the cost of operating such facilities and services.

– Look out for similarly motivated parties to leverage influence as fast as possible.

f) Long term functional objectives

– Channel existing hard waste management budgets into profitable, industry sponsored "drop-off" facilities.

g) Future systems and infrastructure needs arising

Drop-off centres.

Conclusions

All the Sub-Group councils offer these four discard options to residents, although the garden waste service is not always an actual "green bin" or that the hard waste/occasional discard service is delivered in a standard form; however, a framework to optimise the opportunity for residents to beneficially impact eventual resource recovery outcomes by selecting the appropriate discard option is now established, and can be addressed in the RWS (Section 5 below).

More generally the approach being taken in the development of this RWS includes:

a) To focus on responding to the commercial drivers with the essential public health protection obligations met as an inevitable consequence, rather than as the primary objective;

b) Working towards a position where post-consumer discard and resource recovery options are effectively universal so as to optimise the emerging relationship with the brands and consumer goods manufacturing sector which will eventually deliver the most sustainable resource use and reuse outcomes for the community.

1 Personal discussion with Stephen Beaman, Q4 2013

Biomass ain't Biomass

In a carbon constrained economy, where either legislated or market-based incentives have been established to disincentivise the consumption of fossil fuels (oil, gas or coal), an obvious alternative source of carbon-based molecules is biomass; the vegetative materials produced by the "solar powered" conversion of atmospheric CO_2 with water and soil nutrients (photosynthesis) to form the woody, lignocellulosic materials that were the original source of the fossil fuels that we now seek to replace.

However, recently grown biomass (<100 years) presents in many different forms, each more suitable and sustainably applied to different uses and functions if the full range of anticipated benefits is to be actually achieved.

Vegetative biomass as a renewable resource

The attraction of vegetative biomass as a renewable resource stems from the fact that currently grown (< 100 yrs) vegetative biomass uses sunlight (solar energy) to drive photosynthesis, whereby atmospheric CO_2 is combined with water and soil nutrients to produce the lignocellulosic structures that present as the root, stem and branch and woody biomass materials that are ultimately the essential inputs into the emerging bio-products manufacturing sector.

The carbon "near-neutral" potential for using such materials to replace/supplement fossil resources, and as a source of energy, comes from an analysis of the carbon cycle, whereby the CO_2 absorbed by plant life during growth is released through combustion back to atmosphere in a short, no-net-CO_2-increase cycle, whereas the combustion of fossil resources releases CO_2 to the atmosphere that had been sequestered some 300 million years ago, and whose release in today's modified environment causes a net accumulation of CO_2 in the atmosphere.

The agenda to replace or supplement fossil fuels with biomass-derived alternatives is ultimately driven in response to the respective climate change, resource depletion and adoption of sustainable economic systems agendas. The achievement of these goals is heavily dependent on a detailed understanding of all the different types of biomass and their most appropriate application to all the different uses envisaged, the achievement of their respective Highest Net Resource Value (see EWDP 14-014R).

Biomass was the source of the fossil resources (coal, oil, gas) that we use today. The original biomass deposits were "pyrolysed" by geological processes (heat and compression in the absence of oxygen) during the last 300-350 million years, and in so doing, substantially decarbonised the then prevailing atmosphere, setting the platform for the more "friendly" climatic conditions we enjoy today. In effect, keeping most of the sequestered carbon from re-entering the earth's atmosphere is the essence of limiting climate change as it presents today.

However, using currently produced vegetative biomass operates on a net carbon neutral cycle; and where any portion of that carbon can be sequestered into long life products (such as stable biochar back into soils), net atmospheric CO_2 can even be reduced, whilst still providing the essential services previously supported by the use of fossil resources. Table 1 clearly shows that whilst biomass has demonstrable net GHG benefits over other "renewable" energy sources, it is also the only one that could result in carbon negative outcomes rather than simply carbon "reduced" or only carbon neutral outcomes.

Table 1: Comparison of benefits and properties of non-fossil sources

Compares all other non-fossil sources of energy, which includes biomass, but demonstrates that biomass can also produce (columns E, F, G, H & I) a wide range of carbon-based materials previously only available from fossil resources and which are essential outcomes of an emerging biomass based sector.

Low carbon energy sources	Features/Properties								
	A	B	C	D	E	F	G	H	I
	Renewable	On demand supply	Heat	Power	Gas	Oil	Char	PetroChem industry manufacturing precursors	Potential to be carbon negative
Fossil fuels with sequestration		✓	✓	✓					
Hydro	✓	✓		✓					
Wind	✓			✓					
Solar – thermal	✓		✓	✓					
Solar – PV	✓			✓					
Geothermal	✓	✓	✓	✓					
Wave/Tidal	✓			✓					
Nuclear		✓	✓	✓					
Biomass	✓	✓	✓	✓	✓	✓	✓	✓	✓

The obvious versatility of biomass as a basic source of carbon-based products presents the collateral problem that in a carbon constrained economy, the demand and competitive pressures for the full range of biomass supplies will be intense. With this in mind, it will be essential that the vegetative biomass sources selected for any particular use are absolutely appropriate for that purpose and are produced sustainably and delivered entirely fit-for-purpose. In this paradigm, the available vegetative biomass sources should be applied to the end use that demonstrates the Highest Net Resource Value (HNRV) wherever possible.

To be able to recognise and properly allocate biomass sources for HNRV, not only the precise characteristics of the various biomass sources need to be understood, but their net impact as a land use issue, their ability to provide collateral ecosystem services, and the socio-economic factors surrounding their selected generation and end use need to be recognised and accommodated.

Bio-molecular Profile of Vegetative Biomass

Focusing on plant matter, biomass presents in three major forms:

i) The lignocellulosic structural portion; stems, branches, roots etc. (the water **insoluble** hydrocarbon material);

ii) The water soluble carbohydrates, sugars, starches and proteins; and

iii) The lipids, oils and fats.

Hydrocarbons contain only carbon and hydrogen, have a high energy density and are used for energy storage by biological organisms where weight and volume are critical. Carbohydrates also contain carbon and hydrogen, but have approximately one atom of oxygen for each atom of carbon in the structure. Oxygen reduces the energy density of carbohydrates compared to hydrocarbons, but has other valuable biological outcomes such as making the molecule water soluble (proteins, sugars and starch) so that it can be easily transported within the organism, or aiding in the formation of polymers for structural roles (lignocellulose).

Humans are only able to successfully digest soluble carbohydrates and lipids; hence lignocellulose is not a direct human food. Animals are able to maintain the structural integrity of amino acids during digestion and hence use food protein for their own growth and development. This means that if protein can be separated from other biomass components, it can often have more value as an animal (including human) feed where the nitrogen and sulphur are an asset rather than a pollutant.

The energy density and physical properties of the biomass are critical factors for bioenergy feedstock considerations and need to be understood in order to match a feedstock to its most efficient processing technology.

The net result is that it is usually the lipids and water soluble carbohydrates that achieve their highest order use as sources of food (human and animal) and have provided the basis for first generation biofuels and the like, whilst the majority of biomass by weight and volume is the water insoluble lignocellulosic fraction.

It is this "dry", lignocellulosic or "woody" material that is likely to be the most appropriate and cost-effective to apply to industrial and agricultural uses as it does not compete with food.

It is also worth noting that it is usually the reproductive parts of plants that provide the high value lipids and sugars, starches and proteins, whilst the foliage has high moisture and is more nitrogenous, and the bark on woody parts is often the higher ash-containing fraction.
All these factors influence not only which biomass is optimum for fossil resource replacement, but which parts of which plants.

To reinforce the point, the following table, reproduced from the Rural Industries Research and Development Corporation's Sustainability Guide for Bioenergy (RIRDC Publication # 05/190)[1] demonstrates that just using biomass isn't enough, it's which biomass and how it is applied.

[1] *O'Connell, D., Keating, B., Glover, M., (2005), Sustainability Guide for Bioenergy: A scoping study, RIRDC Publications, https://rirdc.infoservices.com.au/items/05-190*

Table 2: Balancing benefits and disbenefits of bioenergy

Biomass production/ recovery for Bioenergy can:	Which can present as a benefit…	Or as a disbenefit…
i) Provide a level of security of supply from the sun rather than fossil sources that are finite	If generated and recovered sustainably	If too much fertile land is quarantined or degraded in the process
ii) Provide more localised supply of heat and power	By reducing transport (fuel) and transmission (power) costs and impacts	Where smaller plant is less efficient in the conversion of the biomass – lack of efficiency equals waste of initial resource value
iii) Deliver substantial greenhouse benefits with short cycle carbon release and sequestration	Because fossil carbon is contained or not released	Where more essential land uses are denied
iv) Improve overall air quality	By provision of ecosystem services when growing and, if converted via sensitively designed and operated plant, when harvested as compared with traditional fossil fuel conversion	If the conversion pathway is inefficient, such inefficiency can squander much of the potential net benefit
v) Provide economic opportunities for rural and regional Australia	Where biomass energy sources provide a major new product range from the traditional food and fibre sectors or the stimulus for land remediation programs	Where the biomass is harvested unsustainably, the land has a finite capacity to sustain yields for offsite application and biomass harvesting could exacerbate soil degradation if conducted insensitively
vi) Impact soil quality, fertility, erosion and production	If the activity is conducted to improve soil quality, fertility, retention and production	If the activity is conducted so as to deliver negative soil impacts (over harvesting, insensitive monocultures etc.)
vii) Facilitate the remediation of degraded lands	Where the production of biomass yields is from land quite unsuitable for food production	If conducted inappropriately
viii) Provide local, catchment and global water cycle and management outcomes	If conducted sensitively and with due regard to the prevailing water cycle issues	Where inappropriate planting and over harvesting etc. deliver any or all of the outcomes as disbenefits
ix) Deliver net biodiversity outcomes in the soil and above ground	Where such issues are duly considered in the selection of plantings and the conduct of the specific management plan relevant for each locale	Where insensitive planting (mono cultures) and harvesting deliver negative biodiversity outcomes
x) Provide an intensive bioremediation opportunity for certain urban and industrial waste materials	Where the plantings and nutrient cycles are managed proactively	Where inappropriate wastes are put to land and managed inappropriately
xi) Deliver social/aesthetic outcomes/impacts	Over and above the economic benefits (v)	If inappropriate methodologies or management practices are adopted

Summary and Preferred Profile for Biomass Sourced for Fossil Fuel Replacement/Supplementation

In sourcing the most appropriate, assured and cost-effective sources of biomass for fossil resource replacement/supplementation, the previous discussion on sustainability issues has defined some useful scoping criteria that could affect and influence any finally selected strategy:

i) To seek to optimise biomass use is to be in the **sustainability business**. This is not because fossil resources are about to run out, although they are likely to increase in cost as governments introduce a price on carbon. To be in the sustainability sector means doing it properly, to achieve the full suite of potential benefits available for taking this initiative. The Food vs. Fuel outcomes in the liquid transport fuel sector provide clear indicators of what happens if genuine sustainability principles are not adopted. Table 2 demonstrates how the same action can produce quite different outcomes if the detail is not observed.

ii) A program to optimise the use of biomass to replace fossil resources will be greatly challenged to present as a net cost cutting exercise (because of the convenience and energy concentration of existing fossil resources). However, by addressing the issue systematically, the cost increase is likely to be no more than is absolutely essential or unavoidable to achieve the primary sustainability goals. Having adopted the most cost-effective biomass sources and supply chains, a sustainable competitive outcome should be achievable, especially where economic externalities are acknowledged.

iii) The agenda to reduce Greenhouse Gas emissions and adopt potentially renewable biomass to replace or at least supplement fossil resources is attracting systematic responses throughout the economy. Certainly proactive initiatives are evident in the metals smelting/manufacturing sector, the cement sector, the petrochemical sector and the agricultural fertilisers sector. Even the energy generation industry will have ambitions to adopt sustainably sourced biomass.

To respond to this situation, each sector should focus on biomass sources that are ideally suited to their particular needs, rather than on sources suitable for only heat/energy generation, such as in the cement making or power generating sector (Table 1). This focus should be on securing the most appropriate parts of the plants identified setting aside lipid or starch or sugars or the moist nitrogenous foliage, or stem material that has a demonstrable higher order use as construction, agriculture, pulp and paper or furniture and the like.

Attachment F

RWS High Level Commercial Viability

Please view the information over the following pages

CURRENT OPERATIONS

Gate Fees	MSW	115,000	$307	$35,305,000
		115,000		$35,305,000
Land Fill		115,000	$200	$23,000,000
Levy		115,000	$107	$12,305,000
				$0

PROPOSED SITUATION

						10% Increase in Costs	20% Increase in Costs	50% Increase in Costs
Gate Fees	MSW	115,000	$307		$35,305,000	$38,835,500	$38,835,500	$38,835,500
	Garden Waste	50,000	$40		$2,000,000	$2,200,000	$2,200,000	$2,200,000
	Other Organics	35,000	$45		$1,575,000	$1,732,500	$1,732,500	$1,732,500
		200,000			**$38,880,000**	**$42,768,000**	**$42,768,000**	**$42,768,000**
Operating Costs		**Capital Recovery**	**Operating Cost**	**Total Cost/ Tonne**				
VATS/AWT	Cost / Tonne	$16.98	$30.00	$46.98	$5,402,830	$5,943,113	$6,483,396	$8,104,245
Composting	Cost / Tonne	$2.55	$40.00	$42.55	$2,127,358	$2,340,094	$2,552,830	$3,191,038
Dry/Torrefy	Cost / Tonne	$121.43	$50.00	$171.43	$6,000,000	$6,600,000	$7,200,000	$9,000,000
Pyrolysis	Cost / Tonne	$136.36	$65.00	$201.36	$6,645,000	$7,309,500	$7,974,000	$9,967,500
Plastics	Cost / Tonne	$198.24	$35.00	$233.24	$5,294,500	$5,823,950	$6,353,400	$7,941,750
					$25,469,689	$28,016,658	$33,619,989	$50,429,984
Landfill (Residuals)		12,000	$307		$3,684,000	$4,052,400	$4,420,800	$5,526,000
(Plastics)		7,491	$307		$2,299,737	$2,529,711	$2,759,684	$3,449,606
Sales								
– Metals					$368,000	$368,000	$368,000	$368,000
– Inerts					$207,000	$207,000	$207,000	$207,000
– Composts					$525,000	$525,000	$525,000	$525,000
– Char (Dry/Tor)					$2,200,000	$2,200,000	$2,200,000	$2,200,000
– Chjar – Pyrolysis					$1,732,500	$1,732,500	$1,732,500	$1,732,500
– Green Power					$459,000	$459,000	$459,000	$459,000
– Plastics					$9,148,100	$9,148,100	$9,148,100	$9,148,100
					$22,066,174	**$22,808,832**	**$16,607,127**	**-$1,997,989**

VATS / AWT Capital Cost

Capital Cost	$20,000,000	Repayment	$3,600,000 p.a.
Useful Life	10 years		
Interest Rate	7.00%		
Admin Cost	5.00%		

Total Payment $34,941,518

Annual Payment over 10 years = $3,494,152 p.a.

Year	Capital Balance	Interest + Admin	Repayment
1	$20,000,000	$2,400,000	$3,600,000
2	$18,800,000	$2,256,000	$3,600,000
3	$17,456,000	$2,094,720	$3,600,000
4	$15,950,720	$1,914,086	$3,600,000
5	$14,264,806	$1,711,777	$3,600,000
6	$12,376,583	$1,485,190	$3,600,000
7	$10,261,773	$1,231,413	$3,600,000
8	$7,893,186	$947,182	$3,600,000
9	$5,240,368	$628,844	$3,600,000
11	$2,269,212	$272,305	$2,541,518
12	$0	$0	$0
13	$0	$0	$0
14	$0	$0	$0
15	$0	$0	$0
16	$0	$0	$0
17	$0	$0	$0
18	$0	$0	$0
19	$0	$0	$0
20	$0	$0	$0
			$34,941,518

Composting

Capital Cost	$3,000,000	Repayment	$540,000 p.a.
Useful Life	10 years		
Interest Rate	7.00%		
Admin Cost	5.00%		

Total Payment $5,241,228

Annual Payment over 10 years = $524,123 p.a.

Year	Capital Balance	Interest + Admin	Repayment
1	$3,000,000	$360,000	$540,000
2	$2,820,000	$338,400	$540,000
3	$2,618,400	$314,208	$540,000
4	$2,392,608	$287,113	$540,000
5	$2,139,721	$256,767	$540,000
6	$1,856,487	$222,778	$540,000
7	$1,539,266	$184,712	$540,000
8	$1,183,978	$142,077	$540,000
9	$786,055	$94,327	$540,000
10	$340,382	$40,846	$381,228
11	$0	$0	$0
12	$0	$0	$0
13	$0	$0	$0
14	$0	$0	$0
15	$0	$0	$0
16	$0	$0	$0
17	$0	$0	$0
18	$0	$0	$0
19	$0	$0	$0
20	$0	$0	$0
			$5,241,228

Dry/Torrefy

Capital Cost	$25,000,000	Repayment	$4,250,000 p.a.
Useful Life	10 years		
Interest Rate	7.00%		
Admin Cost	5.00%		

Total Payment $45,931,771

Annual Payment over 10 years = $4,593,177 p.a.

Year	Capital Balance	Interest + Admin	Repayment
1	$25,000,000	$3,000,000	$4,250,000
2	$23,750,000	$2,850,000	$4,250,000
3	$22,350,000	$2,682,000	$4,250,000
4	$20,782,000	$2,493,840	$4,250,000
5	$19,025,840	$2,283,101	$4,250,000
6	$17,058,941	$2,047,073	$4,250,000
7	$14,856,014	$1,782,722	$4,250,000
8	$12,388,735	$1,486,648	$4,250,000
9	$9,625,384	$1,155,046	$4,250,000
10	$6,530,430	$783,652	$4,250,000
11	$3,064,081	$367,690	$3,431,771
12	$0	$0	$0
13	$0	$0	$0
14	$0	$0	$0
15	$0	$0	$0
16	$0	$0	$0
17	$0	$0	$0
18	$0	$0	$0
19	$0	$0	$0
20	$0	$0	$0
			$45,931,771

Pyrolysis

Capital Cost	$25,000,000	Repayment	$4,500,000p.a.
Useful Life	10 years		
Interest Rate	7.00%		
Admin Cost	5.00%		

Total Payment $43,676,897

Annual Payment over 10 years = $4,367,690 p.a.

Year	Capital Balance	Interest	Repayment
1	$25,000,000	$3,000,000	$4,500,000
2	$23,500,000	$2,820,000	$4,500,000
3	$21,820,000	$2,618,400	$4,500,000
4	$19,938,400	$2,392,608	$4,500,000
5	$17,831,008	$2,139,721	$4,500,000
6	$15,470,729	$1,856,487	$4,500,000
7	$12,827,216	$1,539,266	$4,500,000
8	$9,866,482	$1,183,978	$4,500,000
9	$6,550,460	$786,055	$4,500,000
10	$2,836,516	$340,382	$3,176,897
11	$0	$0	$0
12	$0	$0	$0
13	$0	$0	$0
14	$0	$0	$0
15	$0	$0	$0
16	$0	$0	$0
17	$0	$0	$0
18	$0	$0	$0
19	$0	$0	$0
20	$0	$0	$0
			$43,676,897

Plastics

Capital Cost	$25,000,000	Repayment	$4,500,000p.a.
Useful Life	10 years		
Interest Rate	7.00%		
Admin Cost	5.00%		

Total Payment $43,676,897

Annual Payment over 10 years = $4,367,690 p.a.

Year	Capital Balance	Interest	Repayment
1	$25,000,000	$3,000,000	$4,500,000
2	$23,500,000	$2,820,000	$4,500,000
3	$21,820,000	$2,618,400	$4,500,000
4	$19,938,400	$2,392,608	$4,500,000
5	$17,831,008	$2,139,721	$4,500,000
6	$15,470,729	$1,856,487	$4,500,000
7	$12,827,216	$1,539,266	$4,500,000
8	$9,866,482	$1,183,978	$4,500,000
9	$6,550,460	$786,055	$4,500,000
10	$2,836,516	$340,382	$3,176,897
11	$0	$0	$0
12	$0	$0	$0
13	$0	$0	$0
14	$0	$0	$0
15	$0	$0	$0
16	$0	$0	$0
17	$0	$0	$0
18	$0	$0	$0
19	$0	$0	$0
20	$0	$0	$0
			$43,676,897

This page has been left blank intentionally

This page has been left blank intentionally

Western Sydney Regional Organisation of Councils Ltd
Street Address: Level 1, WSROC House
49 Campbell Street Blacktown NSW 2148
Postal Address: PO Box 63 Blacktown NSW 2148
Phone: (02) 9671 4333 | Email: info@wsroc.com.au