Supplementary
Submission
No 150a

INQUIRY INTO 'ENERGY FROM WASTE' TECHNOLOGY

Organisation: WSROC

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Advocating for the people of Western Sydney

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The Hon. Paul Green, MLC
Chair – Energy from Waste Technology Inquiry
Parliament House
Macquarie Street
SYDNEY NSW 2000

Briefing paper for Energy from Waste in Western Sydney.

Dear Paul,

Attached is a report commissioned by WSROC into the Energy from Waste Regulatory environment with a brief analysis of opportunities for local Government in Western Sydney.

WSROC appreciates that a majority of the domestic waste stream to service an Energy from Waste facility in Sydney is under the control of Local Government. It also appreciates that substantial community concerns over such a facility being built within an urban area has been expressed via several public forums. For these reasons, it may be entirely appropriate that Local Government will be more intimately involved in the planning and delivery of these facilities in the foreseeable future as is the case in several jurisdictions in Europe.

While we await the outcomes of the current proposal for the large facility to be located at Eastern Creek we draw your attention to the need for these "regional" scale facilities to attract appropriate attention from regulatory, planning and environmental perspectives.

It may well be the case that the first of these facilities may be facilitated through a public-private partnership in due course.

Yours sincerely,

Charles Casuscelli RFD
CEO

Briefing paper for Energy from Waste in Western Sydney

A submission to the WSROC

23 June 2017

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Disclaimer

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Glossary

Abbreviation	Definition
ABS	Australian Bureau of Statistics
ACCUs	Australian Carbon Credit Units
AWT	Alternative Waste Treatment
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BOT	Build Own Transfer
C&D	Construction and Demolition waste
C&I	Commercial and Industrial waste
CAGR	Compound Annual Growth Rate
CAPEX	Capital expenditure
CPI	Consumer Price Index
EfW	Energy from Waste (a.k.a. WtE- Waste to Energy)
EPA	Environment Protection Authority
EU	European Union
FY	Financial Year
IED	European Union's Industrial Emissions Directive
LGA	Local Government Area
MRA	MRA Consulting Group
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MW	Megawatts
MWh	Megawatt hours
NGER	National Greenhouse and Energy Reporting
NSW	New South Wales
pa	per annum
PEF	Processed Engineered Fuel
PPP	Public Private Partnerships
RDF	Refuse Derived Fuel
Residuals/residual waste	Garbage subsequent to recycling, i.e. waste disposed of in the red-lidded bin *or* Residual waste subsequent to any recovery (after AWT processing, after EfW processing or after MRF Processing).
ROC	Regional Organisation of Councils
SRF	Solid Recovered Fuel
SMA	Sydney Metropolitan Area
t	Tonnes
tpa	Tonnes per annum
TS	Transfer Station
VIC	Victoria
WA	Western Australia
WARR	Waste Avoidance and Resource Recovery
WLRM	Waste Less Recycle More
WSROC	Western Sydney Regional Organisation of Councils

1. Introduction

One of the actions of WSROC's 2014-2017 Regional Waste Avoidance and Resource Recovery Strategy under the *Increase Recycling* strategy theme was to:

> *Advocate on behalf of the region to the State government to facilitate the appropriate planning approvals adjustments and to develop a favourable context for the establishment of waste infrastructure such as AWT and EfW.*

WSROC could play an important role in facilitating the construction and operation of an Energy from Waste (EfW) facility in western Sydney. This position paper presents the NSW EfW policy frameworks and explores WSROC's potential role in facilitating an EfW facility in Western Sydney.

1.1 EfW background

Although well established overseas, EfW in Australia has largely remained confined to recovery though the capture and combustion of landfill gas and bagasse. Direct energy recovery from the solid waste stream is largely ignored. A number of reasons have contributed to this situation, including poor financial incentives due to ample and cheap landfill capacity, public opposition and lack of government policy support. However this is changing. Although barriers remain, the increasing gate fees at Australia's (and NSW's in particular) landfills, along with a demand for higher resource recovery, are key drivers for the increasing pursuit of EfW facilities. Table 1 summarises the drivers and barriers to EfW in the Australian context.

Table 1 EfW market drivers and barriers

Drivers	Barriers
• Increasing landfill prices, including through the landfill levy, provide incentives for waste generators and collectors to divert waste to resource recovery facilities and energy recovery facilities; • Decreasing availability of landfill space in the Sydney region puts pressure on government and waste asset owners to reduce waste to landfill; • Improving state policies and commitment to resource recovery by state and federal bodies; and • National and state funding opportunities.	• Technology is relatively new and untested in the Australian context; • Negotiating with existing waste service providers; • Securing long term waste supply contracts that are of appropriate composition; • A lot of the combustible material is made up of recyclables whose diversion take precedence under the waste hierarchy; • Planning and approvals processes are relatively long and costly if unable to find an existing licensed site; • Negative public perception due to past failures; • Uncertain demand for heating and cooling outputs; and • Current EfW policy limitations.

No EfW facilities are currently operating in Australia on mixed residual waste streams but a number of proposals have been submitted (Table 2).

Table 2 Summary of proposed EfW facilities in Australia

Company	Proposed Location	Cost	Waste feedstock (type/ tpa)	Energy Outputs (MW)	Technology Type
Dial-a-Dump, The Next Generation	Eastern Creek (NSW)	$700 million	C&I and C&D residues 1,200,000	140	Moving grate thermal treatment
New Energy	Port Hedland (WA)	$180 million	MSW/ 70,000 – 130,000	15	Entech gasification
New Energy	East Rockingham (WA)	$160 million	MSW/ 225,000	18.5	Entech gasification
Phoenix Energy	Kwinana (WA)	$400 million	MSW/ 400,000	32	Martin GmbH reverse-acting stoker grate
Eastern Metropolitan Regional Council	Hazelmere (WA)	$25 million	Wood waste	3	Pyrolysis
Visy Group	Tumut (NSW)	$300 million	Pulp and paper waste	.75	Unknown

In Europe, where the EfW sector is more developed than in Australia and in many countries forms a key component of the waste management system, EfW is considered to have the following benefits:

- Compatibility with recycling systems;
- Energy recovery;
- CO_2 and CH_4 reduction;
- Gas cleaning for clean emissions; and
- Significant architectural input to ensure that facilities blend in with the surrounding area.

2. Policy framework

The Commonwealth Government has limited constitutional powers to engage directly in domestic waste management issues. This responsibility rests largely with state, territory and local governments. However, the Commonwealth Government has recently taken on a strategic involvement in waste policy development with the National Waste Policy in 2010 which, along with the Direct Action Plan are the key national policies pertaining to EfW.

State Governments in Australia use legislation, guidelines and the development of strategies, plans and policies to manage waste and resources throughout each jurisdiction. The following section is a summary of the attitudes and policy of the state of New South Wales with regard to EfW facilities.

2.1 Policy and legislative framework for EfW in NSW

The relevant New South Wales State Framework consists of legislation, guidelines, development plans and strategies pertaining to waste management, as summarised in Table 3. The objective of the NSW Government is to provide a clear and consistent regulatory and policy framework that minimises harm to the environment and encourages waste avoidance and resource recovery. This framework uses a mix of legislative, policy, educational and economic tools.

Table 3: Relevant NSW Waste Controls

Legislation	Plans, Guidelines and Strategies
• Environmental Planning and Assessment (EP&A) Act 1979 • Protection of the Environment Operations (POEO) Act 1997 • Waste Avoidance and Resource Recovery (WARR) Act 2001 • Protection of the Environment Operations (Waste) Regulation 2005 • Protection of the Environment Operations (Waste) Amendment (Residue Wastes) Regulation 2005	• Energy from Waste Policy Statement 2015 • 'NSW 2021: A Plan to make NSW number one' • Waste Avoidance and Resource Recovery Strategy (WARR) 2014 – 2021 • *Waste Classification Guidelines (DECC, 2009)* • Environmental Guidelines: Assessment Classification and Management of Non-Liquid and Liquid Waste (NSW EPA)

2.1.1 Protection of the Environment Operations Act (1979)

The NSW *Protection of the Environment Operations Act 1997 (POEO Act)* provides an integrated system of licences, administered by the NSW EPA, to set out Protection of the Environment policies, and to adopt more innovative approaches to reduce pollution in the environment.

The objectives of the *POEO Act* include:

- To protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development;
- To provide increased opportunities for public involvement and participation in environment protection;
- To ensure that the community has access to relevant and meaningful information about pollution;
- To reduce risks to human health and prevent the degradation of the environment by using mechanisms that promote the following:
    - Pollution prevention and cleaner production;

- The reduction to harmless levels of the discharge of substances likely to cause harm to the environment;
    - The elimination of harmful wastes;
    - The reduction in the use of materials and the re-use, recovery or recycling of materials;
    - The making of progressive environmental improvements, including the reduction of pollution at source;
    - The monitoring and reporting of environmental quality on a regular basis;
- To rationalise, simplify and strengthen the regulatory framework for environment protection;
- To improve the efficiency of administration of the environment protection legislation; and
- To assist in the achievement of the objectives of the Waste Avoidance and Resource Recovery Act 2001.

Clauses 48 and 49 of the *POEO Act* require certain premises-based and non-premises-based activities to obtain licences for their operation. These activities and their licencing thresholds are listed in Schedule 1 of the POEO Act:

- Clause 17 of Schedule 1 – Electricity generation triggers the criteria for a scheduled activity under this Act for general electricity works with a capacity to generate more than 30 megawatts of electrical power; and
- Clause 18 of Schedule 1 – Energy recovery triggers the criteria for a scheduled activity under this Act for energy recovery from general waste involving processing more than 200 tonnes per year of waste (other than hazardous waste, restricted solid waste, liquid waste or special waste).

2.1.2 Protection of Environment Operations (Waste) Regulation 2005

The *Protection of the Environment Operations (Waste) Regulation 2005 (POEO Waste Reg)* relates to the regulation of waste and resource recovery in NSW. It gives effect to the broad objectives and specific provisions within the *POEO Act* relating to waste, including:

- The administration of the section 88 contribution (the waste levy) within the POEO Act;
- Waste tracking and transportation requirements and obligations;
- Management requirements for special wastes (e.g. asbestos; and clinical and related waste);
- Makes it an offence to apply, or to cause or permit the application of, residue waste to land that is used for growing vegetation, subject to any exemptions;
- Provisions for the recycling of consumer packaging;
- Exemption powers from the requirements of the POEO Waste Reg for waste; and
- Transport, immobilisation, application to land and use of waste as fuel.

Resource recovery exemptions are granted by the EPA where the land application or use as fuel of a waste material is a bona fide, fit-for-purpose, reuse opportunity that causes no harm to the environment or human health, rather than a means of waste disposal. An exemption facilitates the use of these waste materials outside of certain requirements of the waste regulatory framework.

The EPA encourages the recovery of resources from waste by issuing both general and specific resource recovery exemptions. General exemptions are issued for commonly recovered, high-volume and well characterised waste materials. A general exemption may be used by anyone, without seeking approval from the EPA, provided the generators, processors and consumers fully comply with the conditions of the exemption.

Where no general exemption is available for the intended use, a specific exemption may be issued after an application is made to the EPA. Clause 51A of the POEO Waste Reg applies to exemptions relating to waste that is used with thermal treatment processing.

2.1.3 Protection of the Environment Operations (Waste) Amendment (Residue Wastes) Regulation 2005

The *Protection of the Environment Operations (Waste) Amendment (Residue Wastes) Regulation 2005* (POEO WARW Reg) aims to protect land, food and the environment from contamination by the inappropriate application of potentially harmful wastes to the land under the guise of 'fertiliser'. These potentially harmful wastes are called 'residue wastes'.

Except with the approval of the EPA, a person must not apply any residue waste, or cause or permit any such waste to be applied, to land that is used for a purpose related to the growing of vegetation, including, but not limited to: land used for agricultural, horticultural, silvicultural, pastoral or environmental rehabilitation purposes.

Residue wastes are:

- Fly ash (commonly referred to as 'air pollution control ash' (APC));
- Bottom ash from any furnace;
- Lime or gypsum residues from any industrial or manufacturing process;
- Residues from any industrial or manufacturing process that involves the processing of mineral sand;
- Substances that have been used as catalysts in any oil refining or other chemical process;
- Foundry sands and foundry filter bag residues;
- Residues from any industrial or manufacturing process that involves the refining or processing of metals or metallic products; and
- Any substance that is hazardous waste, industrial waste or Group A waste (as defined in the *Protection of the Environment Operations Act 1997*).

The prohibition does not apply if the residue waste is lawfully sold as a soil improving agent (fertiliser or liming material) or trace element product within the meaning of the *Fertilisers Act 1985* and complies with the prescribed maximum contaminant levels.

General exemptions are intended for lime and gypsum residues from water treatment processes and plasterboard manufacture, and ash from furnaces burning only coal or uncontaminated biomass. The EPA can grant a specific exemption from the regulation if this is applied for and where it can be demonstrated that the residue waste is beneficial and will not cause harm to the environment, human health or agriculture.

2.1.4 Waste Avoidance and Resource Recovery Act 2001

The waste hierarchy, established under the *Waste Avoidance and Resource Recovery Act 2001 (WARR Act)*, is designed to ensure that resource management options are considered against the following priorities:

1. Avoidance including action to reduce the amount of waste generated by households, industry and all levels of government;
2. Resource recovery including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of recovered resources; and

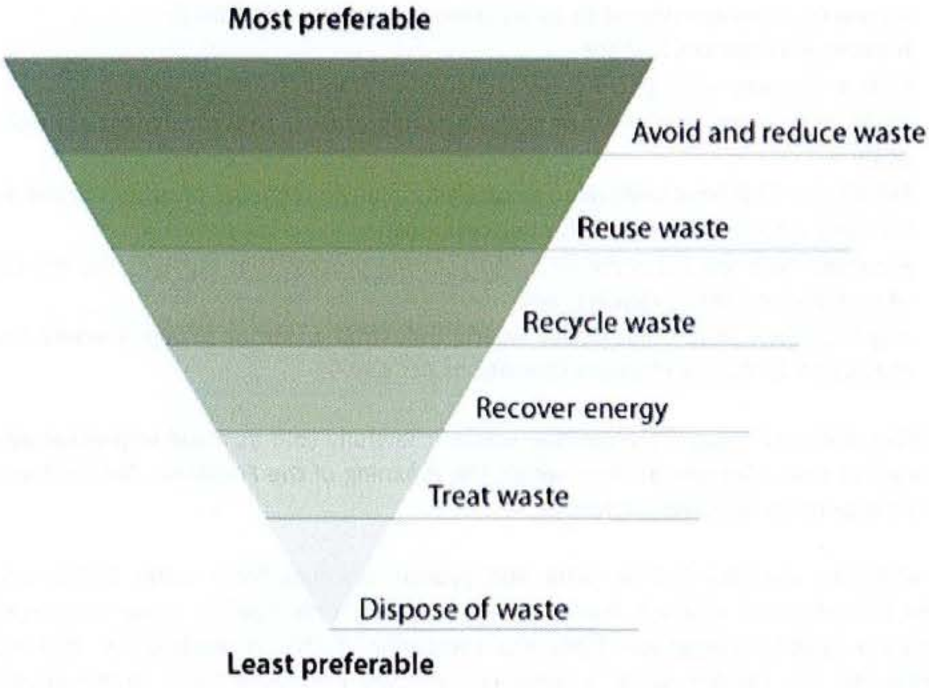
3. Disposal including management of all disposal options in the most environmentally responsible manner.

The highest priority, avoidance, encourages the community, industry and government to reduce the amount of virgin materials extracted and used, and waste generated, and to be more efficient in their use of resources.

Resource recovery maximises the options for reuse, recycling, reprocessing and energy recovery at the highest net value of the recovered material. This encourages the efficient use of recovered resources while supporting the principles of improved environmental outcomes and ecologically sustainable development. Resource recovery can also embrace new and emerging technologies.

The waste hierarchy lists, in order of preference, the approaches needed to achieve efficient resource use with disposal being the least preferred method and waste avoidance the most preferred. The place of EfW in the hierarchy established under the *WARR Act* is illustrated in Figure 1 under the "Recover energy" category.

Figure 1: Position of EfW in the WARR Act waste hierarchy.



2.1.5 Protection of the Environment Operations (Clean Air) Regulation 2010

The *Protection of the Environment Operations (Clean Air) Regulation* (POEO CA Reg) provides regulatory measures to control emissions from wood heaters, open burning, motor vehicles and fuels and industry. In relation to industry, the POEO CA Reg:

- Sets maximum limits on emissions from activities and facilities for a number of substances, including chlorine, dioxins, furans, smoke, solid particles and sulphur;
- Deals with the transport and storage of volatile organic liquids;

- Restricts the use of high sulphur liquid fuel; and
- Imposes operational requirements for certain afterburners, flares, vapour recovery units and other treatment plant.

Exemptions are provided for emergency bushfire hazard reduction work and burning that is authorised by a bushfire hazard reduction certificate. The *Clean Air Regulation* also:

- Prohibits all burning (in the open or an incinerator, including burning of vegetation and domestic waste) in certain local government areas except with approval from the EPA and/or local councils (refer to Appendix A for a list of all councils);
- Prohibits the burning of specified articles, including tyres, coated wire, paint and solvent containers and certain treated timbers; and
- Imposes a general duty to prevent or minimise air pollution when burning in the open or an incinerator.

Emission standards are dependent on the categorisation of plant. "Group 6 treatment plant" refers to afterburners and other thermal treatment plant established after September 2005 and subject to an Environmental Protection License.

The Industrial Emissions Directive (IED) 2010 is the main European Union (EU) instrument regulating pollutant emissions from industrial installations. The IED aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of Best Available Techniques (BAT). The IED standards are adopted in NSW under the Energy from Waste Policy and have been included for comparison with the POEO Reg in Table 4 below.

Table 4: POEO Clean Air Regulation standards of concentration for Group 6 plant emissions and IED air emission limit values

Pollutant	POEO Reg limits (mg/Nm^3)	Source	Activity	IED limits (mg/Nm^3)
Solid particles (total)	50	Electricity generation	Any activity of plant using liquid or solid standard fuel or non-standard fuel	10
HCl	100	General standards	Any activity	10
HF	50		Any activity of plant using liquid or solid standard fuel or non-standard fuel	1
SO_2	No applicable standard			50
NO_2	500	Electricity generation	Any boiler operating on a fuel other than gas, including a boiler used with an electricity generator that forms part of an electricity generating system with a capacity of 30MWe or more	200
Type 1 & 2 substances (in aggregate)	1	Electricity generation	Any activity of plant using non-standard fuel	0.5
Cd or Hg	0.2	Electricity	Any activity of plant using non-standard fuel	0.05

Pollutant	POEO Reg limits (mg/Nm^3)	Source	Activity	IED limits (mg/Nm^3)
(individually)		generation		
Dioxins or furans	1E-07 ($0.1ng/m^3$)	Electricity generation	Any activity of plant using non-standard fuel that contains precursors of dioxin or furan formation	1E-07 ($0.1ng/m^3$)
VOC	40 (VOC) or 125 (CO)	Electricity generation	Any activity of plant using non-standard fuel	-

2.2 Energy from Waste Policy

In 2015, the NSW EPA released its finalised *EfW Policy Statement* to replace the 2005 *Guidance Note: Assessment of Non-Standard Fuels*. The statement sets a framework for the operation of purpose-built facilities to recover energy from residual wastes that are not able to be recycled and would otherwise be disposed of to landfill.

The policy also facilitates the use of certain low-risk wastes as fuels which, due to their origin, low levels of contaminants, homogeneity and consistency over time, are considered by the EPA to pose a minimal risk of harm to human health and the environment.

The NSW EfW Policy Statement is designed to encourage the recovery of the embodied energy from waste while offsetting the use of non-renewable energy sources and avoiding methane emissions from landfill. It is intended to ensure that this energy recovery:

- Has minimal risk of harm to human health and the environment; and
- Will not undermine higher order waste management options, such as avoidance, reuse or recycling.

2.2.1 Public Consultation

Under the policy, proponents are required to provide effective information and public consultation about EfW proposals. Proponents should engage in genuine dialogue with the community and ensure that accurate and reliable information is provided to planning and other approval consent authorities.

The operators of EfW facilities will need to be 'good neighbours', with regard to waste deliveries and operating hours, but also regarding information about emissions and resource recovery outcomes.

2.2.2 Choice of fuels

The EPA has applied the following overarching principles to waste avoidance and recovery:

- Higher value resource recovery outcomes are maximised;
- Air quality and human health are protected;
- 'Mass burn' disposal outcomes are avoided; and
- Scope is provided for industry innovation.

2.2.3 Eligible waste fuels

Waste or waste-derived materials that pose minimal risk of harm to human health and the environment due to their origin, low levels of contaminants and consistency over time are categorised as eligible wastes. The following wastes are categorised by the EPA as eligible waste fuels:

- Biomass from agriculture;

- Forestry and sawmilling residues;
- Uncontaminated wood waste;
- Recovered waste oil;
- Organic residues from virgin paper pulp activities;
- Landfill gas and biogas;
- Source-separated green waste (used only in processes that produce biochar); and
- Tyres (used only in approved cement kilns).

Domestic waste is not listed as an eligible material. Therefore Any facility proposing to thermally treat a waste or waste-derived material that is not a listed eligible waste fuel **must** meet the requirements of an Energy Recovery Facility and use current international best practice techniques. In these cases, proponents should refer to Section 4 of the *NSW Energy from Waste Policy Statement* (NSW EPA, 2015) and the *Energy Recovery Facility Guidelines* (NSW EPA, 2016).

2.2.4 Technical criteria

To ensure that any emissions are below levels that may pose a risk of harm to the community, facilities proposing to recover energy from waste will need to meet current international best practice techniques. The NSW EfW Policy Statement documents a number of technical, thermal efficiency and resource recovery criteria that must be met, which are summarised in Table 5.

Table 5: Energy from Waste Policy Statement technical criteria

Energy from Waste Policy Statement Technical Criteria	Reference Standard
The gas resulting from the process should be raised, after the last injection of combustion air, in a controlled and homogenous fashion and even under the most **unfavourable** conditions to a minimum temperature of 850°C for at least 2 seconds (as measured near the inner wall or at another representative point of the combustion chamber).	IED Article 50 (2)
If a waste has a content of more than 1% of halogenated organic substances, expressed as chlorine, the temperature should be raised to 1100°C for at least 2 seconds after the last injection of air. [1]	IED Article 50 (2)
The process and air emissions from the facility must satisfy at a minimum the requirements of the Group 6 emission standards within the Protection of the *Environment Operations (Clean Air) Regulation 2010.* [2]	POEO Act 2010

[1] In the EU regulation, the following is stated in the IED: If hazardous waste with a content of more than 1% of halogenated organic substances, expressed as chlorine, is incinerated, the temperature has to be raised to 1100°C for at least two seconds.
In the NSW EfW Policy it is stated: *If a waste has a content of more than 1% of halogenated organic substances, expressed as chlorine, the temperature should be raised to 1100°C for at least 2 seconds after the last injection of air.* There is a small, but significant difference between these two texts, with considerable implications for EfW in Australia ("hazardous waste" versus "waste"). PVC is not classified as a hazardous waste in both jurisdictions. Moreover, the IED regulation is not concerned about "chlorine", but about "hazardous waste with halogenated organic substances".
In the European EfW experience it has been found that EfW typically has to cope with concentrations of PVC of around 1% (MSW) with around 0.4% as back ground chlorine (not PVC related). Residual fractions from recycling, C&D and C&I can reach up to nearly 10% in the European experience. Similar chlorine level of around 1% in MSW as per European experience, the current NSW EfW Policy would require burning at 1,100°C/2s instead of 850°C/2s. Current technology (from all EfW providers) doesn't allow efficient energy recovery at the higher temperature. In consequence, the energy efficiency requirement of R1>0.65 cannot be achieved. Hence, the NSW EfW Policy will contradict itself unless the wording is changed (back to the European IED).

[2] The European Commission Directive on Industrial Emissions (IED) daily emission standards set out in Annex VI Part 3 exceeds the requirements of group 6 emission standards set out in Schedule 2 of the Protection of the Environment Operations (Clean Air) Regulation 2010.

Energy from Waste Policy Statement Technical Criteria	Reference Standard
Continuous measurements of NO_x, CO, particles (total), total organic compounds, HCl, HF and SO_2. The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded.	IED Annex VI Part 6 point 2.1 (a) and point 2.3
This data must be made available to the EPA in real-time graphical publication and a weekly summary of continuous monitoring data and compliance with emissions limits published on the internet.	N/A
There must be continuous measurements of the following operational parameters: temperature at a representative point in the combustion chamber; concentration of oxygen; pressure and temperature in the stack; and water vapour content of the exhaust gas. This must be conducted and held by the proponent for a period of three years.	IED Annex VI Part 6 point 2.1 (b)
Proof of performance (POP) trials to demonstrate compliance with air emissions standards. There must be at least two measurements per year of heavy metals, polycyclic aromatic hydrocarbons, and chlorinated dioxins and furans. One measurement at least every three months shall be carried out for the first 12 months of operation. If and when appropriate measurement techniques are available, continuous monitoring of these pollutants will be required.	IED Annex VI Part 6 point 2.1 (c)
The total organic carbon (TOC) or loss on ignition (LOI) content of the slag and bottom ashes must not be greater than 3% or 5%, respectively, of the dry weight of the material.	IED Article 50 (1)
Waste feed interlocks are required to prevent waste from being fed to the facility when the required temperature has not been reached either at start-up or during operation.	N/A
An air quality impact assessment must be undertaken in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (Pacific Environment 2014)

2.2.5 Thermal efficiency criterion

The EfW Policy Statement is restricted in its scope to facilities that are designed to thermally treat waste for the recovery of energy rather than as a means of disposal. The net energy produced from thermally treating waste, including the energy used in applying best practice techniques, must therefore be positive.

To meet the thermal efficiency criterion, facilities must demonstrate that at least 25% of the energy generated from the thermal treatment of the material will be captured as electricity (or an equivalent level of recovery for facilities generating heat alone).

Energy recovery facilities must also demonstrate that any heat generated by the thermal processing of waste is recovered as far as practicable, including use of waste heat for steam or electricity generation, or for process heating of combined heat and power schemes.

2.2.6 Resource Recovery Criteria

The EPA considers energy recovery to be a complementary waste management option for the residual waste produced from material recovery processes or source-separated collection systems. The EfW Policy Statement's objectives in setting resource recovery criteria are to:

- promote the source separation of waste where technically and economically achievable;
- drive the use of best practice material recovery processes; and
- ensure only the residual from bona fide resource recovery operations are eligible for use as a feedstock for an energy recovery facility.

2.2.7 Eligible feedstock

EfW facilities may only receive feedstock from waste processing facilities or collection systems that meet the criteria outlined in Table 6. In summary, the potential tonnages of feedstock for an EfW facility are to be calculated based on the following:

1. NSW bin collection systems according to council area (25% – 100%);
2. C&I recycling per individual business site (0 – 50% allowable);
3. Residuals from AWT (up to 100% allowable);
4. C&D recycling rates per C&D processing facility (0 – 25% allowable); and
5. Waste or waste-derived material that is not listed in Table 6, may be approved for EfW processing following EPA review on a case-by-case basis.

Table 6 Resource recovery criteria for specific waste streams

Mixed wastes		
Waste stream	**Authorised facility**	**% of residual waste allowed for energy recovery**
Mixed municipal waste (MSW)	Facility processing mixed MSW waste where a council has separate collection systems for dry recyclables and food and garden waste	No limit by weight of the waste stream received at an authorised facility
	Facility processing mixed MSW waste where a council has separate collection systems for dry recyclables and garden waste	Up to 40% by weight of the waste stream received at an authorised facility
	Facility processing mixed MSW waste where a council has a separate collection system for dry recyclables	Up to 25% by weight of the waste stream received at an authorised facility
Mixed commercial and industrial waste (C&I)	Facility processing mixed C&I waste where that waste is sourced solely from an entity that has separate collection systems for all relevant waste streams	No limit by weight of the waste stream received at an authorised facility
	Facility processing mixed C&I waste	Up to 50% by weight of the waste stream received at an authorised facility
Mixed construction and demolition waste (C&D)	Facility processing mixed C&D waste	Up to 25% by weight of the waste stream received at an

		authorised facility
Source-separated recyclables	Facility processing source-separated recyclables	Up to 10% by weight of the waste stream received at an authorised facility
Source-separated garden waste	Facility processing garden waste	Up to 5% by weight of the waste stream received at an authorised facility
Source-separated food waste (or food and garden waste)	Facility processing source-separated food or source-separated food and garden waste	Up to 10% by weight of the waste stream received at an authorised facility

Separated waste streams	
Waste stream	**Feedstock able to be used at an energy recovery facility**
Waste wood	Residual wood waste from a manufacturing process or extracted from a mixed waste stream that does not meet the definition of an eligible waste fuel
Textiles	Residual textiles from a manufacturing process, or extracted from a mixed waste stream
Waste tyres	End-of-life tyres
Biosolids	Used only in a process to produce a char for land application
Source-separated food and garden organics	Used only in a process to produce a char for land application

Source: NSW EPA, 2015. NSW Energy from Waste Policy Statement www.epa.nsw.gov.au/resources/epa/150011enfromwasteps.pdf

Notes

1. *The EPA may give consideration to increases to the maximum allowable percentage of residuals from facilities receiving mixed municipal and commercial and industrial waste where a facility intends to use the biomass component from that process for energy recovery, rather than land application and the facility can demonstrate they are using best available technologies for material recovery of that stream.*
2. *Waste streams proposed for energy recovery should not contain contaminants such as batteries, light bulbs or other electrical or hazardous wastes.*
3. *Bio-char or char materials produced from facilities using mixed waste streams will not be able to be considered for land application as a soil amendment or improvement agent.*

2.3 WSROC's statutory role

As a Regional Organisation of Councils (ROC), WSROC has no formal statutory authority to dictate the region's direction in terms of waste management. However, as a highly successful ROC it can rely on the authority of its member councils, its joint procurement and advocacy experience to influence regional waste management decisions.

As per the *Local Government Act 1993,* local governments' responsibilities in Australia generally extend no further than MSW. Local governments have little or no regulatory control over waste generated from C&I and C&D sources. Councils cannot compel businesses to recycle or direct them to take their waste to a particular location or dispose of it in a particular way. However, as a group of councils with a unified voice and a clear picture on the type of waste management the region needs, WSROC can drive reform via its collective bargaining power and regional coordination, resource sharing, project management, partnership building and advocacy.

As outlined in the WSROC *Western Sydney Regional Waste and Recycling Infrastructure Needs Assessment* (WSROC, 2015), private sector investment in additional resource recovery infrastructure is conditional upon well-planned, long term and secure waste supply agreements. Without a secure supply they cannot get access to the private capital necessary funding for large and complex waste treatment facilities, nor can they justify the ongoing cost of maintaining an asset that may be forced to operate at less than its built capacity. In Sydney only SUEZ and Veolia control sufficient supply of mixed solid waste and enough existing waste infrastructure to consider private investment without securing long-term regional contracts for supply. Collectively WSROC members control sufficient MSW supply to be able to influence infrastructure development decisions.

Moreover, WSROC can support waste infrastructure development by educating the community and facilitating its involvement in decision making and planning process. Member Councils also have the option to invest in pre-approving sites that waste management companies can utilise for developing the agreed infrastructure. This is a process that should be undertaken following agreement with waste service operators as it can be costly and lengthy. It involves obtaining all the necessary planning and environment approvals for pre-identified sites in appropriately zoned areas.

2.4 Major, developer-led EfW in NSW

2.4.1 DADI The Next Generation

Following the City of Sydney decision to revise its waste management strategy and abandon the gasification facility plans, Dial-a-Dump Industries' (DADI) The Next Generation NSW Pty Ltd (TNG) remains the only EfW incineration facility in NSW at an advanced planning stage.

In March 2017, DADI lodged a submission for approval to the Planning Assessment Commission NSW. The proposed facility covers four hectares and is located next to the DADI's existing Genesis recycling facility, within a 120-hectare site. TNG is a conventional trigeneration EfW facility using Hitachi Zosen Inova (HZI) moving grate furnace technology. It will be capable of converting combustible residual waste into electricity, hot water to heat buildings, and chilled water to cool buildings. By-products and waste gases from the process will be either sent off-site for further processing or treated before being released in to the atmosphere.

At the currently planned 1.2m tonnes of residual C&I and C&D waste input, the facility would generate and export to the grid approximately 140 MW of electricity. Co-location of the facility along the existing Genesis recycling facility within the DADI industrial site (already used in waste management) is advantageous in that some feedstock would be readily available in the form of residual waste from Genesis.

According to DADI, the facility would be built to the latest EU and Australian engineering and environmental standards with air emission outputs well below the limits set out by the NSW Environmental Protection Agency and the strict European directives. Moreover, the NSW EPA would be in a position to monitor the facility's pollution controls will be monitored in real time while monitor results would be made publicly available.

Although the waste industry of NSW seems to generally support the TNG facility, there is growing opposition to its construction and operation by local councils and politicians concerned with its proximity to residential areas and fears that air emissions will not be as well controlled as claimed. Experience abroad where incinerators are located within cities has shown that when controls are applied appropriately, clean emissions are possible. As an example, the Ivry Incinerator with a capacity of almost half a million tonnes is situated on the banks of the Seine in the centre of Paris. The facility is situated within 1-2km of three Hospitals and a University and less than 10km from the Eiffel Tower.

Whether the development will progress or not is unknown, as the political opposition appears to be increasing. However, even if political opposition is overcome, uncertainty in regard to feedstock availability could still lead to the cancelation of the project. Currently TNG has secured only 200ktpa of C&I and C&D residuals, following resource recovery at the DADI Genesis facility. This is well short of the 1.2mtpa that the project needs to operate at its full scale. Undoubtedly DADI will be looking to secure larger quantities of feedstock prior to initiating construction. However, given the competitive nature of the Sydney waste market including the availability of cheap landfill for <u>dry</u> waste (as low as $160-220/t) and the latest trend of waste being shipped to Queensland, a guaranteed supply of suitable waste cannot be considered a given.

2.4.2 ResourceCo PEF at Wetherill Park

In early May 2017, the CEFC announced that it is lending $30 million to ResourceCo to build two plants, which will transform selected non-recyclable waste streams to a solid fuel known as Processed Engineered Fuel (PEF). The first facility is to be built at Wetherill Park in Western Sydney while a second one will be built in an as yet unspecified Australian state.

Although this is not an energy-producing incinerator as the DADI facility, it will be using similar, EfW eligible waste feedstock and therefore will be competing for the same waste material. The current plan is for the ResourceCo PEF facility to have an annual capacity of 150,000t and be operational by March 2018. It would also recover metal, clean timber, and inert materials.

The plan has also secured $5 million in grant funding from the NSW Environmental Trust under the Waste Less, Recycle More initiative (2014 Major resource recovery infrastructure program) and is eligible for Australian Carbon Credit Units (ACCUs) due to the diversion of waste from landfill.

2.4.3 UR-3R RDF at Eastern Creek

Global Renewables has also secured $5 million in grant funding from the NSW Environmental Trust under the 2013 Major resource recovery infrastructure program, Waste Less, Recycle More initiative to build a refuse derived fuel (RDF) facility at its Eastern Creek UR-3R site. The facility would turn the currently landfilled, residual waste, from the existing AWT processing MSW into an alternative fuel. The new facility, along with other elements of the project, will increase recycling capacity at the site by 40,000 tonnes a year.

2.4.4 Veolia RDF at Camellia

Similarly, Veolia's Camellia Recycling Centre will process up to 150,000 tonnes of non-putrescible mixed C&I waste from business and industry each year. The $22.4 million project has secured $5 million in grant funding from the NSW Environmental Trust under the 2013 Major resource recovery infrastructure program Waste Less, Recycle More initiative and in addition to recovering paper/cardboard, metals, aggregates, plastics and timber will have the capacity to produce RDF suitable for future energy from waste generation.

2.4.5 Visy NSW waste to energy project

Visy is exploring a new electricity generation facility, likely to be sited in NSW, using solid recovered fuel (SRF). The $350-$400m project, which is still at the feasibility study stage, is expected to comprise a network of MSW collection facilities, an SRF manufacturing facility and a clean electricity generation plant capable of producing 70MW for export to the grid. A Visy RDF generating facility in Smithfield has been put forward as a possible development.

3. Business case elements

3.1 Available tonnage under the EfW policy

The total amount of waste generated in NSW (including MSW, C&I and C&D) increased from 16.3mt in 2008/09 to 17.1mt in 2010/11[3]. Waste generation rates continued to outstrip the population growth of 3.4% during this period (EPA, 2014).

Assuming a 2.4% per annum waste generation growth rate (taking into consideration compounding growth) and given the restrictions on the types of waste allowable for incineration in an EfW facility (refer Section 2.2.7), less than half of the approximately 6.5mt tonnes landfilled in 2015 in NSW is eligible for energy recovery. Table 7 summarises the potential sources of EfW eligible waste for 2015 along with projections for 2021.

Table 7 Potential tonnes for EfW processing in NSW, 2020

Waste Source	Process	Waste Stream	2015: Total Potential	2021: Total Potential
MSW	Kerbside residual bin	MSW	745,877	839,782
C&I	Mixed	C&I	1,482,250	1,668,865
C&D	Processing facility residual	C&D	495,750	558,165
Source-separated recyclables	Processing facility residual	MSW	78,025	87,848
Source-separated garden waste	Processing facility residual	MSW	32,181	36,233
Source-separated food or food & garden waste	Processing facility residual	MSW	8,326	9,374
		C&I	4,000	4,504
		Total tonnes	2,846,408	3,204,771

3.1.1 Available tonnes in Western Sydney

According to the WSROC *Western Sydney Regional Waste and Recycling Infrastructure Needs Assessment* (WSROC, 2015), by 2021, the Western Sydney region will be generating a total of around 4.4mt of waste per year. Assuming that the proportion of EfW eligible tonnes is similar to that for NSW, approximately 700,000t of 2021 WSROC-originating waste (MSW, C&I and C&D) would be potentially available for EfW.

A WSROC backed EfW facility would have the benefit of securing WSROC MSW as long term regional base load tonnes. WSROC involvement and the associated MSW commitment of its MSW tonnes for the life of the facility would increase funding opportunities by increasing confidence in the project's long-term viability. Subsequently the project proponent would seek additional C&I and C&D as "merchant" tonnes, which are commonly subject to short and long term contracts. This is the key benefit of WSROC being involved as only it can secure those long term base load tonnes.

Note that the Western Sydney region is a waste management hub for the Sydney metropolitan area (SMA). The region already hosts the majority of the waste facilities utilised by the SMA. Therefore an EfW facility located within Western Sydney would likely attract waste from the whole of the SMA.

Similarly, other facilities that plan to utilise waste eligible for EfW such as DADI's TNG and ResourceCo's PEF will also be competing for at least part of the waste generated within both WSROC boundaries and in the SME.

[3] Latest available official data for Australia through the SoE Overview.

3.1.1.1 MSW tonnes

The WSROC 2014-2017 Regional Waste and Resource Strategy reviewed the MSW generation in the region and identified that in order for the ROC to hit the 2021 diversion targets, an additional 300,000t of MSW would need to be diverted through new facilities (Table 8). At least part of this waste could be diverted to an EfW facility along with residuals from the processing of the region's C&I and C&D waste.

Table 8: MSW generation and potential for additional recovery

<table>
<tr><td>2021 Projected MSW generation (t)</td><td>Dry recycling</td><td>Organic</td><td>Residual</td><td>Total</td></tr>
<tr><td></td><td>200,943</td><td>168,982</td><td>668,609</td><td>1,038,535</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">2011 processing capacity for WSROC region (t)</td><td>Recyclable MRF*</td><td colspan="2">Organics/residual waste processing capacity*</td><td></td></tr>
<tr><td>400,000</td><td colspan="2">200,000</td><td>Approx. 600,000</td></tr>
<tr><td colspan="5">Target 2021=70% diversion rate</td></tr>
<tr><td colspan="3">Tonnage of residual waste and organic matter targeted for recovery by 2021**</td><td colspan="2">Gap for AWT processing of organic and residual waste approx.</td></tr>
<tr><td colspan="3">526,031 tonnes</td><td colspan="2">300,000 tonnes</td></tr>
<tr><td colspan="5">*Calculation is based on current processing capacity in SMA from the GHD report and waste generation rate (2011/12) provided by EPA
**Assume all dry recycling will be recovered within existing infrastructures.</td></tr>
</table>

Source: WSROC 2014-2017 Regional Waste and Resource Strategy

3.2 Technology review summary

Energy recovery from non-recyclable and non-reusable waste through thermal treatments is an environmental and economical friendly alternative to landfill that is well established overseas. The treatment significantly reduces the volume and mass of waste and can also render inert some types of hazardous waste. Heat, the by-product of this waste processing method, is commonly used to generate thermal and/or electrical energy. Specialised filters are used to control and minimise pollutant and carbon emissions to air and water.

The thermal processes utilised are: incineration, gasification and pyrolysis.

Ferrous and non- ferrous metals can be recovered either before thermal treatment (using a front-end MRF) or after thermal treatment from ash residues. Bottom ash and slag, the other by product of the process can be recovered and used in the production of building materials. However the ash is often landfilled as it is common for it to not meet contamination concentration thresholds or for its recovery to be financially unviable.

Gasification and Pyrolysis technologies require a uniform consistent feedstock stream that, for mixed residual MSW, necessitates some form of pre-processing or sorting to remove unsuitable materials and ensure consistency.

While there are currently no thermal facilities operating in Australia which process MSW, C&I or C&D waste, there are many facilities that have been operating overseas for many decades. EfW is mainly implemented in four regions in the world (ISWA, 2013):

1. Europe- mainly Germany, Scandinavian Countries (Norway, Sweden, Denmark), France, Netherlands, Italy, United Kingdom (around 500 installations);

2. United States (71 installations as at the end of 2015 burning approximately 30 million tpa);
3. Japan (more than 1,000 installations); and
4. China and South Korea (around 120 installations, growing fast).

The boundary conditions for EfW are quite different in these regions, therefore, what is successful and feasible in one region may not be feasible in another region. Gate fees are also dependent upon local conditions including environmental regulations and local legislation.

3.2.1 Incineration

Incineration dominates in Europe, where the processes result in residual products and flue gas cleaning additives products, which have to be disposed of at a controlled site such as a landfill or mine. Gases generated are 'cleaned' so that any particulate matter and acid gases are removed.

As incineration occurs in combustion chambers, ash is left as residue at the bottom of the chamber. This ash consists of sintered combustion products, mineral components, metal scrap and other unburnt materials, which can either by recycled or landfilled. Dependent on the ash it can be reused, Phoenix Energy uses part of the ash to make road bricks. More and more companies are inventing technologies that make use of this ash.

Hazardous materials are burned at high enough temperatures to destroy contaminants. Many different types of hazardous materials can be treated by incineration, including soil, sludge, liquid, and gases. The process destroys many kinds of harmful chemicals, such as solvents, PCBs and pesticides, however it does not destroy metals.

Most incinerators have a moving grate, to treat MSW when it passed through the combustion chamber. The idea is that the grate will give way for complete and effective combustion. Such plants are capable of taking in 35 metric ton of waste every hour for treatment.

Waste is poured in the grate via a crane, then the grate moves the waste forward to the ash pit. The waste is further treated, water washes out the ash, forced aeration occurs to cool down the grate.

Air is blown through the boiler one more time, which helps in complete burning of the flue gases. In order to fully breakdown toxins of organic nature, the flue gases must reaches 85°C within 2 seconds.

3.2.1.1.1 Incineration SWOT analysis

Strengths	Weaknesses
• Maximum diversion of MSW from landfill • Well established and effective treatment process • Many international incinerators • Robust technology handles multiple heterogeneous streams • Proven, reliable technology • Councils contract the service • Fixed price, not impacted by market changes • Assists Council in achieving landfill diversion targets • NSW EfW policy supports some forms of thermal treatment	• EfW facility approvals very difficult • Significant political opposition to incineration of waste • Expensive technology • Requires pre-gas and residue treatment plants as well as clean-up of emissions to ensure toxics (dioxin, furans) and fly ash particulates control

Opportunities	Threats
• Move Council towards zero waste • Significant GHG emission reductions through reduced landfilling and recovered energy	• Opposition to incineration by the Australian public is still strong • Potential failure of emissions clean up system • Needs high calorific value waste to keep combustion process going, otherwise requires high energy to maintain high temperatures • Can be an expensive fixed asset, which requires committed inputs over long term contracts. Can therefore erode recycling businesses by acting as a disincentive for pursuing further source separation opportunities

3.2.2 PEF Manufacturing Facilities

As a fuel source for energy generation, MSW is of poor quality due to the low calorific value (CV). For raw mixed MSW to become of high quality, it is necessary to prepare fuel pellets to improve its consistency (in terms of size), storage and CV. There has been an increase in global interest in the preparation of Refuse Derived Fuel (RDF) containing a blend of pre-processed MSW with coal suitable for combustion in pulverised coal and fluidized bed boilers.

Pelletisation involves the processes of segregating, crushing, mixing high and low CV organic waste material and solidifying it to produce fuel pellets. The process condenses the waste and enriches its organic content through removal of inorganic materials and moisture. Calorific value of RDF pellets can be up to 16 GJ/t. Calorific value of raw MSW is typically 8 – 12 GJ/t but varies by region.

In the United Kingdom, approximately 2.4 million tpa of RDF is exported (Waste & Resources Action Programme).

3.2.3 Gasification

Gasification is a well-developed technology which was first used to produce gas from coal in the 1800s. It has since evolved to become more directly associated with the decomposition of biomass and solid waste. The technology has been developing rapidly over the years and as a result advanced technologies such as plasma arc gasification are now widely used in the waste to energy industry.

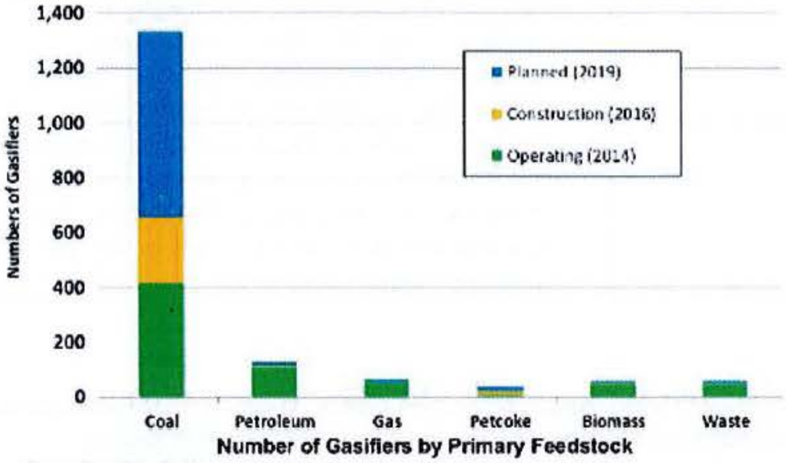
The gasification process can be generically described as the reaction of a solid carbon source at high temperature with a gasification agent to form a combustible gas product containing a mixture of H_2, CO_2, CO, CH_4 and, H_2O as well as other light hydrocarbons. The temperatures employed in the process are typically above 650°C. However, in plasma gasification waste is exposed to intense temperature conditions (4,000 – 7,000°C). The process is largely exothermic but some heat may be required to initialise and sustain the gasification process.

This gas mixture has many applications. It can be combusted and converted to energy via a turbine or engine. Alternatively, the valuable compounds present in the syngas can be extracted and further processed to form products such as chemicals or fuels.

Internationally, gasification of municipal solid waste, as a technology, has possibly seen more failures than successes. Innovative gasification plants have fallen victim to poor planning, inaccurate cost predictions and unexpected technical issues. These failures have given gasification of municipal solid waste a bad reputation amongst some communities and as such social acceptance has become key in getting projects approved. Raw municipal waste is usually not appropriate for gasification and typically would require some mechanical preparation and separation of glass, metals and inert materials (such as rubble) prior to processing the remaining waste.

In comparison to traditional incineration, gasification is more efficient than incineration in recovering energy from waste (Gasification and Syngas Technologies Council). While incineration can recover approximately 550 kWh electricity per tonne of MSW, gasification can recover approximately 1,000 kWh electricity per tonne of MSW. Overall, gasification using waste as a feedstock comprises a relatively small proportion of all gasification facilities (Figure 2).

Figure 2 Gasification facilities by feedstock type (Higman Consulting GmbH)



Interestingly, there is no clear link between plant size and success. In Finland a number of large plants have experienced success while in North America smaller plants have proven to be sound investments.

Ultimately, the success or failure of gasification projects has been dependent upon both the economic climate of the waste industry in the region as well as strategic planning for the localities demand for products and waste disposal.

Drivers for the construction of waste to energy plants include a high landfill levy, a lack of space for landfilling, and a regulatory obligation to switch to renewable energy sources.

In Australia, these drivers are not widely present. The Sydney Metropolitan region in NSW is possibly the only region in Australia which has policies regarding all three drivers. Unfortunately, without these baseline requirements it is unlikely that a gasification plant will prove economically successful.

Gasification of waste is more common in other parts of the world. For example, the total gasification capacity in the greater Tokyo region in Japan is approximately 760,000 tpa, with its six plants ranging in capacity from 70,000 tpa to 200,000 tpa (Furusawa, no date).

3.2.3.1 Gasification SWOT analysis

Strengths	Weaknesses
• Moderate diversion of MSW from landfill • Several international gasifiers • Similar to incineration but limits the availability of oxygen – therefore generates fewer emission gases • Generates a syngas which can be used for electricity or heat • Councils contract the service	• EfW facility approvals very difficult • No demonstrated large scale gasifiers operating on MSW • Some political opposition to gasification of waste • Expensive technology • Requires pre-gas and residue treatment plants as well as clean-up of emissions to ensure toxics

• Fixed price, not impacted by market changes • Assists Council in achieving landfill diversion targets • NSW EfW policy supports some forms of thermal treatment	(dioxin, furans) and fly ash particulates control • Not a proven, reliable technology for MSW • Operating plants focus on hazardous wastes rather than MSW (at scale)
Opportunities	**Threats**
• Move Council towards zero waste • Significant GHG emission reductions through reduced landfilling and recovered energy	• Opposition to thermal treatment by the Australian public is still strong • Potential failure of emissions clean up system • Needs high calorific value waste to keep combustion process going, otherwise requires high energy to maintain high temperatures • Can be an expensive fixed asset which requires committed inputs over long term contracts. Can therefore erode recycling businesses by acting as a disincentive for pursuing further source separation opportunities

3.2.4 Pyrolysis

Pyrolysis is the thermal decomposition of waste in an oxygen free environment. Waste or fuel feedstock is introduced to a reaction chamber and is heated to a high temperature using an external heat source.

During the process, the waste is converted to:

- A combustible mixture of gases including hydrogen, carbon monoxide, carbon dioxide and methane called "Syngas";
- A pyrolysis liquid or oil (consisting of low volatility hydrocarbons); and
- A solid biochar and ash.

The Syngas can be used as a fuel source to generate heat or electricity. The biochar can be used as a solid fuel or as a nutrient additive to improve soils.

The process needs an external heat source to maintain the temperature required. Generally, in the pyrolysis of material such as MSW, lower temperatures between 3000C to 8500C are applied. However, pyrolysis is undertaken at a higher temperature in order to change the amount of each product produced. At higher temperatures, more syngas is produced. A slower process has the capability of producing more carbon rich biochar.

MSW is too heterogeneous for pyrolysis and other thermal conversion technologies and, thus requires pre-processing in most cases. Since inorganic materials such as grit, glass, and metals, do not enter into the thermal conversion reactions, energy, which could be used to produce pyrolysis reactions, is expended in heating the inorganic materials to the pyrolysis reactor temperature. Then the inorganic materials are cooled in clean-up processes, and the heat is lost. Much of the pre-processing is required to remove inorganic materials and to enhance the homogeneity of the feedstock. Depending on the specific pyrolysis process, pre-processing may include sorting, separation, size reduction, densification, etc. In general, pyrolysis processes tend to prefer consistent feedstock.

In general, it is recommended that a consistent, relatively homogenous feedstock is used for pyrolysis. As such, raw MSW, C&D and C&I waste streams are typically pre-processed (removal of incompatible materials and shredding). There is a very limited track record of pyrolysis technology in Australia with very few facilities operating successfully.

3.2.4.1 Pyrolysis SWOT analysis

Strengths	Weaknesses
• Moderate diversion of MSW from landfill • Several international pyrolysis plants operating on clean organics • Similar to incineration but eliminates oxygen – therefore generates fewer emission gases • Generates a biochar and syngas • Syngas can be used for electricity or heat • Biochar likely to be an attractive method of sequestering carbon in soil – likely to attract government funding • Assists Council in achieving landfill diversion targets • NSW EfW policy supports some forms of thermal treatment	• EfW facility approvals very difficult • No pyrolysis plants operating on MSW • Some political opposition to pyrolysis of waste • Expensive technology • Requires pre-gas and residue treatment
Opportunities	**Threats**
• Move Council towards zero waste • Significant GHG emission reductions through reduced landfilling and recovered energy	• Opposition to thermal treatment by the Australian public is still strong • Potential failure of emissions clean up system • Needs organic waste stream inputs. No plants operating on MSW. First plants will be highly experimental and likely to fail.

3.2.5 Plasma Arc Gasification

Plasma arc gasification involves no air or oxygen. Plasma gasification is carried out by exposing waste to intense temperature conditions (4,000 – 7,000°C) from a plasma arc which results in the production of syngas, a vitrified slag and a molten metal. The proportions and composition of the products will depend on the composition of the input waste. Emissions of pollutants such as nitrogen oxides and sulphur dioxide are effectively avoided, but other contaminants such as hydrogen sulphide, ammonia and carbonyl sulphide may have to be abated.

Plasma assisted gasification can break waste down to $1/300^{th}$ of its original size by using ionized gases to produce temperatures greater than 3 times the surface temperature of the sun.

3.2.6 Value of EfW outputs

3.2.6.1 Electricity

Connecting to the grid to distribute the generated electricity can be a costly and lengthy process. Richgro in WA reported that it took approximately 2 years to finalise the agreement with Western Power for its anaerobic digestion plant. Any technology option that is capable of generating electricity, is likely to require a similar timeframe to connect to the grid and is therefore advised that any negotiations should commence at the facility construction stage.

In NSW, the value of electricity produced is dependent on the contract that is struck with the Australian Energy Market Operator (AEMO) (Ricardo-AEA 2013).

Over the last 5 financial years, the average wholesale market price for electricity ranged between $29.78/MWh and $59.52/MWh (AEMO 2015). Assuming that waste entering the facility has a calorific value of 10 MJ/kg, and an energy recovery efficiency of 25% (the minimum required to meet the definition of an EfW facility under the NSW EfW Policy), it is estimated that the sale of electricity to the grid is worth approximately $21 - $41/t waste input.

As such, power generation can prove an important secondary income source for thermal treatment facilities providing there is sufficient generation capacity to overcome the costs associated with establishing the connection to the grid.

3.2.6.2 Heat and Cooling

EfW facilities are generally configured to produce energy in the form of heat (either as steam or hot water) and subsequently transmit it as heat or convert it to electricity. While electricity is comparatively easy to transmit over long distances (as long as a connection to the grid is feasible), transmission of heat energy requires an end user that is close to the EfW facility otherwise the energy losses associated with transmission quickly become prohibitive.

The use of heating and cooling power from EfW facilities in parts of Europe and Japan is widespread due to the prevalence of district heating.

However, due to lack of infrastructure and the generally warmer climate of NSW, the more likely outcome would be to supply the heat to nearby energy intensive industrial users such as cement manufacturing facilities.

Estimating the value of heating and cooling power is much more complicated than estimating the value of electricity generated. In general, studies have found that the value of heating and cooling power is dependent on the following factors (Ricardo-AEA 2013):

- The quantity of useful heat that is generated is dependent less on the capacity of the EfW facility to produce heat and more on how much the end-user requires;
- Whilst electricity is the same regardless of how it is generated, there are many forms in which heat can be transmitted and used (depending in temperature, pressure and state of water); and
- Few EfW facilities have been designed as heat only facilities, rather most are operating as CHP facilities.

As such, the value of heating and cooling outputs will be determined by the agreement struck with the heat user.

3.3 EfW facility ownership and management- Global examples

The ownership and operation modes for the thousands of EfW facilities around the world (refer Section 3.2) span the whole public to private range. In most countries there are examples of both privately and publicly (at the municipal or state level) owned facilities that are either publicly or privately run under a multitude of arrangements including public-private partnerships.

Examples include:

- ISSÉANE facility in Paris, France. 460,000tpa of MSW.
    - Built by the Waste disposal authority SYCTOM, which represents the Western suburbs of Paris.
    - Operated by TSI consortium, which is lead by French renewable energy firm TIRU Groupe
- Tuas Incineration Plant, Singapore. 600,000tpa of MSW.
    - Government owned and operated by the National Environment Agency
- Keppel Seghers Tuas Waste-to-Energy Plant, Singapore. 300,000tpa of MSW.
    - Built under the National Environment Agency's Public Private Partnership initiative
    - Privately owned and operated by Keppel Integrated Engineering Limited (KIE)

- MVA Pfaffenau, Vienna, Austria.
    - The Wiener Kommunal-Umweltschutzprojektgesellschaft mbH (WKU) is a 100% subsidiary of the city of Vienna. The WKU was founded in 2002 to project, plan, build and finance the MVA Pfaffenau waste incineration.
- Ariake Incineration Plant, Tokyo, Japan. 140,000tpa of MSW.
    - Connected to Japan's first pneumatic waste-transport piping network.
    - Operated by Clean Association of Tokyo 23 (Group of Councils)
- Detroit Renewable Power, Detroit, USA.
    - Constructed by the city of Detroit in 1986.
    - Sold in 1991 to private investors to pay off city debt.
- Filborna waste-to-energy plant, Helsingborg, Sweden. 220,00tpa MSW.
    - Owned and operated by Öresundskraft AB (City of Helsingborg municipal energy utility).
- Laogang Incinerator Beijing, China. 1mtpa of MSW.
    - Operated by SMI Environment, a local state-owned enterprise.
- Bristol Resource Recovery Facility, Bristol, Connecticut, USA. 240,000tpa of MSW.
    - Covanta Bristol, Inc. owns and operates the plant under a 25-year agreement with the Bristol Resource Recovery Facility Operating Committee (BRRFOC), a consortium made up of these towns: Berlin, Branford, Bristol, Burlington, Hartland, New Britain, Plainville, Plymouth, Prospect, Southington, Seymour, Warren, Washington and Wolcott.
- Wheelabrator South Broward Inc., Fort Lauderdale, Florida. 800,000tpa of MSW.
    - Privately owned and operated by Wheelabrator South Broward, Inc.

The mix of public/private owners and operators differs between countries. There is no global data for the ratio of public to private facilities however, the Energy Recovery Council provides the following summary for the USA (Table 9). Section 5.1 provides a list of websites with additional information for EfW facilities around the world.

Table 9 Ownership and operational status for the 77 EfW facilities in the USA.

Ownership	Operation
Private 41	**Private** 65
Public 36	**Public** 12

3.4 Sites and waste assets

The ideal situation for any new waste management development is to be located close to where the waste is generated and to have guaranteed access to this waste (sufficient tonnes). An EfW development in particular would benefit significantly from being able to collocate with a feedstock supplier such a Materials Recovery Facility (MRF) that would supply its residual waste for incineration. In summary the key facility siting considerations are as follows:

- Proximity to major road transport routes;
- Access to existing power infrastructure/ proximity to power generation precinct;
- Central location/proximity to major regional sources of waste;
- Distance from sensitive receptors such as residential developments; and
- Alignment with the local Land Use Master Plan.

Since industrial land at the scale required and with connection to necessary infrastructure and services (road access, utilities) can be hard to find within Western Sydney, locating and EfW facility within one of the existing waste management sites in the region would significantly speed up the procurement process, would lead to synergies through the sharing of resources and could provide a nearby source of feedstock.

Both the WSROC *Western Sydney Regional Waste and Recycling Infrastructure Needs Assessment* (WSROC, 2015) and *the 2014-2017 Regional Waste Avoidance and Resource Recovery Strategy* provide information and maps on the waste facilities located within the WSROC region.

3.5 Gate fees

The gate fee for any planned EfW facility would be determined at the time of commissioning taking into consideration landfill and other AWT gate fee prices in the region as well as waste policy at all levels of government. The setting of a gate fee constitutes a commercial decision for the companies involved and cannot be accurately quantified for the purpose of this report. Gate fees are also typically negotiated on a per customer basis and, being commercial in confidence, are usually not publicised.

However, it has been confirmed that the City of Kwinana in WA agreed with the proposed Kwinana EfW Facility to a highly competitive gate fee of $115 per incoming tonne of MSW, a significant discount on both landfill and the SMRC AWT. No EfW facilities exist in Australia to compare this gate fee against. However, a 2001 report to Directorate General Environment of the European Commission has reviewed EfW costs in European Union countries that operate incineration facilities (Eunomia, 2001).

The boundary conditions for EfW are quite different in these regions, therefore, what is successful and feasible in one region may not be feasible in another region. Gate fees are also dependent upon local conditions including environmental regulations and local legislation.

The costs presented in Table 10 are converted 2001 Euros and as a result of inflation, they would now be significantly higher. However it is also possible that in the future, as the technology develops and becomes more available leading to higher competition, costs might reduce. Moreover, the figures provided by Eunomia refer to pre-tax costs excluding profit and therefore they can be quite different than facility gate fees. Therefore, the figures below (Table 10) can only serve as guidance. Nevertheless, a pattern emerges indicating that smaller facilities are costlier to operate than larger ones.

Table 10 Comparative costs (2001 EUR expressed as AUD) of incineration in EU members4

	Pre-tax costs net of revenues ($/t waste received)	Waste throughput (ktpa)	Bottom ash disposal ($/t)	Fly ash disposal ($/t)
Austria	$472	60	$91	$526
	$230	150		
	$140	300		
Belgium	$103	150		
	$109			
Denmark	$43-$65		$49	$194
France	$171	18.7	$125	
	$187			
	$125	37.5		
	$132			
	$146			
	$116	75		
	$130			
	$97	150		

[4] Modified from Eunomia, 2001 (Table 14).

<table>
<tr><th></th><th>Pre-tax costs net of revenues ($/t waste received)</th><th>Waste throughput (ktpa)</th><th>Bottom ash disposal ($/t)</th><th>Fly ash disposal ($/t)</th></tr>
<tr><td></td><td>$116</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Germany</td><td>$362</td><td>50</td><td rowspan="4">$41</td><td rowspan="4">$370</td></tr>
<tr><td>$152</td><td>200</td></tr>
<tr><td>$94</td><td>600</td></tr>
<tr><td>Ireland</td><td>$67</td><td>200</td></tr>
<tr><td>Italy</td><td>$60 - $135</td><td>350</td><td>$109</td><td>$187</td></tr>
<tr><td>Luxemburg</td><td>$140</td><td>120</td><td>$129</td><td>$232</td></tr>
<tr><td>Netherlands</td><td>$101-$194</td><td colspan="3">(The Netherlands figures are gate fees, not costs)</td></tr>
<tr><td>Poland</td><td>$67 - $110</td><td></td><td></td><td></td></tr>
<tr><td>Spain</td><td>$49 - $81</td><td></td><td></td><td></td></tr>
<tr><td>Sweden</td><td>$30 - $77</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">United Kingdom</td><td>$100</td><td>100</td><td rowspan="2">$130</td><td rowspan="2">Recycled (net cost to operator)</td></tr>
<tr><td>$68</td><td>200</td></tr>
</table>

A 2014 report on UK waste facility gate fees also contradicts the ISWA data as it identifies costs in the UK of up to $221/t (Table 11), significantly higher than the maximum $145/t identified for Europe by ISWA. Past UK Waste & Resources Action Programme (WRAP reports) have recorded even higher EfW gate fees in the UK with the 2012 report showing a maximum gate fee of $258/t for facilities under 200,000t.

Table 11 EfW gate fees (2014 GBP expressed as AUD) in the UK (adapted from WRAP, 2014)

Facility age	Median ($/t)	Minimum ($/t)	Maximum ($/t)	Sample
All	$132	$69	$221	31
Pre-year 2000	$116	$69	$197	22
Post-2000	$185	$122	$221	9

The overall pattern that emerges from these reports is that newer facilities have higher gate fees than older ones. Similarly, small facilities have higher gate fees than larger ones, which presumably achieve economies of scale. Given the wide range of gate fees charged around the world and the unknown factors that determine them (including government subsidies), it is difficult to estimate an independent, reliable gate fee. There are a large number of uncertainties.

To arrive at a gate fee price, the costs for ash management, insurance and licensing, operating cost, depreciation, emission control, electricity generation, amongst other things need to be qualified within the Australian/NSW regulatory environment.

Tenders are the most reliable method of determining a gate fee. However these gate fees cannot always be relied upon. While many councils draft legal contracts in an attempt to fix the price and limit council's exposure to unexpected cost increases and gate fee rises, the experience to date in Australia is that when faced with facility closure councils generally pay any premiums required to maintain services.

In other words, it is very difficult to insulate from technology and commercial risk. WSROC should be acutely aware that legal contracts may not bind operators to fixed prices. The next section outlines some of the known EfW commercial risks.

3.6 Gate fee uncertainties

3.6.1 Waste throughput

The proposed throughput of an EfW facility significantly affects the final facility gate fee. Capital amortisation and facility operation costs are directly affected by the availability of waste. There is a higher degree of uncertainty for facilities that have not entered into binding supply contracts for the provision of waste sufficient to satisfy the design capacity prior to construction commencing.

3.6.2 Ash management

Reuse of ash is widespread worldwide including in Europe and the USA. Most EfW facilities would be proposing to do the same and therefore achieve cost neutral ash management or even generate some income through the sale of bricks and pavers.

However, currently in NSW there is no legislation governing EfW ash management and no regulatory pathway exists for re-use. The default management approach would be disposal to landfill and then proving up beneficial re-use. An EfW operator would have to prepare and implement an Ash Reuse Management Plan to ensure that by-products meet all the necessary environmental criteria, such as content of heavy metals (mainly lead, cadmium, copper and zinc), dioxins and furans and are fit for use on an on-going basis.

This situation leaves EfW facilities in NSW exposed to two risks. First that they have to be able to prove, that their ash-based products (such as bricks and pavers) consistently meet the environmental criteria through leach tests to confirm that the material is non-hazardous and would not be classed as a controlled waste. If the ash-based products are not deemed environmentally stable, alternative management methods may be required. Landfill would be the fall-back option in which case the products would need to undergo a TCLP (Toxicity characteristic leaching procedure) to determine if they should be characterised as hazardous waste. The cost of disposal at NSW landfills is high, more so if the material is hazardous. At a generation rate of 230-280kg of bottom and fly ash per tonne of incinerated material (ISWA, 2006), landfilling costs would run into millions of dollars annually. To cover landfill costs, an EfW facility would need to raise gate fees significantly.

Another possible reason for ash products being sent to landfill would be the introduction of regulations or controls under environmental protection legislation in NSW that categorises incinerator ash (either all or just fly ash) as either not safe for use or as hazardous waste. If such were introduced it would effectively mandate the landfill disposal of ash and therefore increase the facility's operating costs. In such a case however, the facility operator would most likely be able to raise its gate fees and pass on the additional costs to its clients as it would trigger the "change in law" clause (included in most contracts). In other words, actions by the EPA could drive up gate fees under legitimate change in law provisions (though contrary to the spirit of the contract). There is not enough information in the public arena for MRA to quantify or validate this risk.

4. Governance

4.1 Best practice governance for regional authorities

The Victorian Waste Sector Ministerial Advisory Committee Report (MAC) on Waste Governance 2013 sets out a Best Practice approach for the management and governance arrangements of regional waste management groups. The MAC report finds that the seven major roles (or best practice functions) of regional waste coordination bodies are:

1. Policy development and oversight;
2. Administration and expenditure of levy funds;
3. Planning for infrastructure and services;
4. Procurement of waste infrastructure and services;
5. Market development;
6. Education; and
7. Reporting, data and accountability.

Within the constrains of NSW ROCs, WSROC is actively addressing these roles.

4.2 WSROC governance models

Prior to pursuing an EfW facility for managing its MSW, WSROC must first gauge the appetite of its member councils. This report can facilitate initial discussions. The key consideration is whether WSROC can benefit from getting involved in a facility procurement process or whether its needs would be best served by directly going to market to tender for EfW waste management services.

Owning and/or operating an EfW facility requires considerable investment and carries higher risks. However, it also has the potential to generate a considerable, long term income if the facility is run commercially and takes in additional, merchant tonnes. Partnering with another entity shares both the risks and the profits. The key value-add contribution of WSROC in such a project is securing the MSW base load tonnes throughout the facility's lifetime (refer to Section 3.1.1). Since WSROC has no power or history committing tonnages to any collection or treatment contracts, this would need to be achieved through its member councils, by facilitating commitment by members. Additionally, WSROC involvement brings community's confidence. These are the key reasons behind the fact that most EfW facilities in Europe are community owned.

The specifics of the proposed governance models can only be decided upon following extensive research, the development of a business plan and consultation amongst WSROC members. However, generally, there is a limited number of governance options. Regardless of the organizational affiliation of the facility, there is a need for strong irrevocable agreements regulating the supply of waste, the sale of energy, and the gate fee.

4.2.1 WSROC ownership

Following options analysis, WSROC would set up a private company to procure the facility through a tendering design and construct process. Liaison with relevant government departments would be necessary to work out the best delivery model from an environmental, planning and procurement point of view. The following sub options would be available:

- WSROC operation;
    - Special purpose company (Pty Ltd) where Councils hold shares in equal percentages ;

- A company where all Councils are stakeholders and board member and hold shares according to their respective waste quantities (e.g. Copping landfill in Tasmania);
  - WSROC seeks additional tonnes; or
- Outsourced operation;
  - WSROC/ owns site and leases to an EfW operator;
  - WSROC commits tonnes; and
  - Operator free to seek additional tonnes.

4.2.2 Single WSROC member Council ownership

One Council would build and own the facility which would be operating in one of the two following ways.

- Council operation;
  - All other WSROC members would commit tonnes and pay a gate fee (e.g. the Shoal Bay Waste Management Site and Albury landfill in NSW);
  - Council would seek additional tonnes; or
- Outsourced operation;
  - Council owns site and leases to an EfW operator;
  - WSROC members commit tonnes and pay gate fee; and
  - Operator free to seek additional tonnes.

4.2.3 Public private partnership

Public Private Partnerships (PPPs) are one of the options the government uses to procure infrastructure. PPPs offer opportunities to improve services and achieve better value for money in the development of service based infrastructure. Source: NSW Government, The Treasury[5].

Under this option, WSROC should identify a suitable operator (partner) that has significant experience in the waste management sector and access to the Sydney market to seek additional tonnes. The partner would run the facility under one the following delivery modes:

- BOT (build operate transfer);
- BOO (build own operate);
- BOOT (build own operate transfer) e.g. after 20yr; or
- WSROC/member co-ownership with EfW operator.

Possible contributions/commitments of WSROC towards a public-private partnership include:

- Delivery of guaranteed MSW tonnes (WSROC member waste);
- Long term waste supply agreement;
- Potentially assist in locating/licensing or outright procure a suitable site;
- Explore the possibility of financial contribution to CAPEX;
  - WSROC might be able to borrow the money and help fund the facility in exchange for a discounted gate fee; and

[5] For more information refer to www.treasury.nsw.gov.au/projects-initiatives/public-private-partnerships

- Although WSROC is a company limited by guarantee, its members are government organisations and therefore WSROC might be able to secure lower debt interest rate.

4.2.4 100% private sector provision

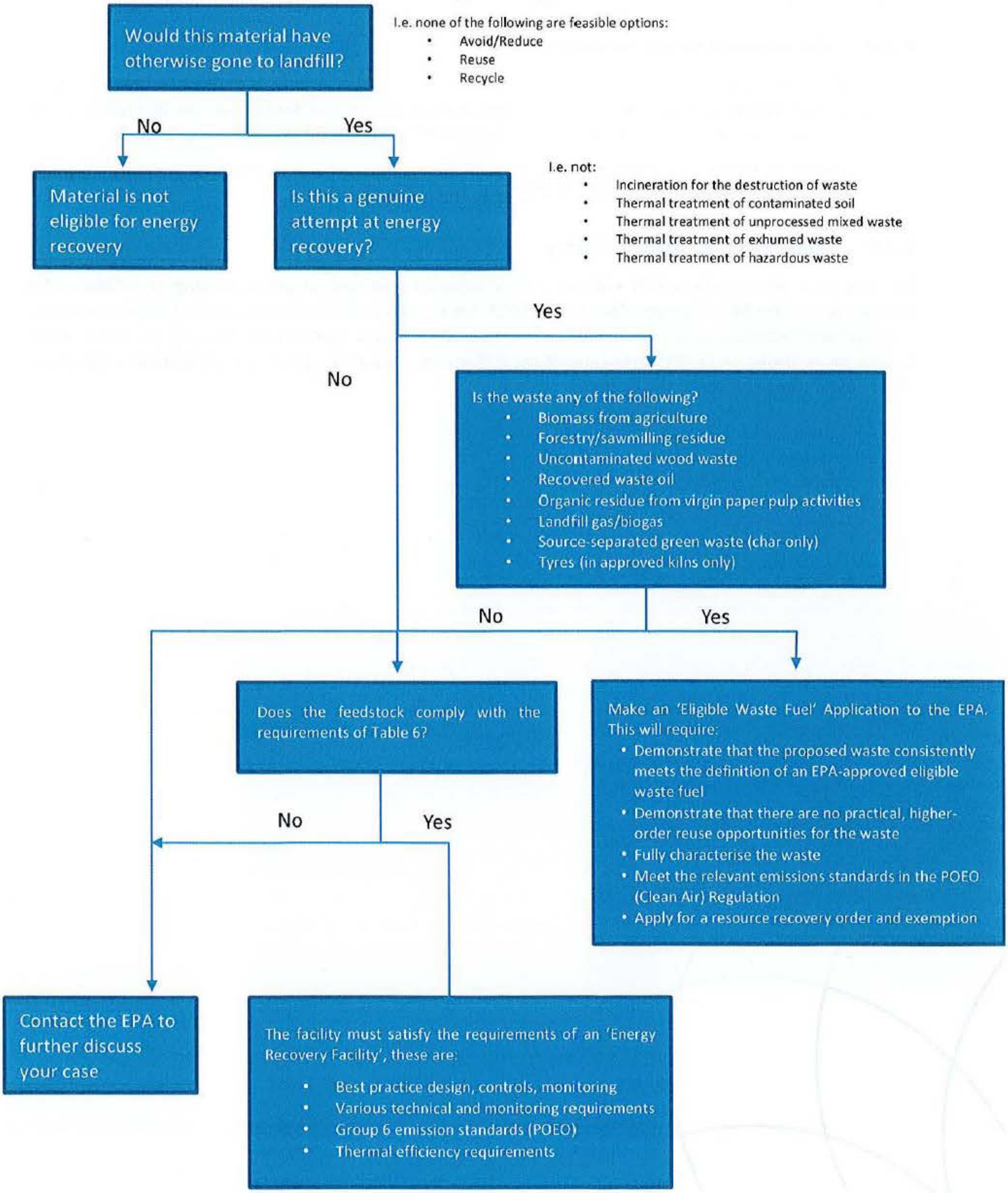
WSROC could outright procure waste management services in a similar way to that it procures landfilling contracts. That option would need to specify a requirement for an EfW facility and the landfilling of ash residues only and can be delivered under any of the four PPP modes listed in the previous section.

- WSROC to tender its waste to a waste management company (such as the arrangements in Sydney where Veolia and Suez built, own and operate the landfills).

4.2.5 Governance options summary

Deciding on a governance model without a clear business plan and an understanding of WSROC's risk appetite is not possible. However given that WSROC has no experience in directly running large scale waste management facilities, including an EfW incinerator, MRA would recommend focusing on either 100% private sector provision or PPP under one of the PPP modes, including options where WSROC is either the silent holder, the procurer or the landlord.

4.3 Legislative/Policy procurement pathway decision tree for EfW facilities



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5.1 Online resources

- **19 countries** ISWA 6th Edition of the *State*-of-the *Art Report* on *Waste*-to-*Energy* plants, list with information on EfW facilities in Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Ireland, Netherland, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland, United Kingdom and USA https://www.google.gr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjK_u7q_PrTAhXDfxoKHfAhC7EQFgglMAA&url=https%3A%2F%2Fwww.iswa.org%2Findex.php%3FeID%3Dtx_iswaknowledgebase_download%26documentUid%3D3119&usg=AFQjCNFk6bJ4KtZuwU4Wh9UeSjz5zBjCwQ&sig2=p2ffqlfKkXHdSAB8FKilT
- **EU** CEWEP – Confederation of European Waste to Energy Plants http://www.cewep.eu/
- **UK** Full list of operational energy from waste (EfW) plants in the UK http://www.wrap.org.uk/content/list-energy-waste-sites
- **USA** Energy Recovery Council- Directory of Waste to Energy Facilities including information on ownership and operational structure http://energyrecoverycouncil.org/wp-content/uploads/2016/05/ERC-2016-directory.pdf
- **Switzerland** List and map of all EfW facilities http://vbsa.ch/anlagegruppen/kva/
- **Hitachi Zosen** (technology provider)- Energy from waste facilities worldwide http://www.hitachizosen.co.jp/english/pickup/pickup002.html
- List of **1,600 EfW** facilities around the world with location links to Google maps http://www.coenrady.com/1600WTE_D20.xlsx

Appendix A Schedule 8 Local government areas in which burning is prohibited (POEO CA Reg)

Part 1 Areas in which all burning (including burning of vegetation and domestic waste) is prohibited except with approval

WSROC: Blacktown, Cumberland, Fairfield, Liverpool, City of Parramatta

All:

Ashfield
Auburn
Bankstown City
Blacktown City
Botany Bay City
Broken Hill City
Burwood
Campbelltown City
Canada Bay
Canterbury City
Fairfield City
Gosford City
Holroyd City
Hunter's Hill
Hurstville City
Kogarah
Ku-ring-gai
Lane Cove
Leichhardt
Liverpool City
Manly
Marrickville
Mosman
Newcastle City
North Sydney
Parramatta City
Pittwater
Queanbeyan City
Randwick City
Rockdale City
Ryde City
Shellharbour City
Strathfield
Sutherland Shire
City of Sydney
Warringah
Waverley
Willoughby City
Wollongong City
Woollahra

Part 2 Areas in which burning of vegetation is prohibited except with approval

WSROC: Blue Mountains, Hawkesbury City, Penrith City

All:

City of Albury
Armidale Dumaresq
Ballina
Balranald
Bathurst Regional
Bega Valley
Bellingen
Bland
Blue Mountains City
Boorowa
Bourke
Brewarrina
Camden
Cessnock City
Clarence Valley
Coffs Harbour City
Cooma-Monaro Shire
Eurobodalla
Forbes
Goulburn Mulwaree
Great Lakes
Greater Taree City
Gunnedah
Gwydir
Hawkesbury City
Hay
Hornsby
Junee
Kiama
Lake Macquarie City
Leeton
Lismore City
City of Lithgow
Liverpool Plains
Nambucca
Narrabri
Narromine
Orange City
Penrith City
Port Macquarie-Hastings
Port Stephens
Richmond Valley
Tamworth Regional
The Hills Shire
Tumut Shire
Tweed
Upper Lachlan Shire
Uralla
Wagga Wagga City
Warrumbungle Shire
Wellington

Coonamble
Dubbo City
Dungog
Maitland City
Mid-Western Regional
Murray Shire
Muswellbrook
Wentworth
Wingecarribee
Wollondilly
Wyong

Part 3 Areas in which all burning (other than burning of vegetation) is prohibited except with approval or in relation to certain domestic waste

WSROC: Blue Mountains City, Hawkesbury City, Penrith City

All:

City of Albury
Armidale Dumaresq
Ballina
Balranald
Bathurst Regional
Bega Valley
Bland
Blue Mountains City
Boorowa
Bourke
Brewarrina
Camden
Cessnock City
Clarence Valley
Coffs Harbour City
Coolamon
Cooma-Monaro Shire
Coonamble
Cootamundra
Dubbo City
Dungog
Eurobodalla
Forbes
Glen Innes Severn
Goulburn Mulwaree
Great Lakes
Greater Hume Shire
Greater Taree City
Gunnedah
Guyra
Gwydir
Harden
Hawkesbury City
Hay
Hornsby
Inverell
Junee
Kiama
Kyogle
Lake Macquarie City
Leeton
Lismore City
City of Lithgow
Maitland City
Mid-Western Regional
Murray Shire
Muswellbrook
Nambucca
Narrabri
Narrandera
Narromine
Oberon
Orange City
Palerang
Penrith City
Port Macquarie-Hastings
Port Stephens
Richmond Valley
Shoalhaven City
Tamworth Regional
Temora
The Hills Shire
Tumut Shire
Tweed
Upper Hunter Shire
Upper Lachlan Shire
Uralla
Urana
Wagga Wagga City
Wakool
Walcha
Warren
Warrumbungle Shire
Wellington
Wentworth
Wingecarribee
Wollondilly
Wyong
Yass Valley