WtE and Nutrient Recovery - Australia

Daniel Roberts

ENERGY
www.csiro.au

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Overview

Thermal Waste to Energy in Australia: a short story!

Combustion products in Australia = coal ash (usually)

Some Australian 'nutrient recovery' considerations in a WTE context

- Biochar
- RD&D in the wastewater treatment area

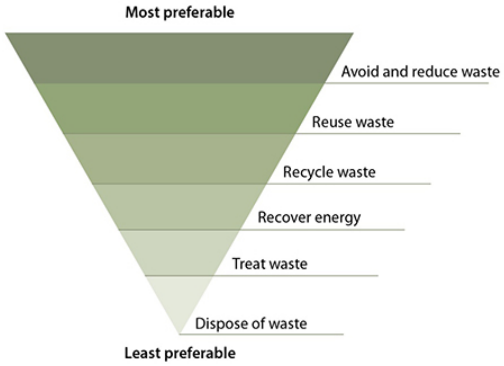
Out of scope (for now): AD, algae, direct applications

Introduction

Australia missed the WtE bus, but given the current interest in circular economy principles, perhaps that's not so bad …

Philosophically, Australia sees 'resource recovery' as a priority over 'WtE' – but there is a lot of misunderstanding regarding what WtE really is. This recovery is usually pre-WtE, and fits well in the context of circular economy.

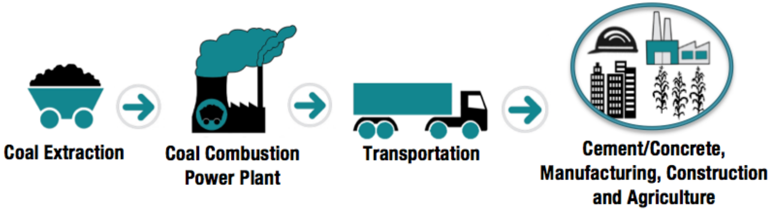
Recovery of specific nutrients in the context of waste management and waste to energy is not well-advanced – and is usually part of an environmental solution.



Ash in Australia = Coal Ash

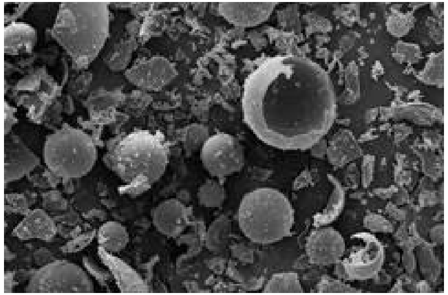
12 MT/yr ash from coal fired power stations

- Industrial uses: cement and concrete, etc
- Agriculture and horticulture are limited, largely by effectiveness but also regulation



Coal ash isn't a fertiliser (or a good source of nutrients):

- Low Ca, Mg, N, P, K. Not replacement materials for fertilisers, gypsum, lime … brown coal at best may be a poor dolomite.



Biochar

Pyrolysis-based WtE processes usually produce a char – some feedstocks produce ‘biochar’ which has agricultural applications.

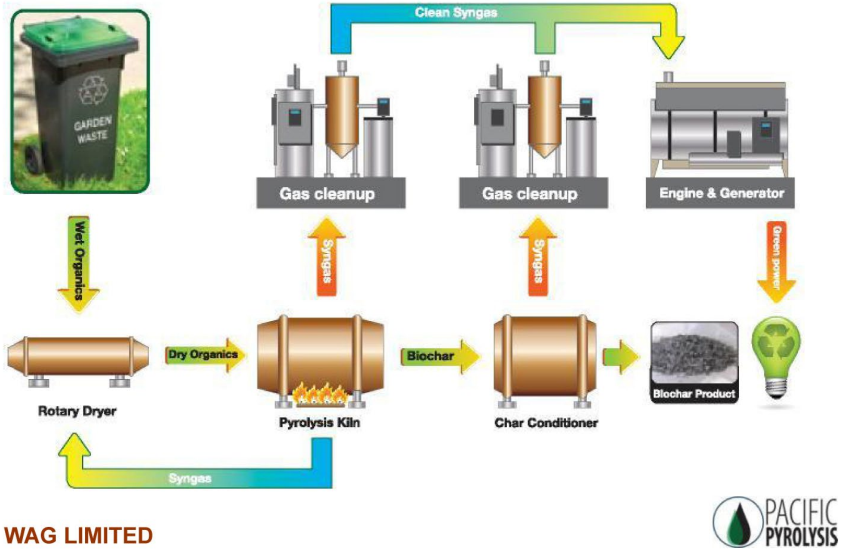
Not so much a fertiliser or nutrient provider in its own right, but an ameliorant that improves soil performance.

Popular due to low-cost pyrolysis; challenge may be with ‘byproducts’.

Carbon sequestration potential.

Biochar

BiGchar - Pacific Biochar
https://pacificbiochar.com/bigchar-biochar-production-technology/



https://pacificpyrolysis.com/

Wastewater treatment

Nitrogen is a key element from an environmental perspective

- Focus on minimising environmental impacts
- The emerging hydrogen/ammonia energy system may change all of this …

Phosphorous is emerging

- Struvite – more of a solution to a process management problem with a possible nutrient recovery outcome

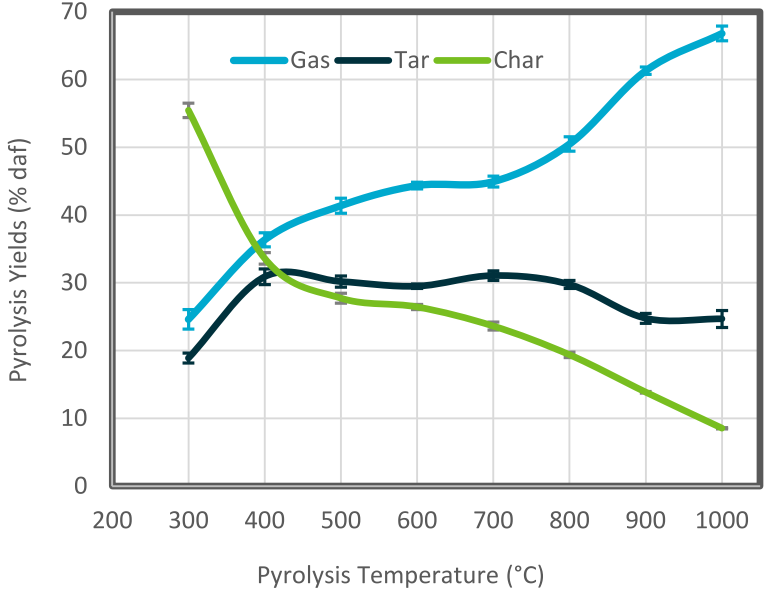
Nutrient recovery is emerging as a medium-to-long-term strategic priority, along with additional energy recovery.

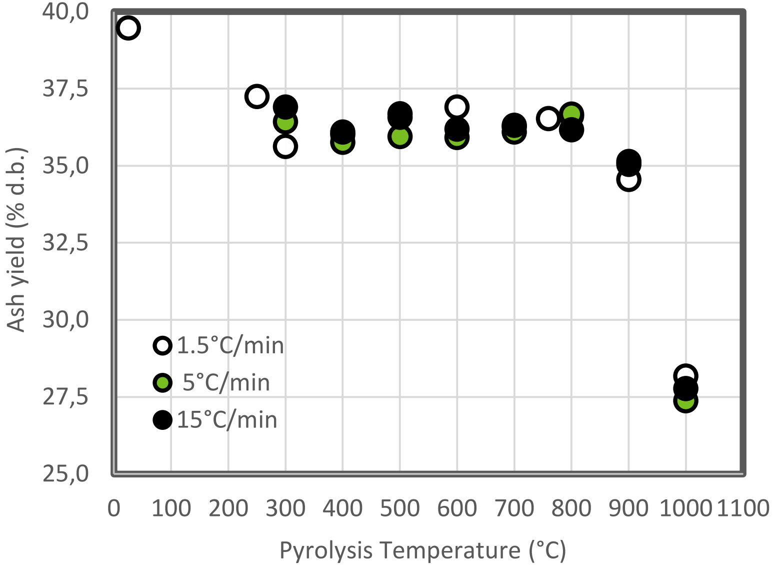
Biosolids

- Direct agricultural applications – becoming harder (pathogens, metals, cost)
- Thermochemical pathways under development and consideration

Biosolids conversion (to energy, and nutrients)

Example of Supporting Research





Biosolids Conversion

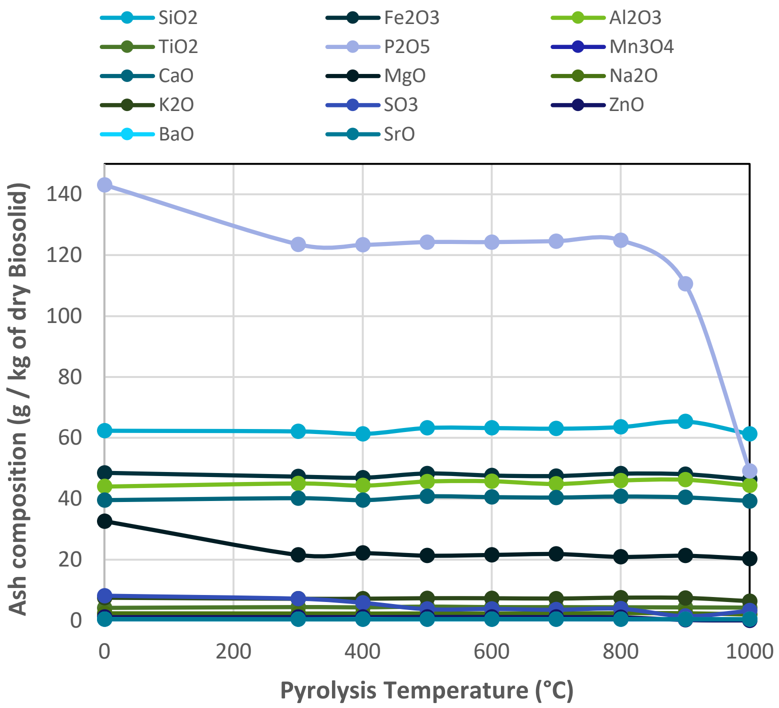
Mineral matter transformations

Devolatilisation

- Some crystallisation starts at 600°C
- From 760°C, start to form Fe/P phases
- High P content compared to Fe: some P losses at high temperatures.

Gasification

- The high amount of Fe/P material diminished rapidly during gasification

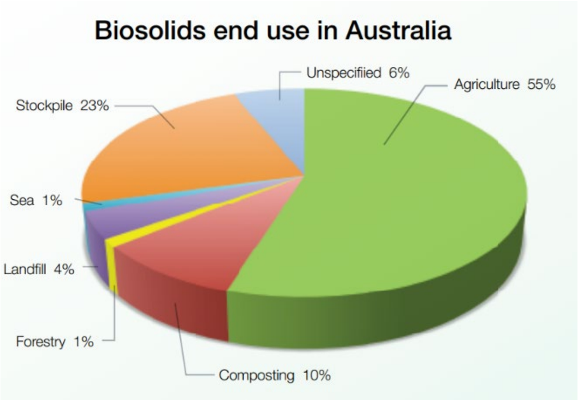


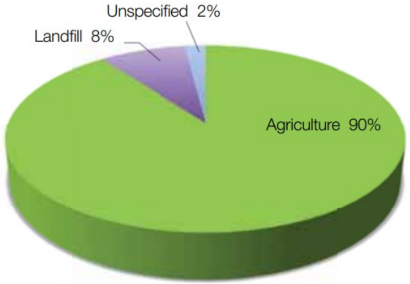
The Biosolids Opportunity

Energy and nutrients – while achieving local environmental goals.

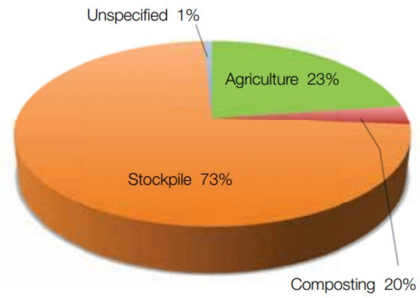
- An energy approach that fits with nutrient recovery

A good candidate for 'circular economy principles'





Biosolids end use in QLD



Biosolids end use in Victoria

http://www.environment.gov.au 'Biosolids Snapshot'

Summary

Thermal WtE in Australia is immature.

Nutrient 'recovery' from WtE residues is moreso

- Combustion products = coal ash
- Some application of AD sludge and biosolids from a fertiliser perspective

Residues for fertiliser applications are typically used whole

- Post-processing for specific nutrient recovery is uncommon (but under development)

Biochar is a common 'soil ameliorant' in a waste conversion context

Wastewater treatment is innovating in this regard

- Environmental motivations, slowly evolving

Thank you

CSIRO Energy
Dr Daniel Roberts

T: +61 7 3327 4521
e: daniel.roberts@csiro.au