Combustion Waste to Energy – High Emissions and Poor Recycling Outcomes July 2020





Overview of LMS Energy

LMS abates more carbon emissions than any other company in Australia (>3.7T CO2 per year)

27 landfill biogas power stations across Australia and New Zealand

- 65 MW installed capacity
- Project capacities from 0.5 MW to 8.8 MW
- Baseload availability > 95%
- 100% grid connected
- Anticipating c. 500 GWh in FY21
- Equivalent power for **80,000** households
- Additional 3 MW of solar PV on landfill

19 biogas flaring projects

- 3 currently scheduled to be developed as power stations by end of 2021
- 4 new flare projects in development

Operate on 50 landfills throughout Australia and NZ



LMS History 35+ years of unrivalled industry experience

1982 - 2020: Brick Kilns to Energy Innovators

1982: 1st to capture landfill biogas for fuel use (Brick Kiln)

1988: 1st to purify landfill biogas for injection into the local gas network

1993: 1st landfill biogas-to-electricity plant connected to the grid by LMS senior management (with EDL)

2001: 1^{st} to generate carbon credits from landfill biogas (with BP)

2001: Sims Metal acquires 50% stake in company

2002: 1st use of landfill biogas as an alternative fuel in a Coal Fired Power Station (Swankbank Qld)

2007-2012: Australia's 2 largest landfill biogas energy projects in 20 years (7.7 and 8.8 MW)

2010 – 2019: Largest producer of RECs from landfill biogas

2012 - 2019: Largest producer of ACCUs under the LFG method

2019: 1st grid scale solar project built on a landfill cap

2019: 1st EV recharge station powered by landfill biogas

2020: Surpassed 35million tonnes of CO2 abatement

2020+ : Next generation technologies

Cumulative CO2e Abatement (2001 - 2020)





Executive Summary

- Combustion WtE releases high emissions into the air as energy is derived from burning plastics (i.e. fossil fuels) along with organic waste
- These facilities are touted as 'green' by relying on misleading assumptions around 'avoided landfill emissions' to offset these air emissions
- Modern landfills with 83%+ gas capture and power generation have an emissions neutral outcome from each tonne of waste they receive – so these "avoided landfill emissions" are highly misleading
- Combustion WtE does not support a circular economy or recycling:
 - Restricts ability for communities to achieve waste reduction or recycling
 - Permanently destroys an organic resource and doesn't return carbon to the soil
- Recycling creates at least ten times more jobs than incineration (a low workforce operation)

Myths vs Facts of Combustion WtE

Myth Fact 1. Combustion WtE produce high air emissions (similar 1. Combustion WtE reduce greenhouse gas emissions to a fossil fuel power station) as majority of energy is from waste derived from burning plastics (i.e. fossil fuels) 2. Modern landfills with good gas capture do not produce significant emissions. 75% of Australia's waste 2. Combustion WtE are considered "green" due to the avoided emissions from waste going to landfill is already being converted into renewable energy at landfill biogas facilities 3. Only 30 – 40% of the energy is renewable (i.e. 3. Combustion WtE produces 100% renewable energy produced from organic waste). The rest is energy from from waste burning plastics (i.e. produced from fossil fuels) 4. Combustion WtE can be supportive of a circular 4. Combustion WtE locks councils into long term contracts for waste generation and restricts ability for economy communities to achieve waste reduction or recycling 5. Recycling creates at least ten times more jobs than 5. Produces more jobs than sending waste to landfill incineration (a low workforce operation) 6. Europe has had this technology for a long time and 6. The EU is moving away from combustion and no Australia needs to follow suit longer recognises it as a "sustainable activity"

Highest Cost Power Generation

The recently approved WtE facilities in WA will be Australia's most expensive electricity power stations



*Landfill Biogas data from LMS and international benchmarks

*Waste Combustion Based on published sources for Kwinana and Rockingham (WA) Projects

High Emissions

Combustion WtE produce standalone emissions equivalent to a fossil fuel fired power station due to the burning of plastics

Emissions (per MWh) from power generation / waste disposal technologies



- Combustion WtE facilities produce high air emissions as they rely on burning plastics (fossil fuels)
- These WtE facilities are considered "green" due to the claimed "avoided landfill emissions". However, modern landfill cells with gas capture > 83% and generating renewable electricity result in ZERO or beneficial net emissions at a landfill

*Note: Range of 0.4 to 0.7 TCO2e/MWh depending on composition of waste

Sources: Fossil source: ACIL Allen update of input values for AEMO (2016); Combustion source: Ramboll (2018)

Proving the energy and emissions benefits of Waste to Energy requires the right assumptions

A Recent Australian Waste to Energy Facility Life Cycle Assessment



Source: Ramboll, 2018

*Only required under contract for year 1

The key benefits *claimed* by waste to energy are <u>avoided emissions from landfill</u> but the assumptions used to justify these are incorrect

- The 'Avoided Landfill Impact' claim is misleading as in reality, this impact is already being mitigated by current onsite gas capture activities and power generation (which is ignored in the emission assessments)
- In effect, Combustion WtE is not reducing emissions, but increasing them

CO2e Impact Assessment T CO₂e 400 200 0 Quicklime Natural gas Ash to landfill WtE Air Waste Avoided Avoided Total (200)Collection landfill impact missions waste transport (400) (558) (600)(800)(1000)

A Recent Australian Waste to Energy Facility Life Cycle Assessment

Source: Ramboll, 2018

These Lifecycle Assessment assumptions are not appropriate – local landfills have biogas capture systems and renewable energy generation

Amending the "Avoided Landfill Emissions" Assumptions

Landfill Emissions	Lifecycle Assessment	Amended Using Real Assumptions
Gas capture rates	46.2% (claimed Australian average that include old waste and non-gas capture landfills)	80% (more reflective of gas capture of new waste at the two local, modern landfills)
Electricity generation	Zero (assumed there was no electricity generation at landfill, hence also displacement of fossil fuel generation)	Yes (both local landfill's have power
Actual Net Emissions Offset	Avoided emissions of 1T CO2e / waste processed	Avoided emissions of 0.006T CO2e / T waste processed (< 1% of LCA!)

Updating for these assumptions results in combustion WtE providing detrimental emissions outcomes

Emissions equivalent to a natural gas fueled power station when biogas recovery for energy generation is considered

Adjusted CO2e Assessment for Appropriate "Avoided Landfill Emission" Assumptions



CO2e Impact Assessment

LCA Result Result with 80% Gas Capture and Energy Offset

Energy Output

Landfill biogas achieves superior renewable energy recovery per tonne of organics than Combustion WtE

Wollert (Melbourne) Landfill Case Study: Energy content of waste



Energy Output

The majority of energy produced from combustion of waste is derived from plastics (i.e. fossil fuels) and therefore not renewable

Where does the energy come from?



Community Cost

Diverting waste from landfills to waste to energy facilities reallocates the landfill levy from state government to gate fee revenues for corporates

→ Waste to energy relies on very high landfill levies to be cost competitive



→ For every 100,000t combustion waste to energy facility built, State Governments will lose levy revenue of between \$6.6m per year (Victoria) and \$14.4m per year (NSW)

The EU Experience

EU statistics show that adopting a combustion waste to energy approach does not encourage waste reduction or recycling

- 'Leading' EU countries using Combustion WtE that incinerate c. 40%+ of household waste (e.g. Finland, Denmark and Austria) are producing more waste per capita than 20 years ago!
- Australia's has reduced its waste per capita by 6x the EU average over the past 20 years with zero combustion facilities

The EU Trends

- The EU is moving away from incineration technologies:
 - According to Circular Economy EU legislation, combustion technology has been excluded as a sustainable business practice as "it harms waste prevention, recycling and the circular economy"
 - The EU has recently advised its member states that Combustion WtE facilities are no longer eligible for clean energy subsidies
 - Nordic nations Denmark, Finland, Iceland, Norway and Sweden are not on track to meet the recycling targets of the EU revised Waste Directive, because of their overreliance on incineration
- Denmark is now importing waste (120kg per resident) from the UK and changed initial rules to allow biomass to be combusted in order to feed its incineration facilities. So, in effect, it is now encouraging non-recycling In the UK

Destroys Future Biogas Opportunities

Burning waste will limit future biogas opportunities for Australia to transition to a clean energy economy

- Biogas is a growing sector and can be a key player in accelerating Australia's clean energy transition from 2000 to 2020, biogas output in Australia increased from 449 GWh to 1253 GWh (a 280% increase)
- Biogas from landfill or Anaerobic Digestion will be a future low cost resource for:
 - Renewable Natural Gas (Biomethane)
 - o Green Hydrogen
 - o Biofuels
- Combustion of waste does not produce biogas (as it includes the burning of fossil fuels). Accordingly, combustion of waste will significantly limit future biogas opportunities for Australia.

