

# Energy from Waste

- The concept
- The issues and complications
- A practical version for consideration

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## The Concept

$$E = mc^2$$

or...



## The Concept

Spot the difference

$$E = wc^2$$

Sorry Albert.



# EfW as thermal disposal

This landfill



to this incinerator.

Is this what we really want?



# Swings & Roundabouts

## The Concept

### The Swings



Thermal disposal achieves

- 70-75% volume reduction (landfill avoidance)
- Sanitises the wastes
- Provides a net heat source
  - Heating
  - Power
  - Both



# Swings & Roundabouts

## The Concept

But creates



- Difficult/indeterminate – emissions
- Difficult/indeterminate – fly ash
- Difficult/indeterminate – bottom ash
- Binary fate for wastes
- High capital cost, especially with modern gas clean up to provide essential environmental protection – which needs assured supply

**Could it be argued that the energy and volume reduction come at too high a price?**



## The Concept

- Can we optimise the swings whilst avoiding the roundabouts?
- Intuitively we can understand that there are materials in urban wastes that have no higher net resource value (HNRV) than to be converted for the CV.
  - How to identify and present them?
  - How to most appropriately convert them?
  - How to optimise the value of the energy created?
  - How to present the “contaminants” as valuable resources?



# Give unto Caesar what is Caesar's

## The Issues

- **If:**  $E = wc^2$  points to the need to optimise a material's resource value before taking the binary decision to convert that resource for its inherent CV,
- **Then:** the outcome is derived by balancing the:-
  - CV, and avoided disposal cost, with
  - the cost /impact of sorting, streaming, separating like materials

And an assumed value (opportunity cost) for retaining the material in its current form – for short, medium or long term applications (markets, technology, shortages etc.)



**“Waste” may be worth more live than dead.**



# Stakeholder Issues

## The Issues

**Regulator** – environmental protection - an absolute

➤ Standard fuels – homogeneous = manageable

➤ Non-standard fuels – heterogeneous = trouble!!

(If you don't know what went in, how can you be sure of what will come out?)

➤ Concerns with compliance once licence granted!

**Green Lobby** – as above, plus:-

– Don't waste the waste – HNRV

– Tail wags the dog

– Thin end of the wedge

**Waste Collectors** – minimise disposal costs

– simplify sorting/streaming requirements



# Stakeholder Issues contd.

## The Issues

### Energy/power end users

- Lower existing fuel costs after capital servicing for new handling systems and any inherent “quality”, “reliability” risks
- Need for
  - “products” not “wastes”
  - Reliable supply of products on spec., on time, no matter what

### Summary

**At any scale, such options will require a “Community Licence to Operate” and that needs a balanced response.**

**(This issue needs much more than an engineered solution).**



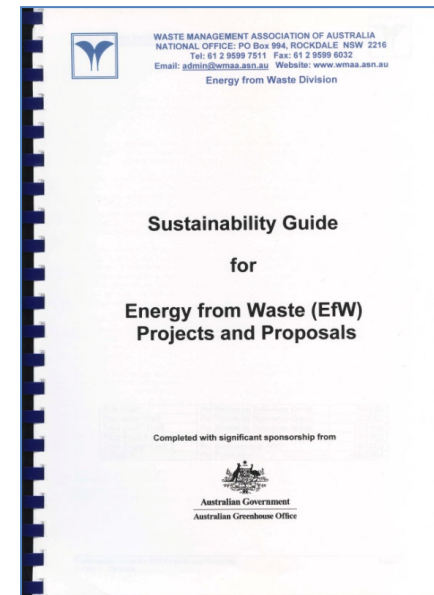
# These Issues have been thoroughly considered before

## WMAA EfW Sustainability Guide

([http://www.wmaa.asn.au/director/divisions/energy\\_from\\_waste/EFWGuideline.cfm](http://www.wmaa.asn.au/director/divisions/energy_from_waste/EFWGuideline.cfm))

### Project 2003/04

- \$500,000 cash & in-kind
- Visited 12 cities for 2 day forums
- 15 person editorial committee
- 46 person reference group
- At least 360 actively involved contributors

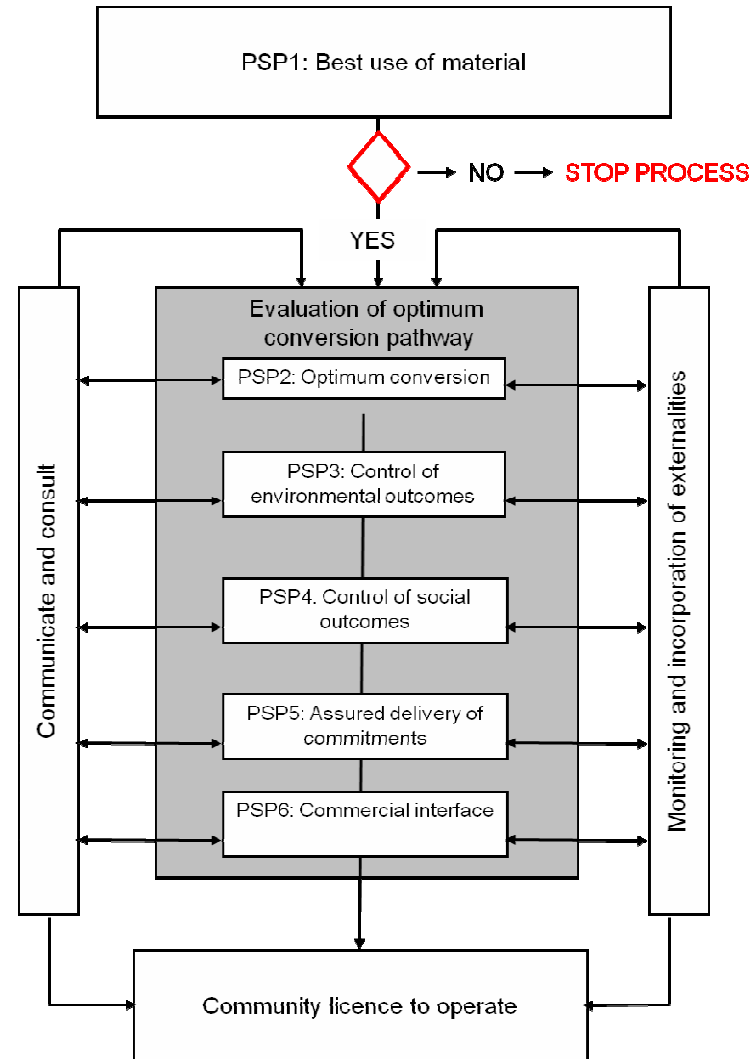


**“The Sustainability Guide is intended to help the community, government and industry stakeholders know when it is acceptable to conserve materials presenting as urban “wastes” in something close to their original form and when to convert them to energy through a variety of processes”.**



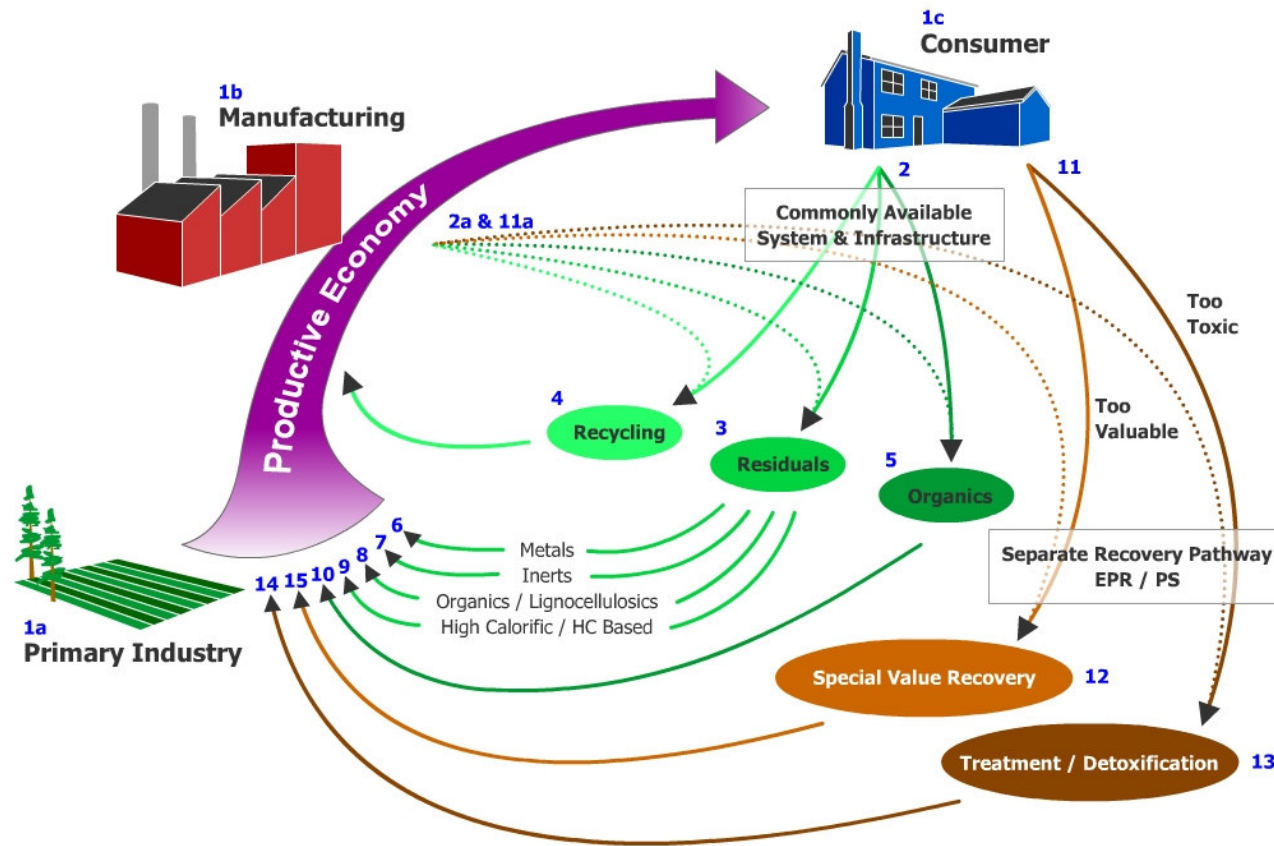
# The Issues

## Assessment Decision Tree



# The Issues

What are these wastes we want to extract the energy from?



Schematic for Urban Solid Waste Generation



# The Issues

- 1) Biomass based materials
  - Clean wood waste
  - Mixed wood waste (treated/engineered)
  - Clean moist organics
  - Mixed moist organics (residual)
    - Food
    - Garden
    - Paper/cardboard
    - Contaminants

Each suggesting a different market or end use and therefore a different conversion pathway and technology.



# The Issues

## 2) Hydrocarbon/High Calorific fraction

- Mixed plastics (after polymer sorting)
  - Residual plastics and textiles, rubbers and synthetics
  - Residual plastics and textiles, rubbers and synthetics plus paper/cardboard/wood/other
- 
- Separated/streamed – different markets, end uses apparent.
  - Mixed up – heterogeneity requires failsafe emissions control



# Commercial Drivers

# The Issues

1. Existing cost structures

➤ Mitigation of disposal costs - Current

2. Carbon constraints

- Emerging

3. Resource depletion issues

- Emerging

} The Sustainability  
Agenda





# Change of Focus

## Some Ideas

**From:** Energy salvage as a by-product of a waste disposal strategy

**To:** Optimised resource and energy value realisation as an alternative to disposal

**How?:** Focus on tailoring process to meet new and existing market demand

Thermal processing (>100°C) can be adopted as advanced sorting/processing/value recovery options when mechanical/biological have reached the limits of their practicality.



# An industry in transition

## Some Ideas

### “Waste Industry”

- Paid to receive / collect , stream and sort to provide low cost broad spectrum industrial inputs or
- Pay to dispose

### “Missing link”

Nascent resource recovery sector to make the necessary commercial and strategic connections

### Product Manufacturers

- Paid to be reliable suppliers of assured quality products (& energy)
- Pay to acquire resources



## Some Ideas

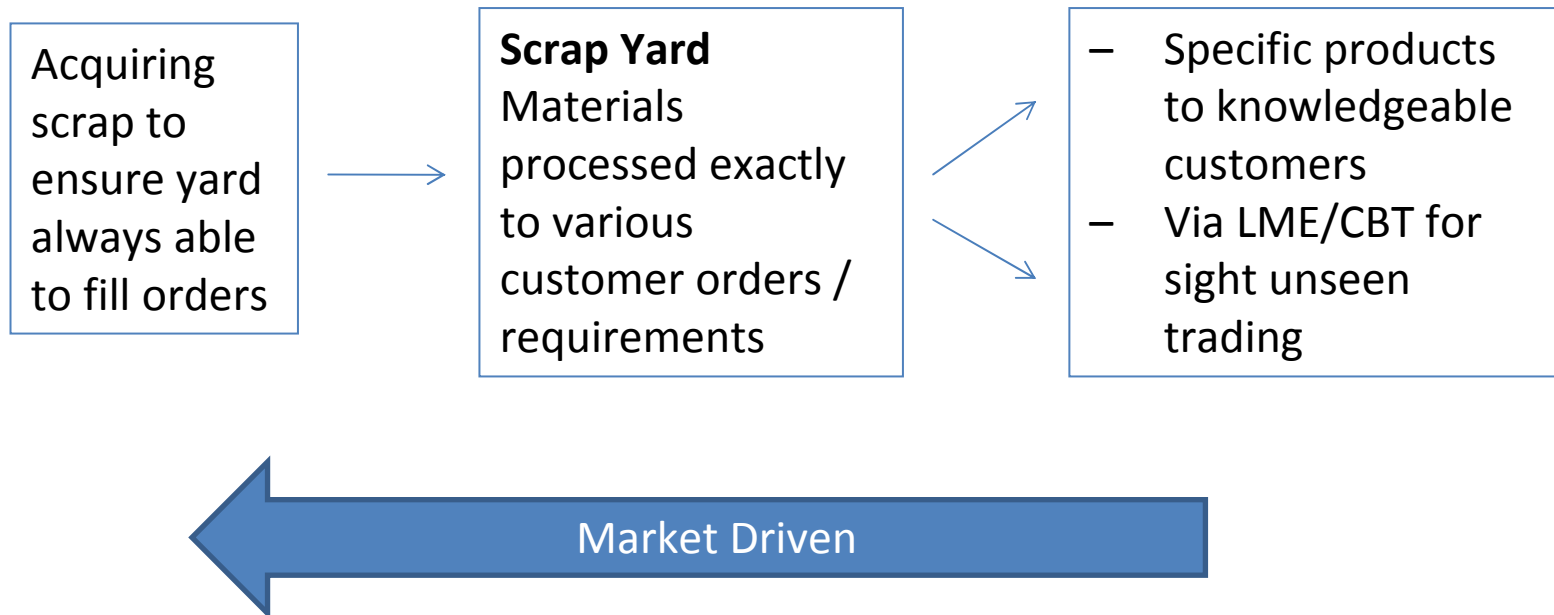
### **To expand on the “Missing link” requirements**

- To supply quality materials to manufacturers
  - To precise specifications
  - To volume/quantity contracted/required
  - With complete reliability
  - To price benchmarked against virgin/alternative supply

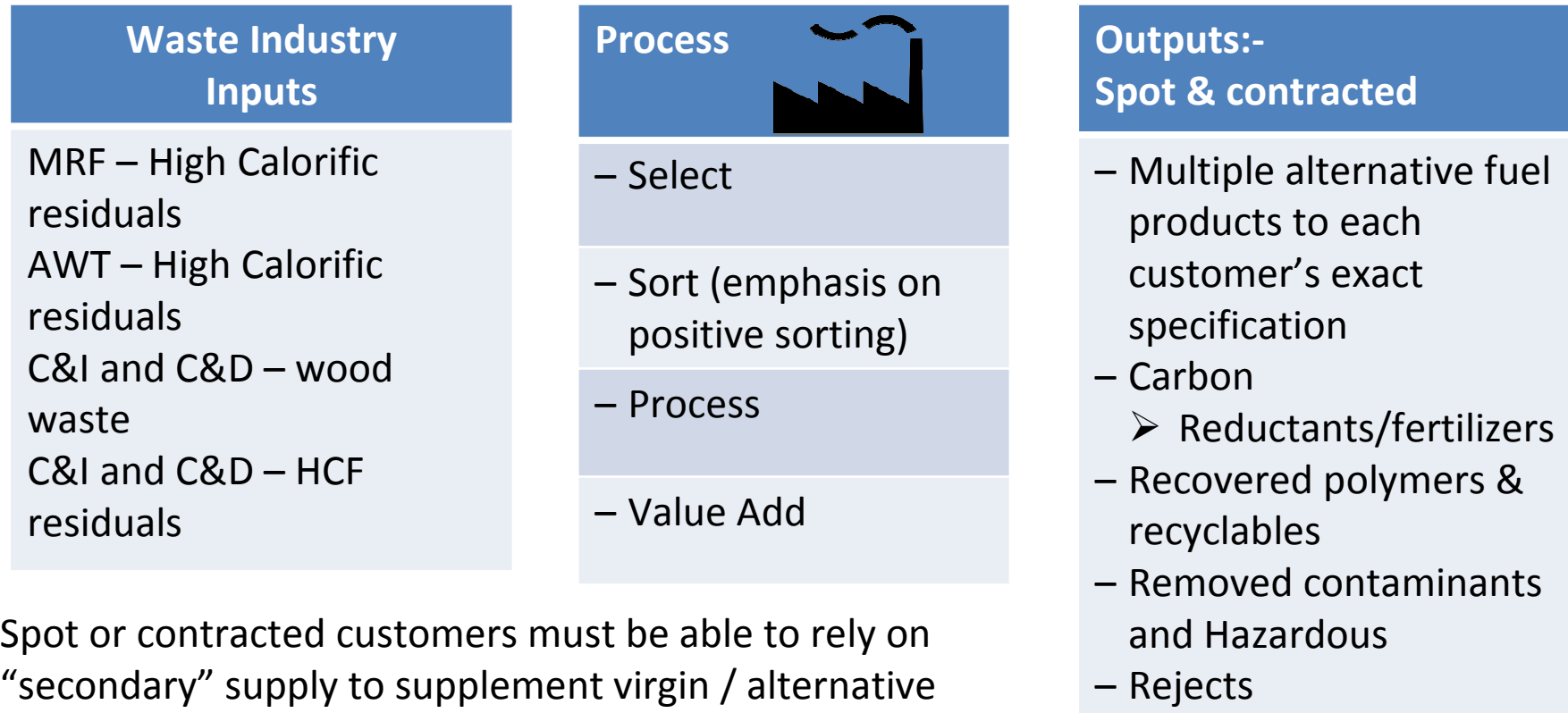
**Challenging to do when the ultimate source is indeterminate “wastes”.**



## Example – Scrap sector



## Why not a similar model for a sustainable EfW sector



Spot or contracted customers must be able to rely on “secondary” supply to supplement virgin / alternative supplies to meet their production schedules.



# Stakeholder Concerns Addressed

## **Regulator's Concern:**

–Absolute environmental protection

## **Outcome:**

–Fit for purpose products to customers whose primary function is making quality assured products – not getting rid of wastes at lowest cost.

–Customers with existing licences and operating parameters that they have no desire to breach or alter – so QA is built in.

–Heterogeneity issues addressed by processor.



# Stakeholder Concerns Addressed

## Green Lobby's Concern:

–Application of materials to highest and best use

## Outcome:

–Processor core function to direct all materials received to highest and best use – even carry over direct recyclables

–The lower Capex approach is best serviced by passing all materials to highest and best use and encouraging “suppliers” to present materials as streamered and sorted as possible.

Also:-

–No direct access to “fiery furnace” for the initial collector to avoid conflicted motives.



# Stakeholder Concerns Addressed

## **Waste Collectors' Concern:**

–Convenient link/feed in to sustainable end markets

## **Outcome:**

–Have a convenient destination for partially sorted, streamered or semi-processed materials that is less than disposal

–Allows them to concentrate on core business (collecting/receiving/sorting/streaming) without needing to learn whole new disciplines of meeting end user product vagaries.





# Stakeholder Concerns Addressed

## End Users' Concern:

–Alternative supplies not sufficiently reliable by quality, quantity, price, certainty to underpin their own demand for assurance to the market.

## Outcome:

- They get a reliable alternative supply of energy product that can offset/supplement virgin supply reliability.
- Special purpose, dedicated facilities could be supported by such reliable fuel sources.



## Outcomes:

## Some Ideas

–Just as scrap generators work through scrap traders/brokers for best outcomes, so too the “specialist processor” model provides value to end users and generators and can more readily acquire a “Community Licence to Operate”.

–**Plus** the wide range of applications opens up defined niches for technology developers and generators without either needing to try to provide the whole supply chain solution.

A fully functioning complex Industrial Ecology should emerge that is always flexible and responsive to market needs and that doesn't sink all its financial, social and technical capital into a single solution incinerator response.

