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**SETTING THE CONTEXT FOR
ALTERNATIVE WASTE TECHNOLOGIES**

by

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Abstract

For many Local Government Councils, and an emerging number of private sector waste managers, alternative waste technologies are seen as a panacea to offset the social and environmental risks associated with landfill-based waste management systems. Landfills are progressively perceived to be inappropriate in or near major population centres and are not considered a preferred option for maximising resource recovery.

However, moving from a landfill-based system to one which includes waste processing is not a simple matter of “going to the market” to see what is on offer. Until the waste generator or waste manager establishes a context within which waste processing technologies are to be implemented, there is no sound or uniform basis to approach the market, and no common ground on which the market can respond.

Too often, approaches have been made to the market for expressions of interest and tenders, which yield a mixed variety of responses, and the absence of a basis for meaningful comparison – with the initiator rarely considering whether they had asked the right question in the first place. A dual consequence of this premature approach to the market is disillusioned Council staff and despondent service providers – since both parties will have invested considerable effort and cost into a process that was flawed from the outset.

Between the current systems that embrace recycling and disposal, and a future system that encompasses waste processing, there are multiple issues that need to be considered before the market can be productively engaged. It is essential that there is a clear understanding of the strategic waste management options available, and the social, environmental, risk and economic implications of each option.

Aside from the direct costs and benefits of the options, logistics issues need to be considered in framing the best strategic direction for the community or business. Transport and handling costs can be highly variable between options in both collecting waste and transporting products to market. Consideration of logistics options cannot be contemplated in the absence of a contextual setting.

Both waste and resource management options, and logistics options need to be developed within the framework of a broad purpose or vision and a set of reasonably firm objectives. And in developing those options, there is sufficient reliable information currently available on costs and implications to evaluate the options and determine a preferred *Strategic Direction* before going to the market for expressions of interest or tenders.

Establishing a *Strategic Direction* before going to the market for alternative waste processing technologies, will:

- permit greater clarity to be established in the questions asked of the market,
- establish clear rationale for evaluating the received proposals from the market,
- clarify the logistics arrangements for moving and handling materials, and



- set in place the foundations of the commercial basis of future relationships between the client and the preferred service provider.

Introduction

Communities are becoming increasingly concerned with the level of mixed waste disposal that occurs. There are two primary drivers that are fuelling this concern:

- a growing level of aversion to landfill disposal in near-residential environs,
and
- a growing interest in greater levels of resource recovery from waste streams.

To varying degrees, current waste management technologies and practices work towards addressing these two drivers. For example:

- kerbside recycling of paper and containers,
- garden waste collection and processing,
- C&D waste recovery and recycling,
- commercial recycling programs for paper, cardboard and glass.

But even with these initiatives, the overall extent of resource recovery rarely exceeds 30 percent.

There are strong indications that communities want to go further and make additional in-roads on the amount of waste that is disposed and to reduce the quantity of resources that are lost from the economy. And there is clear evidence of a preparedness to invest further effort, and to pay additional fees, to see these concerns addressed.

However, addressing this concern is not simply a matter of introducing alternative waste technologies. There are no simple fixes to tackle residual waste and achieve a rapid reversal in resource recovery. Some early forays into sustainable waste management simply focusing on alternative waste technologies appear to support this view and do not appear to be delivering on expectations.

An Essential Foundation

Based on a number of advisory and consulting assignments, the authors are of the view that this failure to deliver on expectations is most often related to the absence of Strategic Direction on the part of the relevant Council or waste management authority. Commonly, Councils will have a waste management plan, which outlines the activities that will be introduced to manage waste and resource recovery, but such plans are often without any over-arching Strategic Direction, i.e. clear objectives and a robust strategy.

In many instances these plans may be very comprehensive and include all activities of waste collection, disposal, recycling and resource recovery. However comprehensive these plans, without a clear strategy the elements of the waste management plan are unlikely to deliver adequately on community expectations.

Establishing a Strategic Direction for waste management and resource recovery supports Council and the community with a vision and a framework within which future waste management and resource recovery activities can be determined and



implemented. Without such a context tool, initiatives to implement new technologies and practices are at best ad hoc, at worst nacent financial disasters, and most unlikely to deliver on the concerns of the community.

The Strategic Direction for a community is owned by the elected members of Council, and developed through consultation with the community, and with technical advice from Council officers. It captures the desire of the community for change, the preparedness of the community to pay, and the level of tolerance of the community to contribute towards the expected outcomes.

Most importantly, the Strategic Direction a Council determines in respect of waste management and resource recovery is not a detailed “how to” plan, but a high-level ideal of where the community wants to go and broadly how to get there.

Differentiating between high-level Strategic Direction and operational-level planning is critical, because in waste management each activity involves varying degrees of commitment and differing degrees in outcome. For example, with recycling it is now well understood that it is not simply a matter of introducing kerbside recycling. Instead it is essential to understand the vision that the community wants to achieve and is prepared to work towards. From this vision a strategy can be designed and then the market can be approached for tenders for a clearly articulated service.

Understanding the *vision* or ideal objective of the community is essentially at the strategic direction level, while *designing the system* and *calling tenders* fall within the function of operational-level planning. It is quite clear, that effective tenders cannot be called if Council has not fully designed the strategy that is likely to deliver on the community’s expectations.

Including The Whole Community

In this paper, the term “*community*” is inclusive of both the domestic and business sectors, because in an integrated system for waste management and resource recovery both elements of the community must be included.

This situation is more critical in non-metropolitan regions than for metropolitan areas. In the non-metropolitan region, Council usually owns the disposal facility, and the business community often generates up to half of the total waste stream that requires management. For these Councils it is not sufficient to focus only on the traditional domestic sector customers, for no matter how dilligent Council and the domestic community might be in resource recovery and waste minimisation, left uninvolved, the business community will still demand disposal space and continue to waste resources – thus not delivering effectively on the overall expectations of the community.

Thus, when considering both the desires and commitments of the community, it is essential that due consideration be given to the roles and responsibilities of both the business and domestic sections of the community.

Dimensions for Options

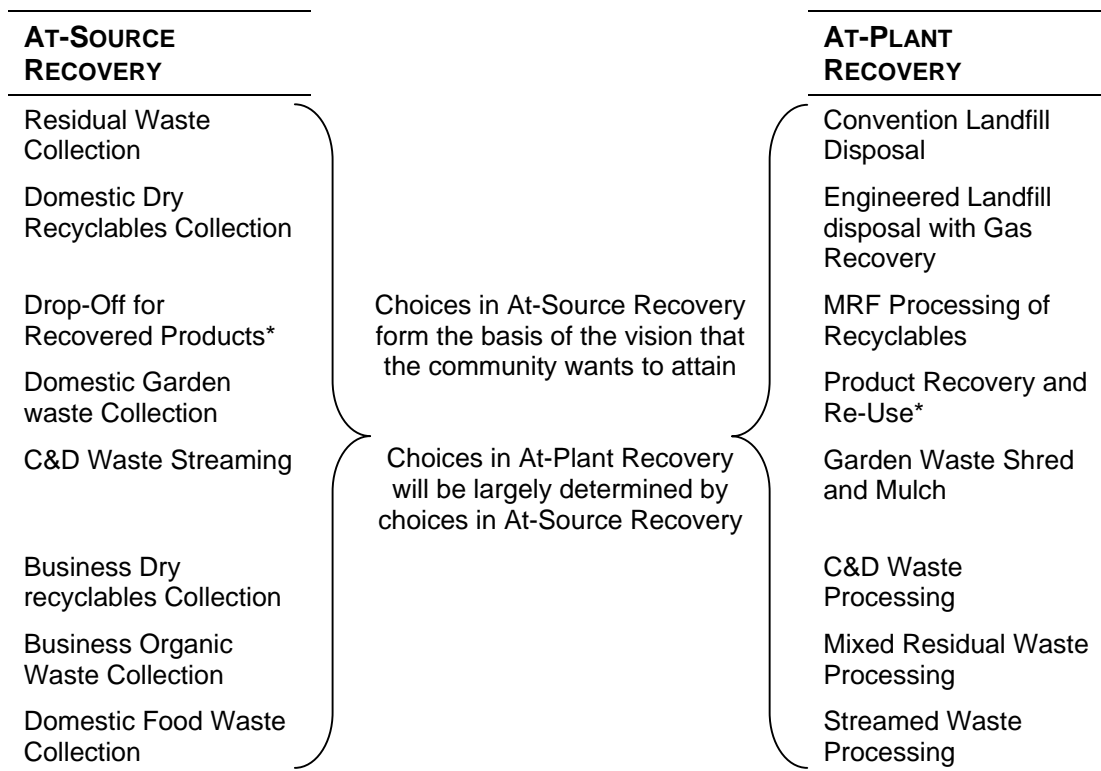
The criticality of high-level Strategic Direction is highlighted below in considering options for improving performance in waste management and resource recovery. Here, two fundamental dimensions can be considered:



- **At-Source Recovery** – where waste generators expend increasing levels of effort and internal cost to source separate recoverable resources and hazardous items from residual wastes, and where separate recovery and logistics systems are used to collate the various resource and waste streams;
and
- **At-Plant Recovery** – where waste managers expend increasing levels of financial and human resources to recover saleable materials from the streams of wastes, to recovered resources presented by the waste generators, and to reduce the toxicity and quantity of disposed residuals.

For a non-metropolitan Council (*see note below), Figure 1 depicts these two dimensions and the typical activities of at-source recovery and at-plant recovery.

Figure 1 Dimensions for Options



***Note:** Figure 1 depicts a situation typical for a non-metropolitan Council, where it is common to see Council organised drop-off centres as an early progression in higher levels of resource recovery than is normally the case for metropolitan Councils.

As Council establishes its vision in respect of the specific at-source recovery options that will deliver on community expectations, so corresponding at-plant recovery options become appropriate. With that clarity, it is then possible to approach the market with a level of confidence that comparable tenders can be received and assessed.

At-Source Recovery Options

The at-source recovery options highlighted in Figure 1 cover residual waste collection through to relatively high levels of source separation and community involvement in



resource recovery. And each option can be implemented to varying degrees in a somewhat cumulative manner, depending on the level of community support. The options and degrees of implementation are discussed below, along with the ramifications for appropriate at-plant recovery systems.

Residual Waste Collection – this represents the residual waste stream disposed of by waste generators. The characteristics of this waste stream will be a direct function of the at-source recovery activities implemented. In instances where little or no at-source recovery activities are involved, the residual waste stream will contain all manner of organic, inorganic, hazardous substances, metals and recyclables. Conversely, where high levels of at-source recovery are implemented, the nature of the residual waste stream will contain less organics, less recyclables, and less hazardous substances etc.

Options available for at-plant recovery activities for residual waste and the quantity, quality and value of the products recovered, will be determined by the extent of at-source recovery. For example, where extensive at-source recovery is implemented, including the recovery and collection of food and organic waste, there may be little point in introducing any form of biological processing for the residual waste, other than possibly for the purpose of volume reduction before landfill disposal. Instead, a refuse derived fuel process may be one of the few appropriate alternatives to landfill disposal.

On the other hand, where little or no at-source recovery is in place, the available options for at-plant recovery processes open up considerably. In such an instance, at-plant recovery systems should be selected which have the capacity to identify and remove hazardous substances, recover recyclables and metals, beneficially extract the organic fraction and derive energy from the combustible inorganics.

Domestic Dry Recyclables Collection – the options available for dry recyclables collection vary from a single fully-comingled bin system, requiring very little effort by waste generators in at-source separation, through split bins, to multiple bins, each of which require additional effort and commitment by waste generators. And each of which requires different cost commitments for implementation.

As with residual waste, the at-plant recovery systems available, coupled with the quality, quantity and value of recovered products will depend on the level of at-source separation.

Drop-Off for Recoverable Products – in many non-metropolitan communities Council provided drop-off facilities afford the community opportunity to at-source separate hazardous materials and products that can be reused. Such Council provided facilities are less common in metropolitan areas, however, the network of charitable institutions that receive and on-sell re-usable products is extensive and well patronised across the community.

This activity can be significantly increased in all communities, and there is considerable potential to integrate extended producer responsibility (EPR) programs into community based drop-off systems.

The options for the ownership, configuration and services offered at drop-off centers are multiple, as are the opportunities for high-level of business involvement in such centers, where they are seen to comprehensively support EPR initiatives.



For waste managers, the type of center for processing recoverable products, and the value-adding activities associated with those centers will be a function of the products permitted for drop-off and the level of community support for both at-source recovery followed by self-haul drop-off, and community acceptability for the purchase and re-use of products.

Domestic Garden Waste Collection – at-source separation and collection of garden waste facilitates shredding, mulching and possibly compost options for at-plant recovery. While, removal of garden waste from domestic waste reduces the amount of organic material remaining, in turn influences the possible options available for at-plant recovery.

C&D Waste Streaming – in general, this material acts as a contaminant in residual waste streams and increases losses in at-plant recovery systems dealing with residual waste. At-source separation of C&D material is well-established practice in the demolition sector, to a lesser extent in the mainstream building and construction sector, and to a significantly lower extent with small builders and households.

This at-source separation in the demolition industry was driven on economic grounds, and in the process has established a critical mass for an emerging C&D reprocessing sector. This in turn attracts more at-source separated C&D material, which will lead to improved processing operations for at-plant recovery systems dealing with the residual waste streams from which the C&D material has been recovered at source. With improved process operations and recovery, the quantity, quality and value of recovered resources increases.

Business Dry Recyclables Collection – already there is considerable activity in the business community recovering paper, cardboard and glass. However, for many non-metropolitan communities, there is considerable scope for Councils to extend their domestic kerbside collection of dry recyclables into the business community – in particular to small businesses that are situated along existing domestic collection routes.

Increased at-source recovery of dry recyclables in the business community will extend existing practices from home into the workplace, and in the process increase employee awareness to further opportunities for at-source separation in their weekday places of employment.

While the level of recoverable resources from business dry recyclables is not expected to be significant, the potential for flow-on changes in at-source separation practices is extensive. In addition, removal of dry recyclables from business residual waste will reduce the need for recovery of such materials in at-plant recovery processes, thus reducing operating costs and improving operating efficiency.

Business Organic Waste Collection – this is typical of a flow-on at-source recovery activity that could arise from heightened awareness through including businesses in dry recycling collection schemes. In addition, where market condition prevail, at-source separation of organic wastes from businesses can be driven by economic expediency – as is seen recently in metropolitan Sydney.

Once again, removal of organic waste from the business residual waste stream will change the nature of that stream and thus affect the options available for at-plant recovery processing.



Domestic Food Waste Collection – as with at-source recovery of organics in the business community, engaging the domestic community in this activity will significantly increase the amount of organics recovered, it will improve both the quality and value of recovered products from at-plant recovery systems and enhance the overall financial benefits.

In addition, with the bulk of organics removed from residual domestic waste the options suitable for subsequent at-plant recovery are limited, as discussed earlier.

At-Plant Recovery Options

As highlighted above, the options available for at-plant recovery activities will be significantly determined by the level and extent of at-source recovery implemented. The options identified in Figure 1 range from basic landfill disposal of waste with no attempt at resource recovery through to comprehensive processing of recovered resources and residual wastes to significantly reduce the amount of waste finally disposed.

The key to selecting options for at-plant recovery will be the vision set by Council in the at-source recovery desired by the community. In the absence of any Strategic Direction with respect to at-source recovery, selection of at-plant recovery options is very ad hoc and unlikely to be integrated into a total effective system.

Investigating The Options

To support the process of determining the options for improving performance in waste management and resource recovery, Council should be presented with assessment of the options under several criteria, including:

- the level of resource recovery to beneficial products,
- the environmental impacts,
- the net financial cost,
- the extent of community commitment required, and
- the associated risks to Council and the community.

In reviewing non-financial criteria, inevitably a level of subjectivity is introduced into the creation of the vision and Strategic Direction. And, it is important to note that, in general, higher levels of benefit or return in the areas of non-financial criteria, often lead to higher financial cost to the community through the internalisation of external costs.

Some aspects relating to each of these criteria, in the context of both at-source and at-plant recovery options, are discussed below.

Level of Resource Recovery – the potential to recover saleable products in good quantity and quality, and with good market value, is significantly enhanced as the community is engaged in higher levels of at-source separation. The community is engaged in streaming targetes resources and reducing the level of contaminants.

With greater at-source separation, cleaner streams of resources can be recovered from waste generators and directed to dedicated at-plant recovery systems that can increasingly expect homogeneous feedstocks. This will simplify processing



demands, reduce contamination, enhance recoveries and lead to higher value products.

While increasing the extent of at-source recovery has attractions in respect of achieving higher levels of resource recovery, this must be tested against the level of community commitment and the likely financial cost.

Environmental Impacts – environmental impacts arise through multiple avenues, such as the quantity and toxicity of waste disposed to landfill; the level of resource recovery; the potential for greenhouse gas emissions; the potential for odour, water and noise emissions to the receiving environment; premature discard of resources.

In general, the higher the level of at-source recovery, the environmental benefits relating to resource recovery, toxicity reduction, and improved control over emissions will be greater. Equally, the higher the level of at-plant recovery, similar improvement in environmental benefits will be seen, coupled with reduced demand for replacement resources and products.

Tempering this pursuit of high levels of recovery will be the additional transport impacts of multiple collections and delivery of products to markets.

Net Financial Cost – the financial cost of the system is not directly affected by additional effort input by waste generators in at-source recovery activities. For the domestic community, these costs are absorbed by the household. For the business community, additional costs may be partially off-set by lower costs for waste removal, while that fraction of cost which remains outstanding may eventually be passed on to consumers through higher prices, but not directly affect the financial cost of the system.

Partially off-setting these absorbed costs will be increased system costs for additional transport in collecting (non-self haul) multiple streams of materials and wastes from generators.

In general, the cost of at-plant recovery will increase as higher levels of recovery are implemented. However, when coupled with increased at-source recovery, it is reasonable to expect that the net financial cost of at-plant recovery will be moderated through cleaner streams of materials being presented, lower operating costs, higher yields, improved quality in products and enhanced sale prices for products.

Extent of Community Commitment – community commitment increases in direct proportion to the degree of at-source recovery implemented. And this is further increased in those instances where self-haul is the mode of transport used to convey the materials from the home or business to the waste management facility.

There is also additional commitment required on the part of the community as the level of at-plant recovery is increased. If higher level at-plant recovery systems are to operate effectively, then greater diligence is required on the part of the community to keep contamination levels low to facilitate effective plant performance.

Associated Risks to Council – principal risks faced by Council, and indirectly the community, arise in areas such as:

- technical – operational, OH&S,
- environmental – emissions, long-term effects,
- social – acceptability, amenity impact,



- financial – costs to community, and
- reputation – exposure to failure.

For each activity in at-source recovery and at-plant recovery an assessment of risk should include consideration of the combined probability and consequence of an unsatisfactory outcome or poor operating performance.

It is feasible through contractual arrangements to allocate many of the risks associated with at-plant recovery activities, but these must be considered on a case by case basis.

Even with risk sharing, there will always be some collateral risk accrual to Council.

Conclusions

Implementing alternative waste technologies is not a simple matter of “going to the market” for proposals to manage waste other than via landfill disposal. The most critical issue for seeking expressions of interest or tenders from the market is to fully understand what the market is being approached to provide.

As the number of alternative waste technology service providers increases, so Councils can expect higher frequency in the number of approaches from the market to show, demonstrate, display the respective technologies. Unless Council has a clear direction in which to proceed, entertaining such meetings or demonstrations is relatively meaningless and a joint waste of time.

Over the last two years there are numerous reported instances where the market has been approached with ambivalent and/or confusing requests in respect of alternative waste technologies. In the majority of those instances, the consequence has been ambivalent and/or confusing responses from the market which satisfy no one.

In this paper the authors have tried to emphasis the value of setting clear Strategic Directions as to the extent of at-source recovery that the community is prepared to commit to and pay for. Having established this Strategic Direction, options on the most suitable alternative waste technologies and practices become relatively straight forward, permitting coherent requests to be put to the market.