

**WASTE 2001 CONFERENCE
TOWARD RESOURCE MANAGEMENT**

**SHIFTING THE PARADIGM TO
RESOURCE MANAGEMENT**

A G Wright
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1. Introduction

The history of waste management has evolved from an initial quest for convenient disposal, through public health protection and, more recently, to increasing concern about local and global impacts on the environment. The traditional notion of waste as a potential resource faded with the relative affluence of the last 50 years, but has resurfaced with our modern regard for conservation of natural resources.

History shows that mankind's consumption of resources has outstripped the rate of population increase, and that discard rates roughly correlate with consumption rates. Despite reductions in per capita disposal rates in NSW, Europe and US disposal rates are on the rise. Turning back the tide of consumption is a tough challenge despite the urgings of green groups. A more appropriate challenge to take on is how best to meet the world's unrelenting urge to consume in ways that both conserve natural resources and reduce harm to the environment.

This was the essential premise of the Waste Inquiry undertaken by the New South Wales Government last year. The Report¹ painted a picture of what might be achieved by managing waste as a potential resource, and how best to go about the task; essentially a vision and a broad strategy for waste management in New South Wales. In this paper I want to tackle some of the tough implementation questions and offer some concrete suggestions to further clarify a way forward; essentially some of the strategic issues to be addressed and some structural considerations.

The unfolding debate has been informed by the Waste Inquiry Report and the Landfill Capacity/Demand Report², and numerous other inputs, including the work of NSW Waste Boards and the EPA. This has sharpened the focus on what ought to be done to manage waste as a potential resource. This paper argues that effective reform will require action on six main imperatives:

- (a) Leadership and institutional drive.
- (b) Valuing and incorporating environmental externalities.
- (c) A possible waste hierarchy.
- (d) Regional and local waste management strategy.
- (e) Encouraging uptake of new technologies and practices.
- (f) Building markets for the products of waste.

The paper provides suggestions to State and Regional governments and to the waste management industry on the above issues.

¹ Alternative Waste Management Technologies and Practices Inquiry. NSW Government. June 2000.

² Independent Public Assessment, Landfill Capacity and Demand. NSW Government. September 2000.

2. Leadership and Institutional Drive

Getting the strategic policy framework right and leadership arrangements in place is crucial to achieving sustained waste reform. We do not yet have all the tools developed sufficiently and in place to count on a fully market-based approach to bring about rapid technology and practice reform. Even if we could fully level the playing field, commercial interests may not coincide with the Government's agenda and priorities for waste reform.

In the circumstances, leadership and guidance is necessary to drive new ways of managing waste. In essence, NSW (and other States, for that matter) needs to establish waste management leadership and accountability for results at a level below the Minister for the Environment. Moreover, a far greater level of collaboration by industry participants is needed to bring about innovation in waste management practices for all sectors. That collaboration must be initiated by Government.

The way forward to bring about rapid action in New South Wales requires leadership action by the Government:

- Establish a statutory body, with expertise in waste strategy and management, to advise the Government **and** take accountability for achieving the Government's waste agenda. This body should take over, as well, the planning and management activities of the Waste Boards and the advisory role of SWAC. It should have a mandate covering all waste sectors (municipal, C&I, C&D).
- Reaffirm the role of the EPA in waste standard setting, regulation and independent policy advice to the Government.
- Determine a worthwhile role for Waste Service that results in a value addition to the waste management industry.
- Develop and promote new models of public sector/private sector collaboration and partnering for waste management advancement.

3. Valuing and Incorporating Environmental Externalities

Progressive take-up of innovative technologies and practices is highly dependent on comparative costs of new versus traditional approaches. The Waste Inquiry argued that the Section 88 disposal levy "... should be struck carefully to ensure that the costs and benefits of non-market externalities (particularly environmental ones) are internalised and become an explicit part of market-based waste management gate price decisions"³.

We argued that, in principle, a tax should apply, at varying levels, to all waste treatment technologies, not just landfill. Why? Because all the technology options have some form of environmental impact and the playing field will not be levelled by limiting the levy to one technology: landfill. Moreover, there is a massive difference in environmental impact between a poorly-run conventional wet landfill and a well-run bioreactor landfill with full leachate

³ Op Cit.

capture and treatment, and 90 per cent landfill gas capture for beneficial (green energy) use. Should each therefore incur an identical levy?

And what are the **relative** environmental impacts of the various biological and thermal alternative technologies? How do these compare with landfill?

Three types of environmental externalities are relevant:

- Local impacts – those that affect the surrounding environment, such as: water, air, and solids emissions; noise, odours and vermin.
- Global impacts – notably potential global warming impacts and long-term residual effects.
- Resource depletion impacts – usage of finite resources; and need to source and process new virgin resources.

There are two approaches worth considering: the first is based on a full analysis of *all impacts* for all technologies: the second is limited to a focus on *disposal* effects, recognising that the Section 88 levy is for the act of disposal (not specifically *landfill* and not *treatment*).

The first approach is based on the idea of a load-based licence concept. Each facility would be assessed for its impacts in the above three types of externalities. These externalities could be appropriately weighted and a “bottom-line” aggregate impact derived for each specific facility. If the task proved too challenging to accomplish with the precision necessary to distinguish between specific facilities, then a useful first approach might be to work at the level of technology types; eg, conventional landfills with gas capture, enclosed composting technologies, pyrolysis/gasification plants, etc.

The effect would be to reward those firms operating environmentally superior facilities, by enabling them to post relatively lower gate prices than less favourable facilities. The competitive advantage conferred in this way should result in market skew to superior technologies and a net improvement in the state of the environment.

The second approach, based on the idea that only *disposal* should incur the levy is more limited, but may be complex to administer. For a start the definition of disposal is open to many interpretations. If landfill burial with gas recovery for green energy is disposal, then what of in-vessel anaerobic digestion resulting in gas recovery for green energy? The main differences between the two technologies are the time taken and amount of energy captured, rather than the ultimate fate of the feedstock. The key issue here is conversion efficiency. Similar arguments surround thermal degradation of waste materials.

One way forward may be to designate landfilling (only) as disposal. In this scenario the levy would be applied to the portion of residual material ultimately landfilled following thermal or biological processing. The main problem with this concept is that it would tend to favour certain types of alternative technologies at the expense of other alternative technologies, ie those that produce more residual material.

The best way forward in the circumstances appears clearly to be the more complete load based licensing levy concept. The Government should investigate the issues by directing the EPA to undertake a feasibility study of the scheme outlined above.

4. A Possible Waste Hierarchy

The waste hierarchy serves an important advocative and guidance purpose. It, importantly, conveys some indication of the Government's attitude to the resource value of discarded materials. The increasing complexity of technologies and the variety of material configurations makes it important to regard the hierarchy as merely a rough guide, rather than a prescriptive command.

There is a continuing role for the hierarchy, however, and it ought to be made more complete to encompass practices not in place in 1995 when the current hierarchy was conceived.

How might a new waste hierarchy be configured?

Waste avoidance deserves to retain its place as the priority goal.

Avoidance is based on the idea of deliberately preventing the creation of waste in the first instance. Initiatives such as reduced packaging, cleaner production and native gardens contribute to waste avoidance. The extent of waste avoided cannot be directly measured, and our record as a community in avoiding waste creation is unclear.

"Waste avoidance is highly rewarding in terms of both environment and economic outcomes. It adds a critical dimension in limiting waste generation because it focuses on maximising resource productivity. Excessive packaging, discarded by retailers or by customers further along the value chain, is not only wasteful but adds to product and transport costs. The customer ultimately bears the resource manufacturing cost and the disposal or recycling and reprocessing cost. This is inefficient in economic terms and hardly responsible in environment terms."⁴

It is important that this issue becomes more fully a part of mainstream waste minimisation initiatives.

Product Reuse is an important part of any waste minimisation agenda. It deserves to retain its status on the hierarchy because it can be accomplished without reprocessing and often without transport. Reuse is product oriented rather than material oriented.

Material Recycling is a high value adding practice because material transformation takes place, without changing chemical composition. Recycling implies that the original general purpose for which the material was created is retained. Thus an important distinguishing benefit of recycling is that virgin materials are conserved. Numerous studies indicate that the total benefits of recycling outweigh the costs.

⁴ Op Cit.

Typical recycle materials are plastics, metals, glass, spoil and paper/cardboard. These materials are sourced from all sectors of the economy.

A new activity is proposed for insertion in the hierarchy below recycling. *Reprocessing* can be thought of as an activity in which the chemical composition of the feedstock material is transformed in a process that results in formation of new materials. Two classes of feedstock are relevant:

- Streamed materials, including organics (food, garden waste, paper, sewage sludge, timber) and synthetics (plastics, solvents, paints etc).
- Mixed residual waste, comprising varying proportions of organic, synthetic and inert materials in comingled configuration.

Both classes are, to varying extents, candidates for biological and thermal transformation. The actual process adopted to achieve the transformation is less important than the outcome (energy, compost or both). Thus it is inappropriate to nominate the process type as part of the hierarchy; better to describe the general act of reprocessing.

Moreover, the greater variation in value-added is not in the process type, but is more related to the quality of the feedstock. Source separated or streamed materials, such as food waste, can provide superior outcomes in energy production, through anaerobic digestion, or compost production, through enclosed composting. The German waste hierarchy supports this proposition. Energy recovery and compost production activities are ranked at equal status on the hierarchy, subject to the proviso that the thermal value of the subject waste is at least 11,000 kJ/kg, a combustion efficiency of at least 75 per cent is achieved, and the output heat is used productively.

With all the above in mind, and consistent with the strong Waste Inquiry support for maximum source separation and streaming, it is proposed that two rankings are established **within** *Reprocessing*:

- (a) Reprocessing of source separated, streamed materials.
- (b) Reprocessing of mixed residual waste.

The final rung in the hierarchy is rightly occupied by *Disposal*. Landfill is the main means of disposal in Australia, but conventional, mass-burn incineration (even with energy production as a side issue) also fits the disposal category. The key criterion distinguishing disposal from reprocessing is the predominant motivation inherent in the practice.

It should be recognised, however, that some incineration systems and some landfill processes, notably bioreactor landfills, can approach the conversion efficiency levels of some *reprocessing* technologies.

Thus the recommended waste hierarchy is as illustrated in Figure 1. The issues raised should be debated (briefly) and a final decision taken by the Government without further delay in order to provide guidance to the community and the waste management industry.

Figure 1. **Recommended Waste Hierarchy**

- Waste Avoidance
- Product Reuse
- Material Recycling
- Material Reprocessing
 - Source separated, streamered materials
 - Mixed residual waste
- Disposal
 - with energy recovery
 - without energy recovery.

5. Regional and Corporate Waste Management Strategy

Sustainable waste management strategy ought to be developed within the context of a triple bottom line perspective: economic, environment and social imperatives all taken into consideration to build a robust plan. And the plan must be capable of smooth transition to action on the ground.

At this level we need to move beyond the theoretical stuff of externalities and hierarchies, and determine how, in practical terms, to bring about management of waste as a potential resource. This is the real-world job of Corporations and Councils, and of regional coalitions of Councils, whether or not those coalitions happen to be called Waste Boards.

Two aspects of the strategy are important: the waste management plan; and the project delivery arrangements.

5.1. The Waste Management Plan

The plan ought to be driven by a vision and goals that are based on outcomes required and desired by the client. The plan must be owned by the client, not the technology or service providers. Clients should take advice from consultants, contractors and lawyers, but must ultimately be accountable for the outcomes that flow from their decisions.

The plan should be situation-based: founded on the reality of local waste composition; regional factor conditions and market opportunities; and the sustainability dynamics prevailing in the corporation or region. It follows that the plan should be based on integrated waste management concepts, where there is a clear linkage between strategy, practices and technologies. And also a clear linkage between waste streams, logistics, treatment technologies and markets for end products.

The client group needs to be armed with a clear understanding of the merits and drawbacks of commercially available solutions and technologies. The logical fit of prospective and practical solutions with the waste management plan is a vital consideration.

Next it is vital to translate corporate goals to project and contract objectives. Key considerations are:

- preferred risk allocation profile between client and contractor, bearing in mind that some risks are best managed by one party rather than the other;

- contract style, duration and delivery method, with particular attention to asset ownership and financing;
- policy issues, such as waste flow guarantees, and product beneficial use requirements, plant upgrades, etc.

5.2. Project Delivery Arrangements

Published Commercial Principles should guide contract arrangements for technology projects and service provision. The Commercial Principles should include:

- outcomes desired and required;
- the risk allocation and management plan;
- key contract provisions;
- project organisation and management.

The process of documenting these principles allows the implications of seemingly simple decisions to be thought out more fully. For instance, a preference for a relatively short duration contract period may inadvertently make uncompetitive those technologies that have higher capital costs and lower operating costs. Further, unintended consequences may also flow from decisions on which party should bear which risks.

When all the project delivery decisions are assembled in a set of Commercial Principles inconsistencies can be spotted and inappropriate arrangements deleted.

An important consideration is the relationship between client and contractor. The traditional adversarial contract has given way to arrangements based on partnering and alliance principles, where each party has a role and a recognised contribution to make as part of a team effort. This move is especially important given that the sorts of projects under consideration typically span 15 to 20 years.

6. Encouraging Uptake of New Technologies and Practices

Australian business and research organisations are highly capable at bringing together ideas and technologies from various sources to create innovative solutions. Governments and public sector agencies are not always fully supportive of these sorts of initiatives, preferring logically to fund proven technologies. We need, however, to find ways to move ideas through the development path to commercial success. The challenge has two main parts: incubation and development; and full-scale demonstration.

6.1. Incubation and Development of Innovations

Breakthrough innovations invariably stem from fundamental thought about an unfulfilled need or an inadequately performing product or service. The highly insightful imagining of a “better way” results in the perception of opportunity,

but is a long way from commercial application. The path from conception to commercialisation requires feet-on-the-ground testing, modification and development that reaches beyond research. Pouring more money into R&D establishments for basic research and urging them to commercialise the results may not be the most cost-effective way of creating innovations to manage waste as a resource.

Many brilliant ideas are born within the public and private sector organisations that operate in the waste industry. The industry has not been good at nurturing and developing ideas; testing variations within the theme and creating prototypes of products and services to objectively gauge potential performance.

The development phase in the innovation cycle requires diverse resources and considerable gestation time. Many setbacks are inevitable, and companies like 3M recognise this in their innovation policy.

The principal ingredients for a successful approach to creating the right conditions for ideas to be developed are:

- increased industry-wide collaboration during the incubation and development stage of innovation;
- recognition of the investment in time and resources required to commercialise breakthrough insights.

6.2. Facilitation of Demonstration Sites

The move from pilot success to full-scale commercial demonstration requires a leap of faith by innovators, sponsors and clients. Start-up risks are often considerable and the potential for stakeholder reputations to be damaged is as real as the potential for financial loss.

Whether the innovation is a technology, practice or service, the inaugural full-scale demonstration site will be relatively costly in capital and resources to build and commission. Selective grants can cushion the impact for innovators. But clever commercial arrangements are required to cover the extra commercial and personal reputation risks assumed by clients in backing start-up projects. Unproven innovations do pose political and personal risks for those who have the foresight to provide their support to demonstration projects.

The principles associated with facilitating demonstration of technologies, practices and services are similar:

- recognition that the first commercial demonstration site will be more costly to establish and commission than subsequent sites;
- recognition that the innovation may under perform the traditional approach in some ways – like cost, simplicity, etc – but offer distinctive advantages which are newly appealing to users;

- recognition that the existence of demonstration sites is critically important for the diffusion and uptake of innovations, and particularly important for scrutiny by potential international clients.

The NSW Government has recognised that the environment is part of the mainstream economic strategy and has been highly supportive of innovation. The Government should continue, and strengthen its resolve to tackle the waste challenge through partnerships between government, business and the community. This partnering and collaboration is vital to bring about innovative change.

7. Market Development

(This section draws heavily on the Waste Inquiry Report).

Market factors in many countries have received second order consideration in the management of waste as a resource. Markets for household recyclate have proved unstable during the last ten years, and prices have rarely matched costs of collecting, transporting and reprocessing recyclable materials. This is at least partly because pricing of virgin materials does not fully cover non-market factors such as non-renewable resource depletion and global warming effects.

The challenge of achieving significantly improved management of waste as a resource requires not only attention to supply side practices and technologies, but also a substantial and supportive effort to create markets and stabilise demand. The development and expansion of markets for recycled and reprocessed materials requires a coalition of effort by government, business and the broader community.

This section describes and assesses market development practices.

7.1. Alternative Recyclate Uses

Traditional dry recycling is founded on the loop concept of feeding recycled materials into like-product development. The quest for alternative uses for recyclate is based on the idea that diversification of end-use applications can help to strengthen and stabilise demand.

The general aim is to discover innovative uses which are diverse (to absorb economic fluctuations) and high in value (to increase returns). The challenge is to achieve the highest value overall portfolio for each resource stream. Several examples of alternative uses cited in the Waste Inquiry Report⁵ are worth considering:

- In glass recyclate, for example, highest value for uniform cullet is in reprocessing, but mixed cullet, of relatively low value, is finding applications in building and construction industries.
- Excess PET is being used successfully in clothing manufacture.

⁵ Op Cit.

- Recovered liquid paperboard is used in manufacture of industrial sheet/board products.
- Rail track ballast is being recycled successfully to manufacture aggregate for use in concrete and road base.

7.2. Standards

Market realities demand that recycled and reprocessed materials must compete with virgin materials. The broad concept of best value for money is applied by product manufacturers as a long run issue. Price, utility, quality and delivery are the critical mix that manufacturers seek to optimise.

The quality framework is fundamental to winning the confidence of the various purchasers engaged in the product value chain. Although business supplier to business buyer specifications exist, there is no broad system of Australian standards for end products comprising inputs of recycled or reprocessed materials. Moreover, if NSW recycle is to compete in an increasingly global marketplace, then formal quality standards will be a requirement.

Quality standards are not only appropriate at end product stage. There is a need for greater transparency and an array of choices of various stages in the value chain:

- recyclable materials supplied to MRF for sorting;
- material supplied to reprocessor (eg mixed polymer, single polymer streams etc);
- material supplied to manufacturers.

7.3. Industry Responsibility

Many participants in the waste management chain argue that waste volumes will not decline until the original generators of the material that becomes waste are responsible for managing it until its full life cycle is complete. Formally termed “cradle to grave” and now called “cradle to cradle” because of the implicit eye toward recycling.

Some nations are legislating for “extended producer responsibility” (eg, Germany), others are adopting primarily voluntary approaches (eg, USA). Either way, effective programs are stimulating innovation in production and distribution for participating sectors. Companies like BMW, Bosch, Miele, Whirlpool, IBM and Fuji-Xerox demonstrate that product stewardship can be accomplished in a context of maintaining or enhancing a firm’s competitive position.

NSW needs a policy on Industry Responsibility. Although largely a national issue, there is every reason to start the national leadership at State level.

8. Conclusions

Shifting the paradigm toward resource management requires leadership by governments and commitment by the waste management industry and the community. New South Wales is well positioned to complete the move which is already well underway. The current review of waste legislation provides an important opportunity for further advance. The current review has been informed by various Inquiries, studies and submissions. This paper provides some further suggestions for debate.