The role of landfill biogas capture, Australia's largest source of carbon abatement, in a changing policy landscape

Tiana Nairn – Policy Group Manager

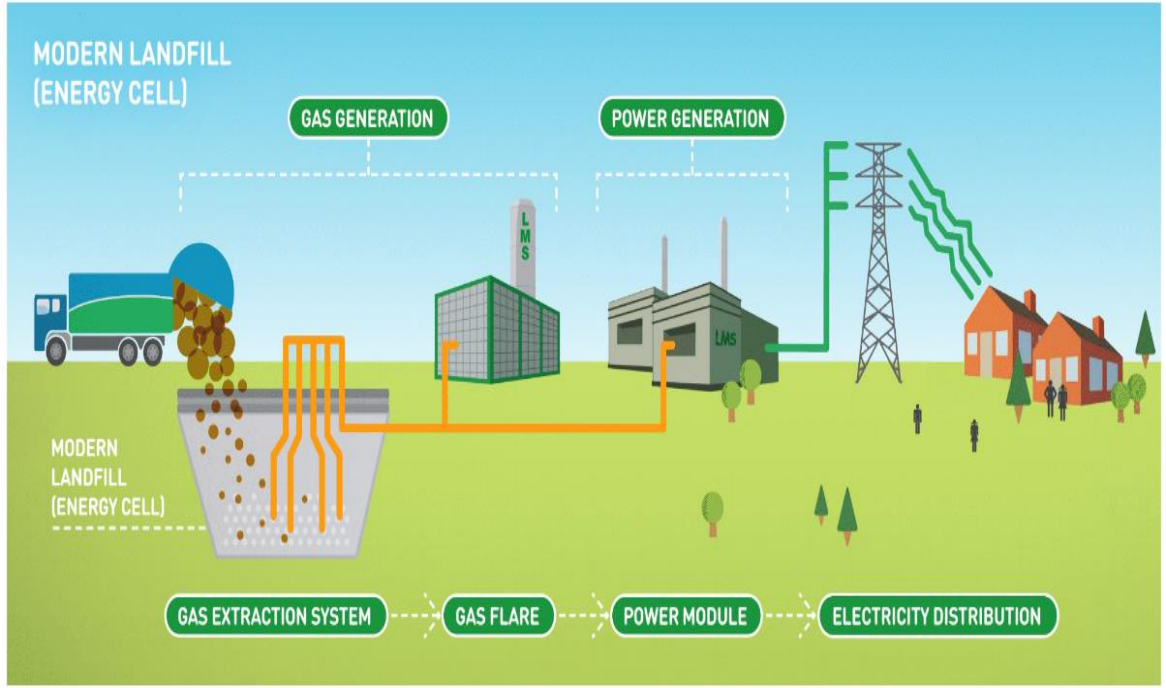
LMS Energy

History

Nearly 40 years of unrivalled industry experience

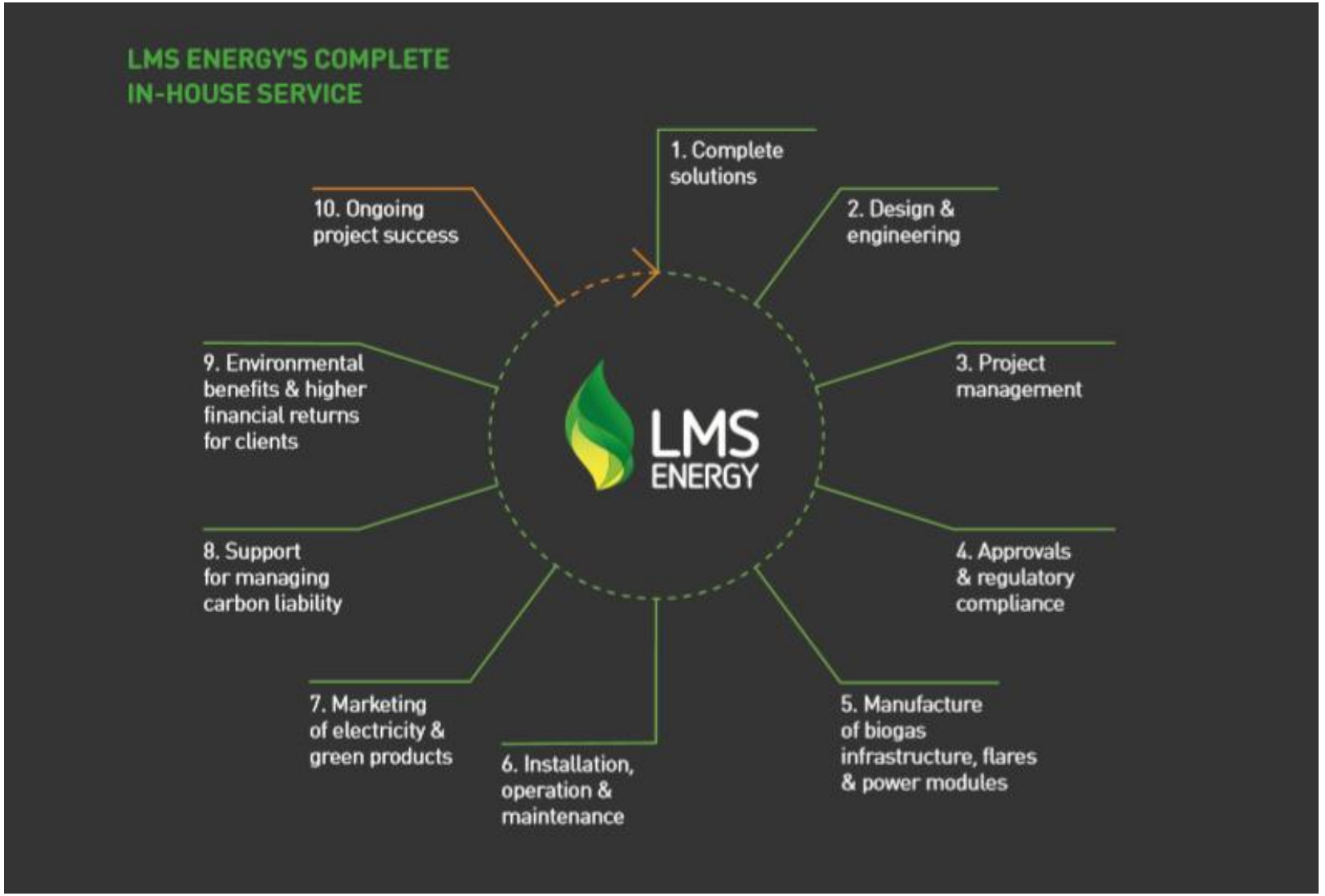
1982 - 2021: Brick Kilns to Energy Innovators

- 1st to capture landfill biogas for fuel use
- 1st to purify landfill biogas for injection into the local gas network
- 1st landfill biogas-to-electricity plant connected to the grid (with EDL)
- Australia's 1st solar projects on landfill
- Australia's 1st EV SuperCharger powered by landfill solar
- Design, engineering and manufacturing undertaken in Australia
- Next generation technologies



Operations

Significant IP underpinned by full in-house business model



LMS Energy in 2021

Australia's most successful Waste to Energy company

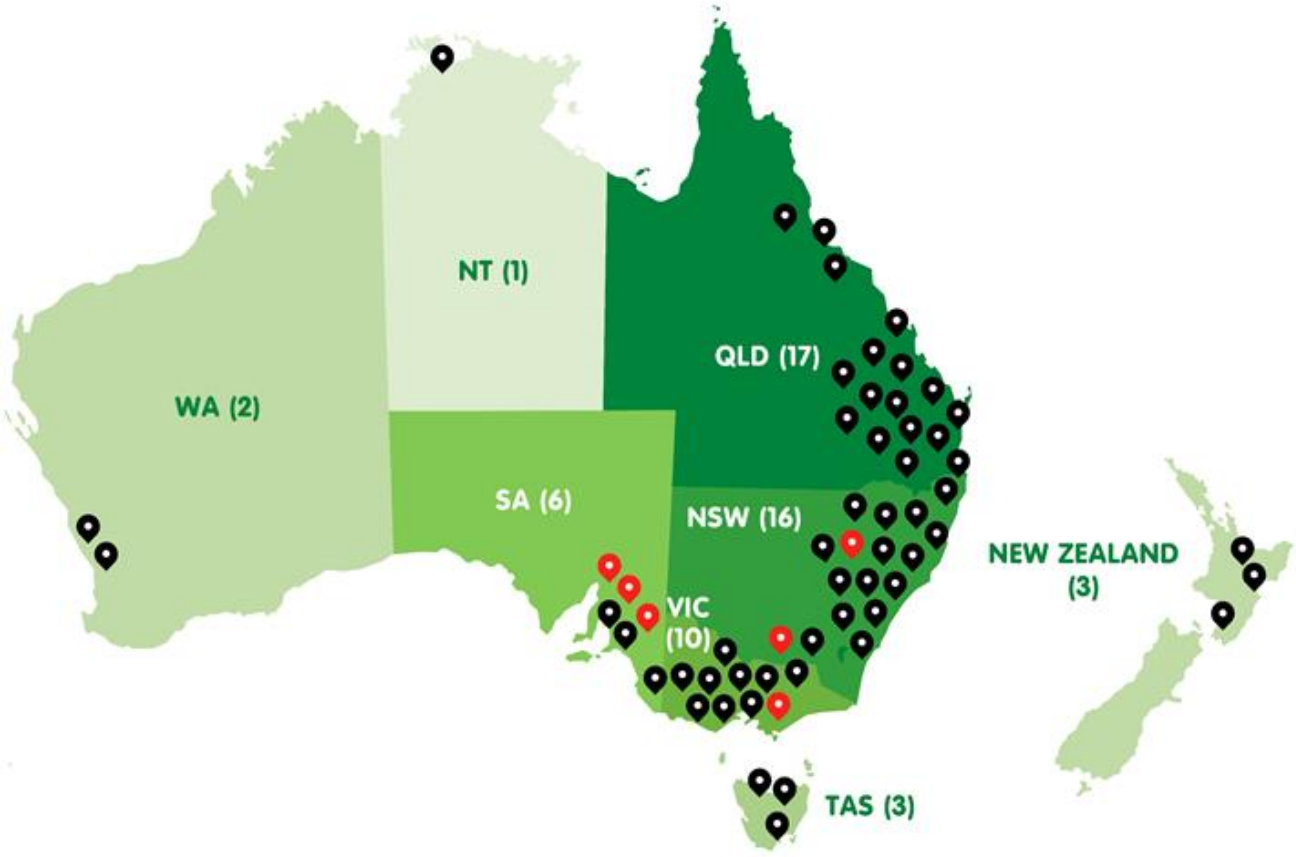
28 landfill biogas power stations across Australia and New Zealand

- **70 MW** installed capacity
- **500 GWh** generated
- Project capacities from **0.5 MW to 8.8 MW**
- Baseload **availability > 95%**
- Equivalent power for **80,000** households each day
- Additional **3MW of solar PV** on landfill
- **22 landfill biogas flaring projects**
- **170PJ of energy reserves (to 2040)**

Australian owned

Employ 160+ staff and growing

Operate on 50 landfills across Australia and NZ



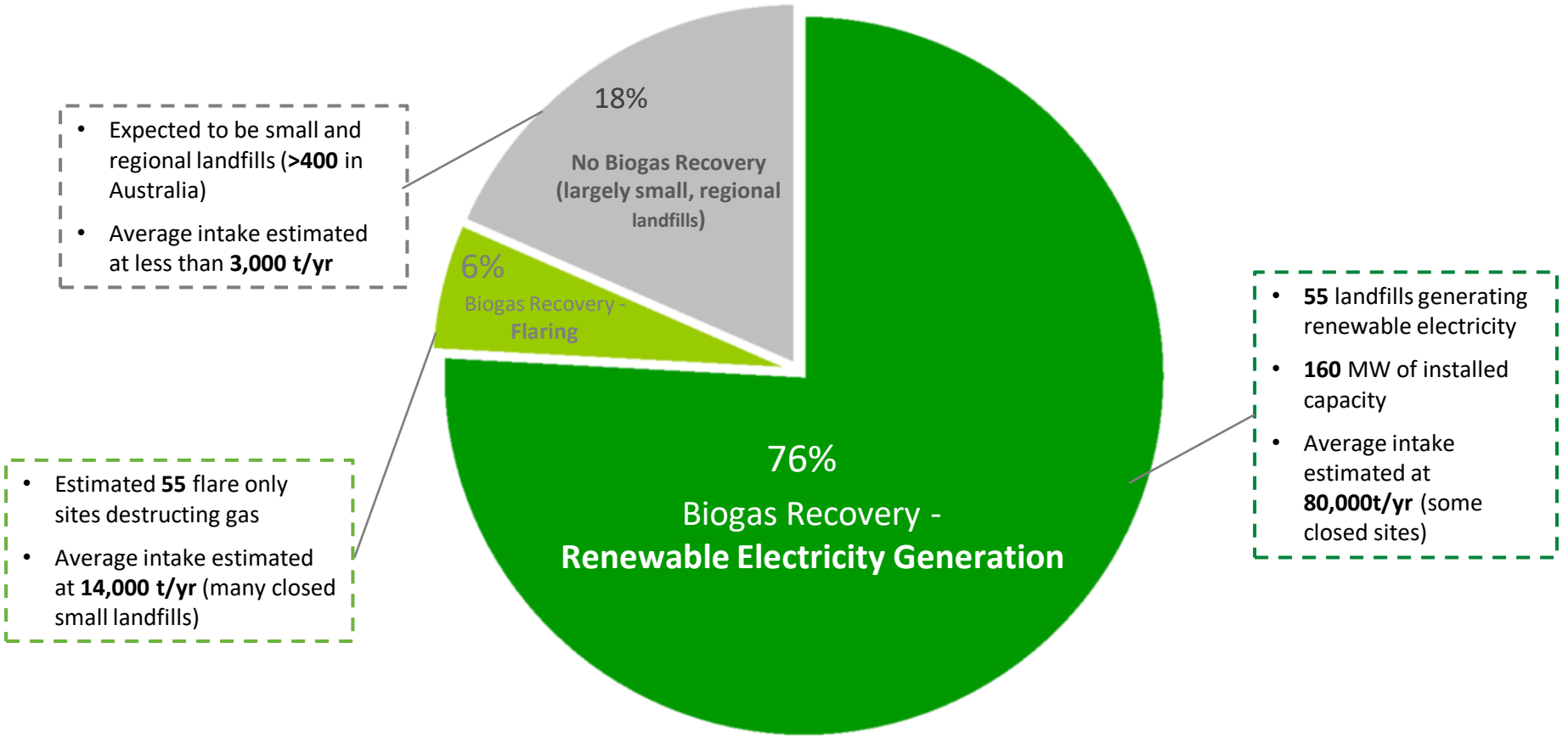
LMS does not own or operate landfills, we are focused on renewable biogas recovery from waste

Landfill Biogas

Existing “Waste to Energy”

Most of Australia’s household waste currently goes to a landfill providing waste to energy recovery

Proportion of household waste going to landfill with methane gas recovery



- Expected to be small and regional landfills (**>400** in Australia)
- Average intake estimated at less than **3,000 t/yr**

- Estimated **55** flare only sites destructing gas
- Average intake estimated at **14,000 t/yr** (many closed small landfills)

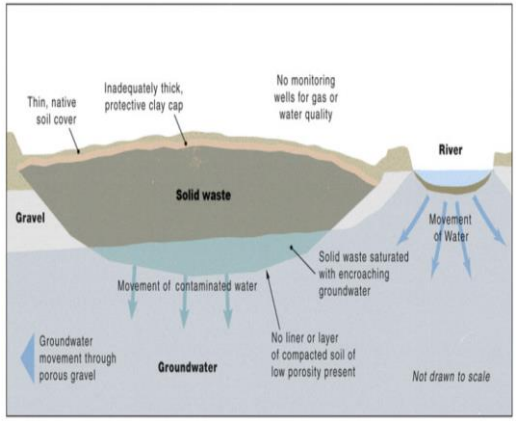
- **55** landfills generating renewable electricity
- **160** MW of installed capacity
- Average intake estimated at **80,000t/yr** (some closed sites)

Source Data: National Waste Report (2018)
CER registers (RECs/ACCUs)

The Modern Landfill

Landfills have evolved from dumps to highly engineered environmental containment systems

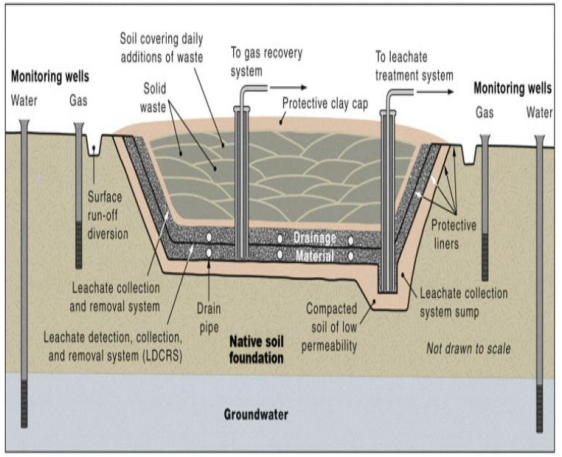
The "Old Style" Landfill



- Highly engineered containment systems
- Heavily regulated for environmental protection
- Controls that facilitate biogas collection efficiencies **> 85%**
- Only issues where urban development impacts traditional buffer zones
- **Remains the cheapest form of waste management**

The Modern Landfill

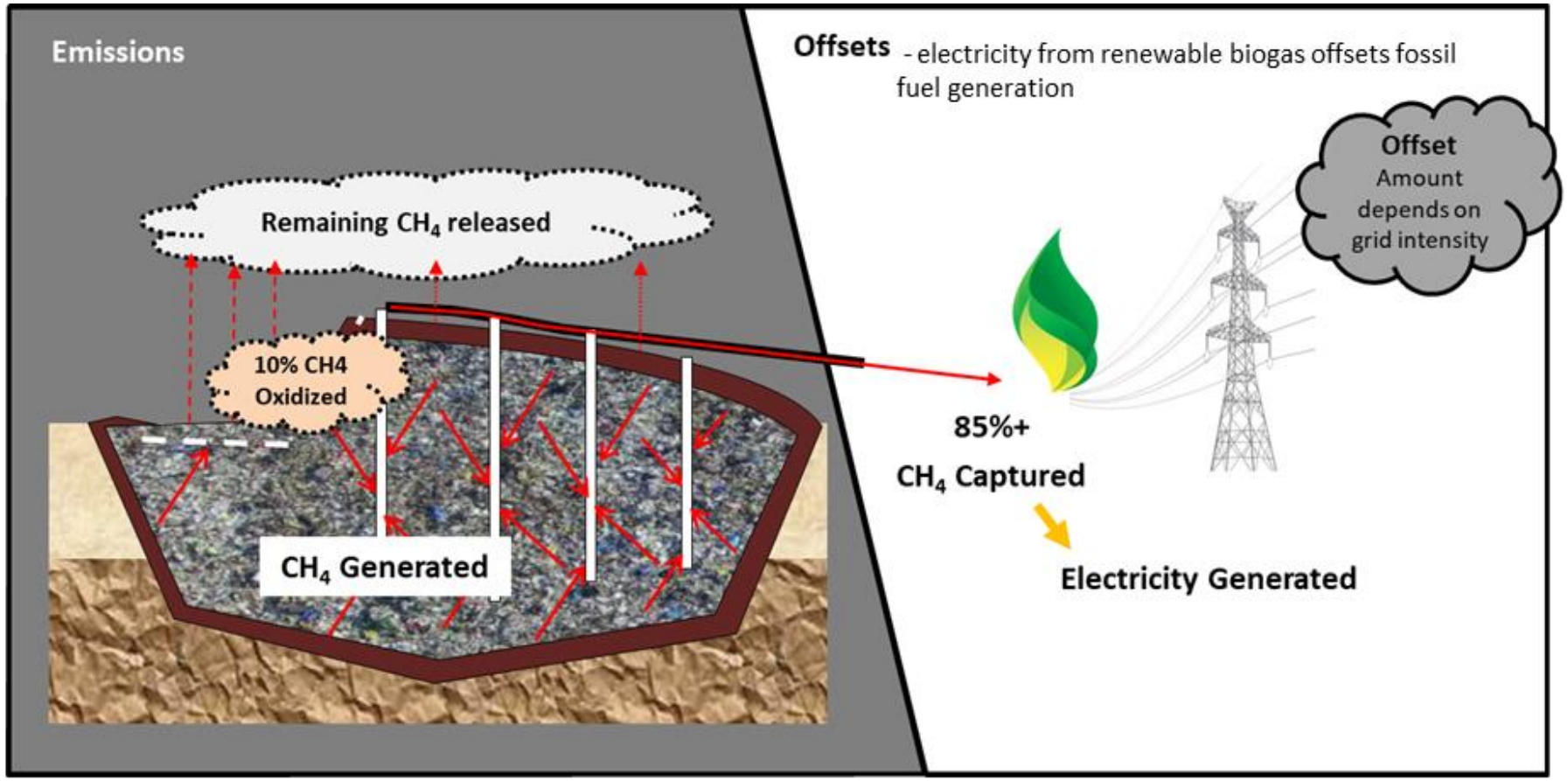
(>85% biogas capture)



Source: Pollution Science, Academic Press, San Diego, CA, 1996

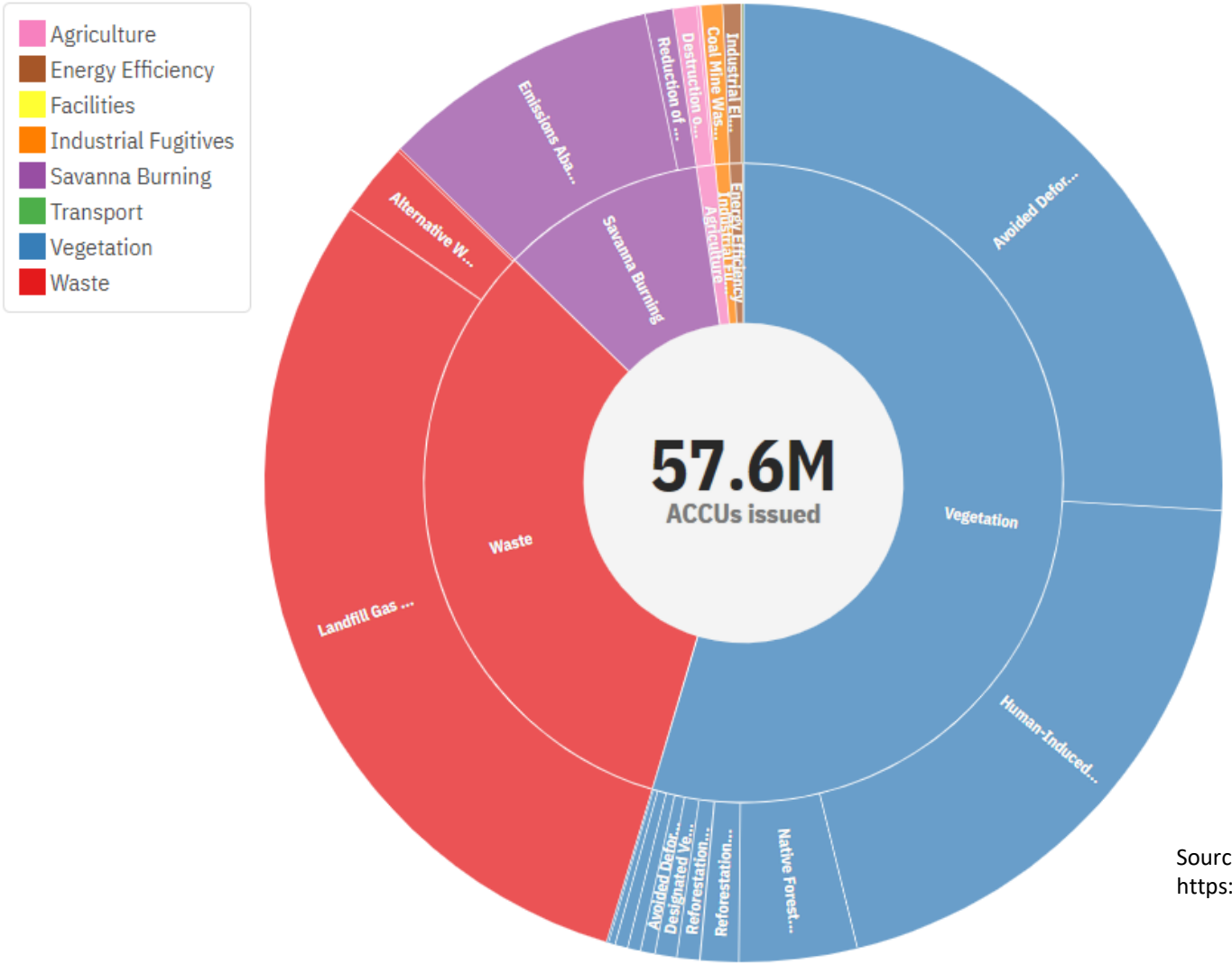
The Modern Landfill

Modern landfills with ~85% gas capture rates and power generation provide an emissions neutral outcome from waste and potentially a net reduction!



Emission reductions

Landfill biogas is responsible for ~30% of all issued Carbon Credits (ACCUs)



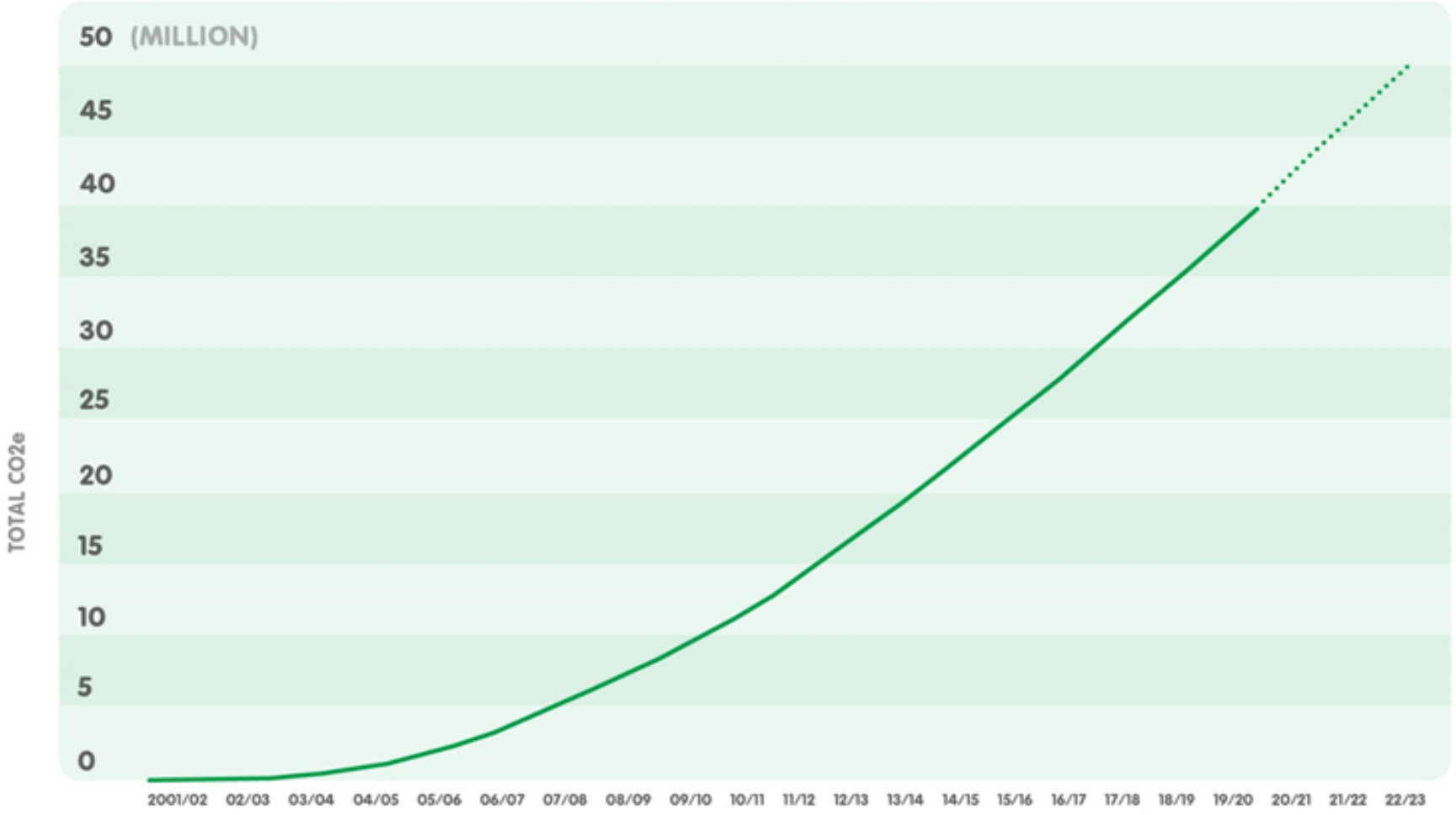
Source:
https://offsetsmonitor.org.au/

Emission reductions

LMS is the largest Carbon Credit (ACCU) provider in Australia

Over 40 million tonnes of total CO_2e emission reductions achieved to date

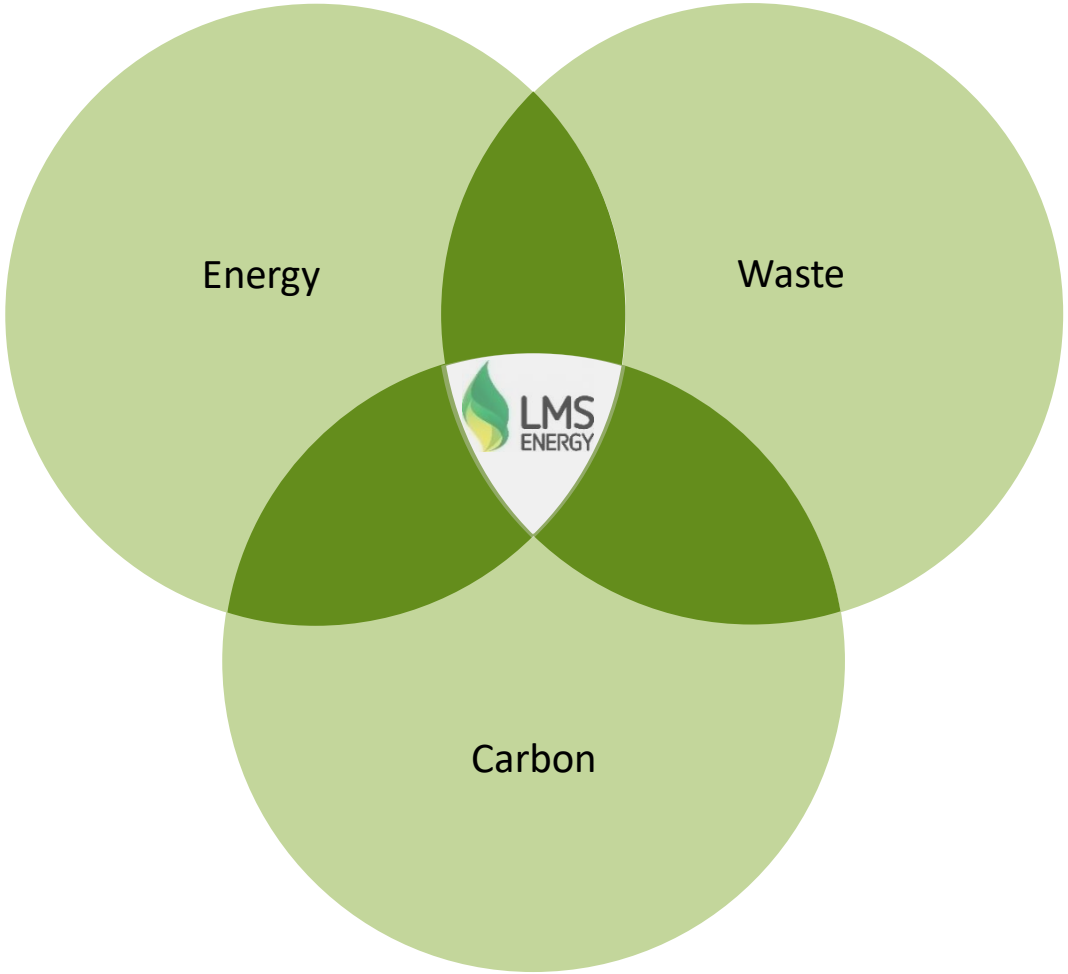
LMS is saving ~4 million tonnes CO_2e emissions per year



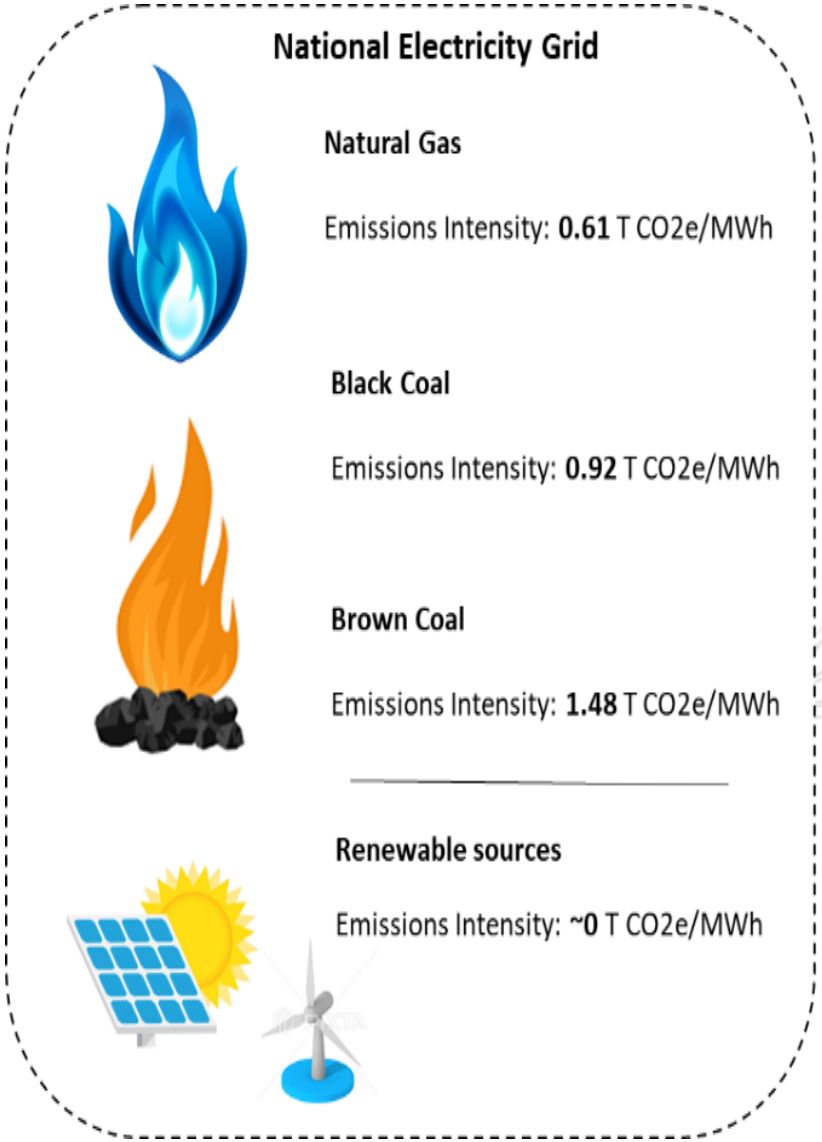
The policy landscape

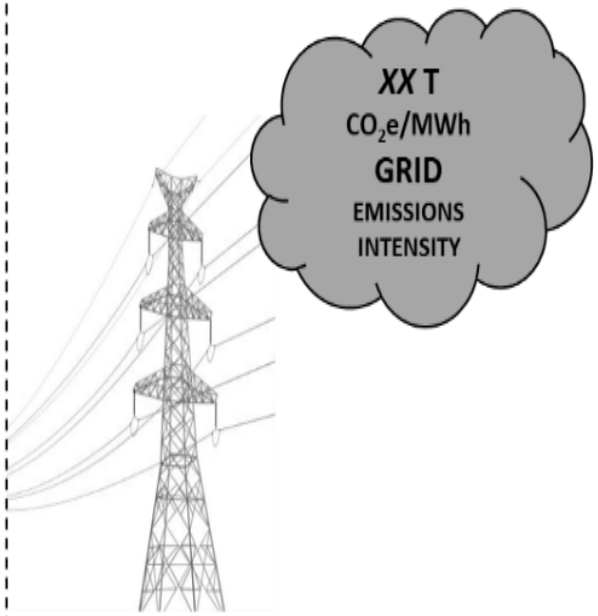
Policy and market environment

Biogas occurs in a complex policy interplay and awareness of its contribution matters



Energy policy – emissions





State/Territory	2019-20
National	0.72
NSW	0.81
VIC	1.02
QLD	0.81
SA	0.44
WA	0.69
TAS	0.15
NT	0.63
ACT	0.81

http://www.cleanenergyregulator.gov.au/NGER/Legislation/Measurement-Determination

Energy policy – net zero by 2050

All states are seeking net zero emissions by 2050 under the following key policies

State policy	Interim targets
NSW - Net Zero Plan Stage 1: 2020-2030 (2020)	2030 - 35% below 2005 levels 2030 – no net emissions from organic waste
VIC – Climate Change Strategy (2021)	2025 – 28-33% below 2005 levels 2030 – 45-50% below 2005 levels
QLD – Pathways to a clean growth economy (2020)	2030 – 50% of energy from renewable sources
WA – Western Australian Climate Policy (2020)	Theme based actions for reductions
SA – Climate Change Action Plan 2021-2025 (2020)	2030 – 50% below 2005 levels
NT – Delivering the Climate Change response: Towards 2050	Objective based actions for reductions
TAS – New plan underway (existing is for 2017-2021)	2015 – Reached net zero (and maintained since) 2040 – generate 200% of needs from renewable energy
ACT – Climate Change Strategy 2019-2025	2025 – 50-60% below 1990 levels 2045 – net zero

Waste policy

The key drivers

The key drivers across waste policies across Australia are:

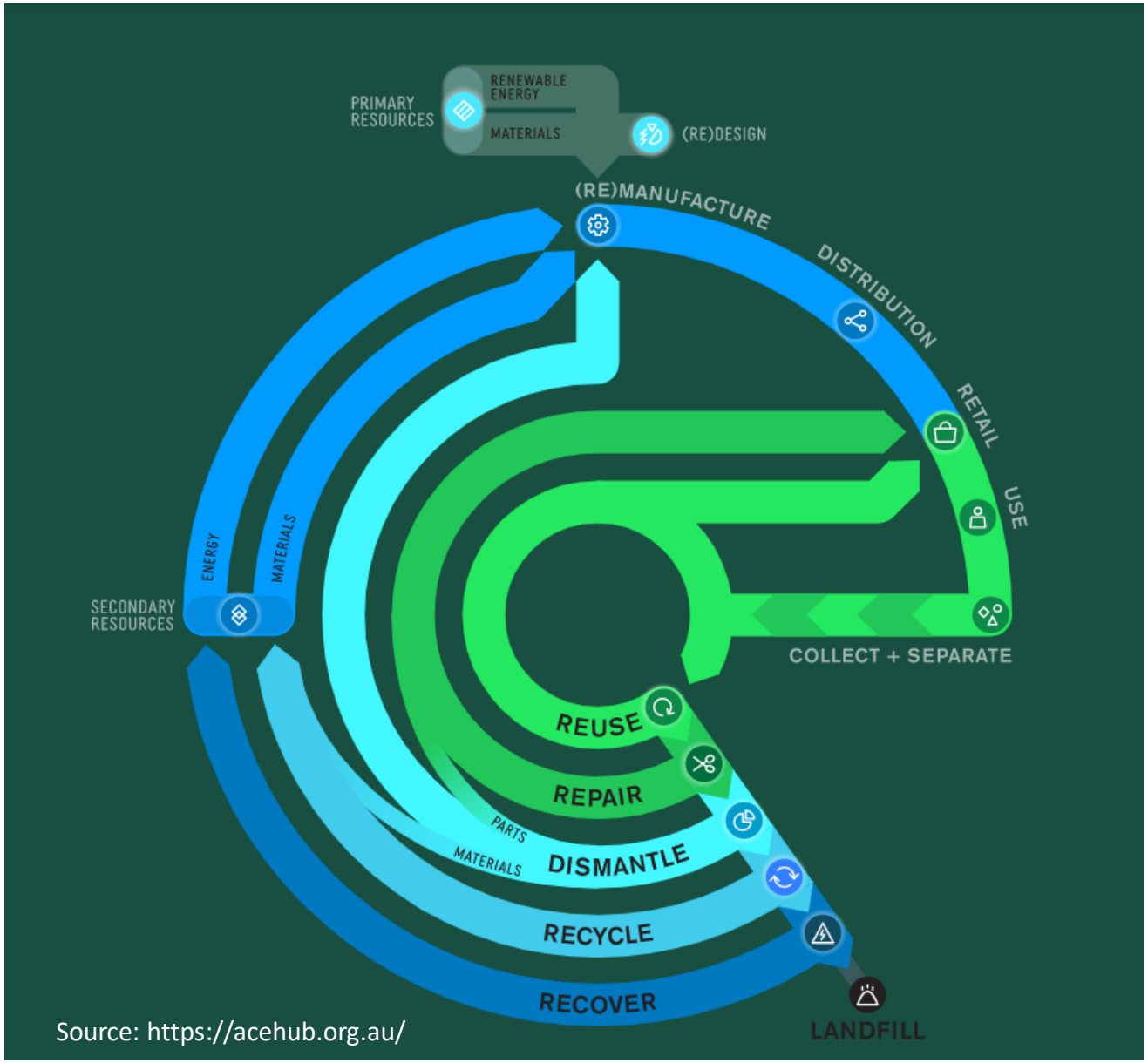
1. The Waste Management Hierarchy
2. The Circular Economy

The waste management hierarchy

- Hierarchy often embedded in law
- Landfill biogas capture is typically viewed in the ‘disposal’ tier – despite energy recovery
- Thermal EfW is typically viewed as ‘recovery’
- Waste levies are used to reinforce the hierarchy

Source: South Australia’s Waste Strategy 2020-2025

The circular economy



Source: https://acehub.org.au/

Involves:

- ✓ Redesign, eg
  - design for longevity
  - design for repair
  - design for reuse in manufacture
  - design for material recovery
- ✓ Reuse
- ✓ Repair
- ✓ <u>Recycling and recovery (including energy)</u>

The circular economy

The need for, and opportunities presented by, a circular economy are gaining momentum in Australia – for example:

2017 – Benefits of a Circular Economy in SA

2018 – Senate Committee recommendation*

National Waste Policy

2019 – NWP Action Plan

QLD Waste Management and Resource Recovery Strategy

2020 – WA Closing the loop: Waste reforms for a circular economy

Recycling Victoria: A new economy

NSW Circular Strategic Plan 2020-23

ACE Hub, NSW Circular, CEBIC (Vic)

* Australian Senate Environment and Communications References Committee (2018) Never waste a crisis: the waste and recycling industry in Australia – recommendation 1

Waste policy outcome – thermal EfW

Considering end fates for residual wastes as we transition …

Landfill biogas has not been well recognised in waste policy to date

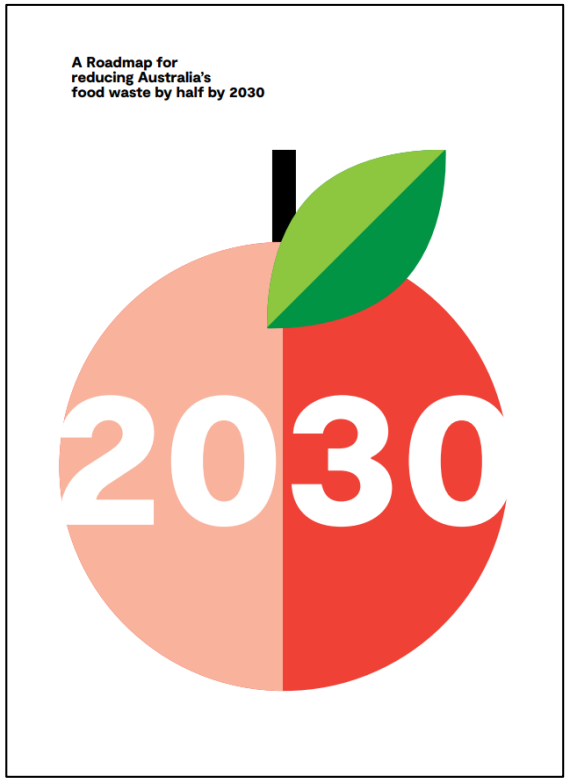
Under current approaches, thermal EfW proposals are expanding rapidly

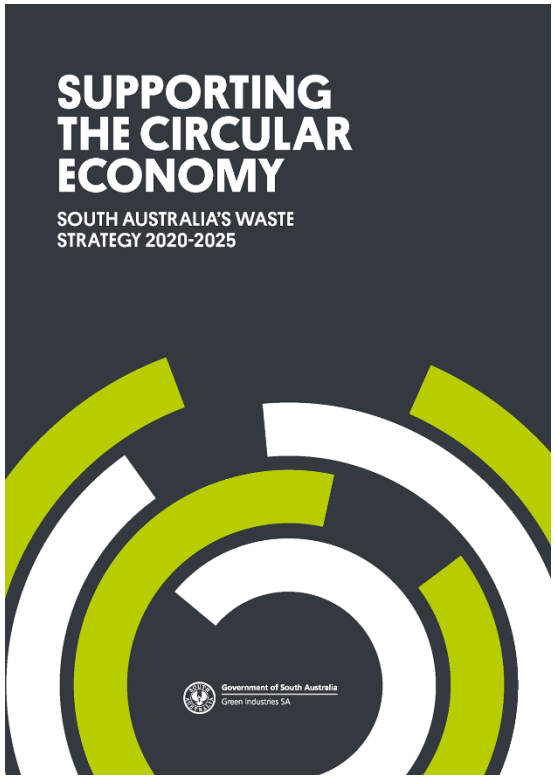
A selection of proposals	Proposal volume (t)
NSW – at least 6 proposals	~1,800,000
VIC – at least 4 proposals	~1,350,000
QLD – at least 1 proposal	~500,000
WA – at least 2 facilities under construction	~700,000
Total tonnes	**~4.35M**

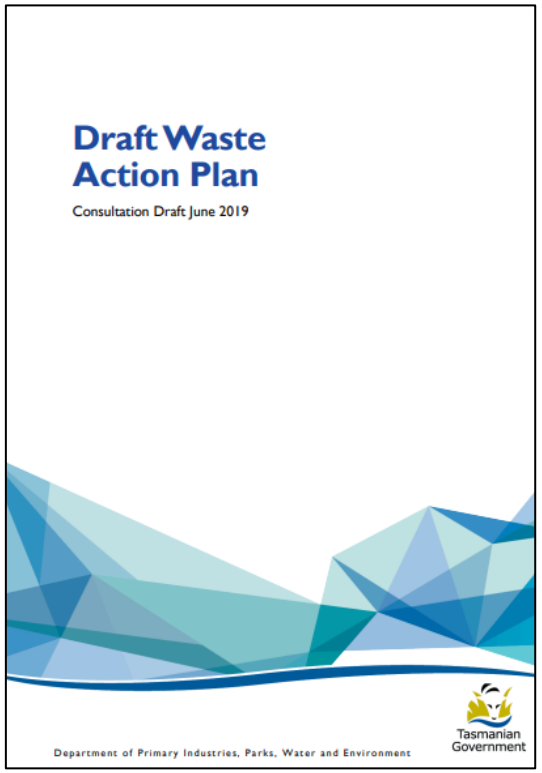
These proposals would result in over 15% of waste currently sent to landfill in Australia being disposed at thermal waste to energy plants

Waste policy outcome – organic waste trends

- Waste policies seek that we:
  - Halve the generation of food waste by 2030
  - Halve organic waste to landfill by 2030
- This will result in <30% organic waste content in residual streams by 2030







Waste policy outcome – organic waste trends

- **Organic waste diversion is a focus for all states, eg:**
  - **NSW** invested $105.5 million to boost food and garden organics recycling in 2017-2021, and more to come?
  - **VIC** has committed to FOGO for all households by 2030
  - **QLD** is developing an Organic Waste Action Plan
  - **SA** has widespread FOGO already and is to spend another $7.7 million over the next 3 years to further expand
  - **WA** has committed to all Perth and Peel households to move to a 3-bin FOGO system by 2025
  - **TAS** is releasing organics research outcomes and strategy in late 2021
  - **ACT** is introducing FOGO for all households from 2023

Councils with FOGO have less organic waste in red bins

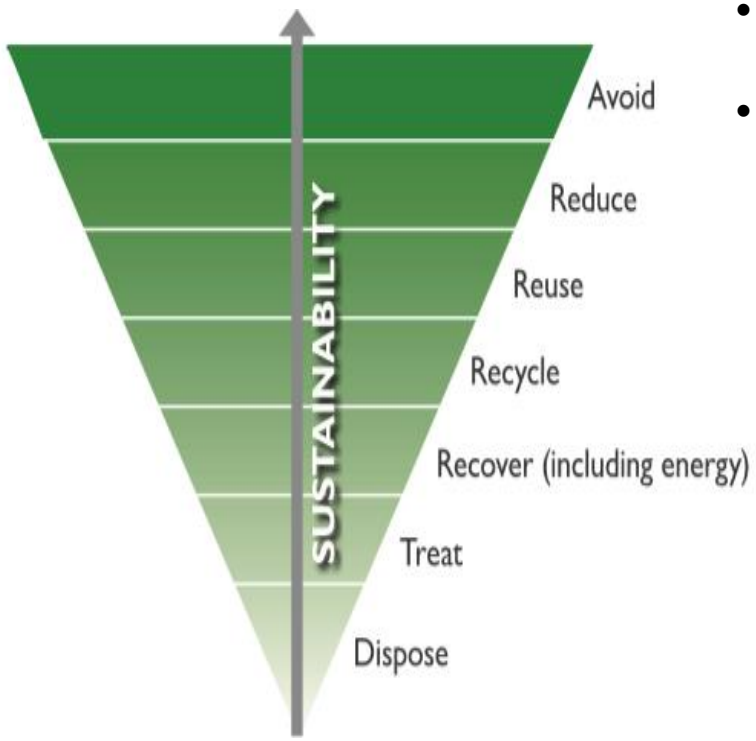
No organic service: 53.6%

Green waste service: 41.2%

FOGO service: 24.8%

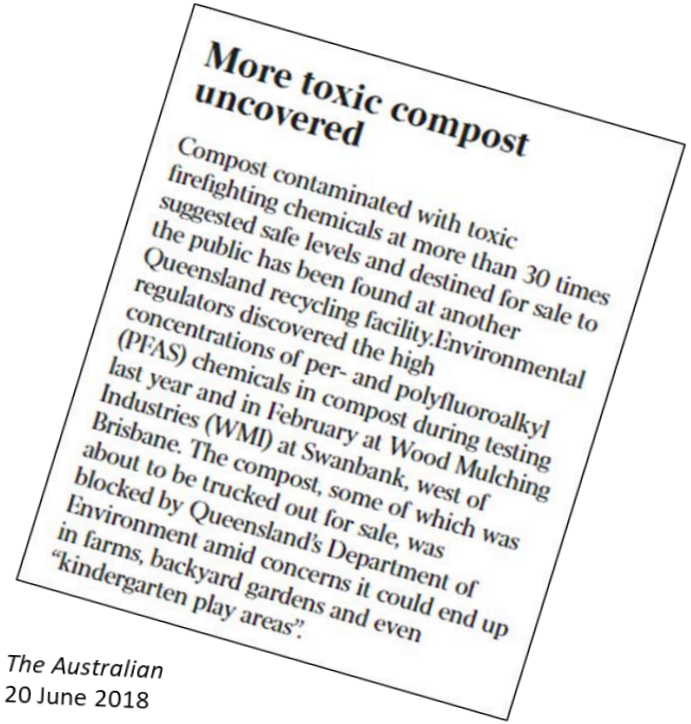
Source: Rawtec 2020

Waste policy outcome – avoiding contamination



- Recovery needs to be safe
- Matters to consider include:
  - Heavy metals and other chemicals of concern
  - Emerging persistent contaminants (eg PFAS)
  - Plastics and microplastics
  - Glass, needles or other ‘sharps’

Currently, regulatory approaches are inconsistent between jurisdictions



More toxic compost uncovered

Compost contaminated with toxic firefighting chemicals at more than 30 times suggested safe levels and destined for sale to the public has been found at another Queensland recycling facility.Environmental regulators discovered the high concentrations of per- and polyfluoroalkyl (PFAS) chemicals in compost during testing last year and in February at Wood Mulching Industries (WMI) at Swanbank, west of Brisbane. The compost, some of which was about to be trucked out for sale, was blocked by Queensland's Department of Environment amid concerns it could end up in farms, backyard gardens and even "kindergarten play areas".

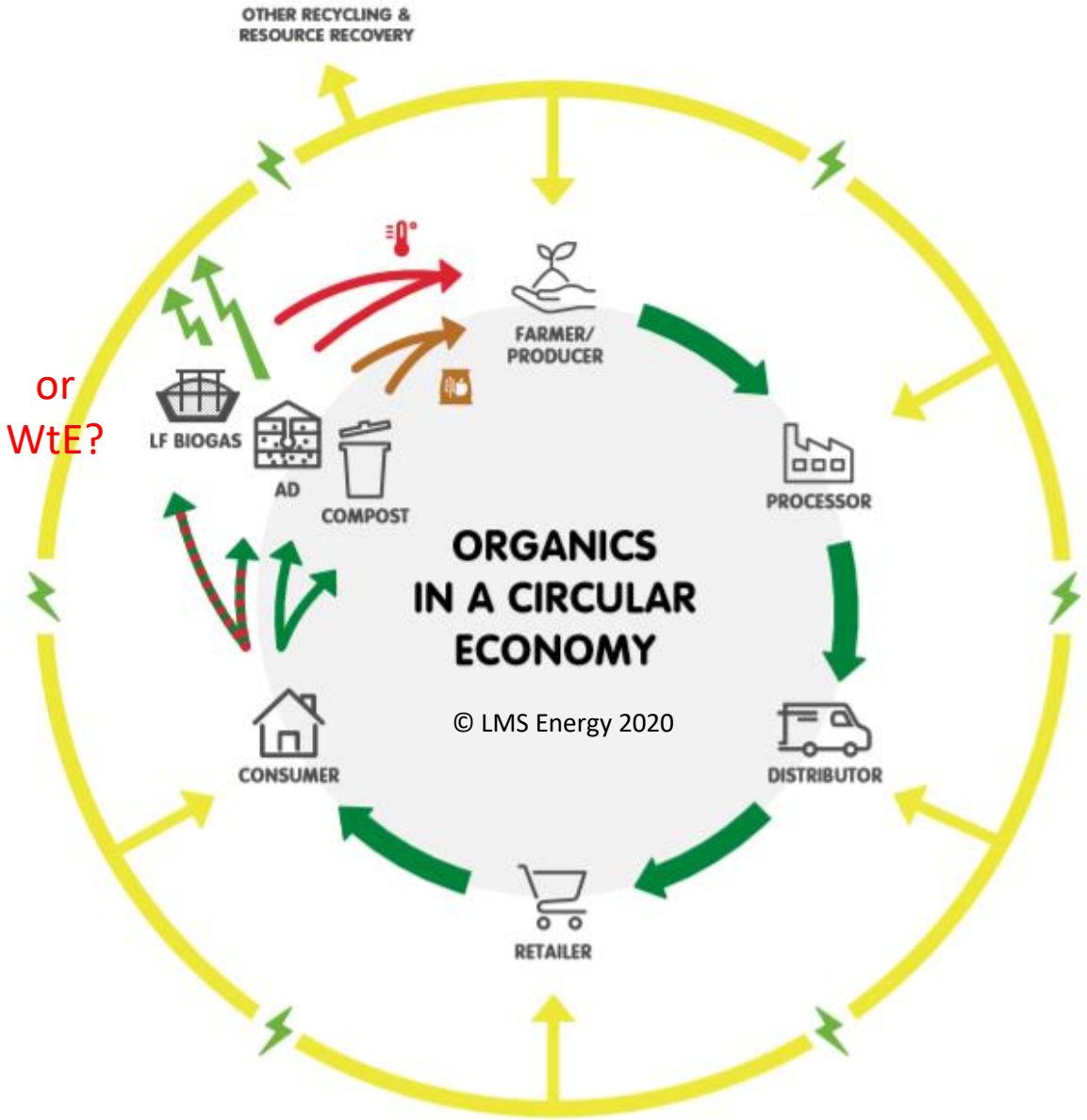
The Australian
20 June 2018

Hundreds of Victorian home gardeners angry and out of pocket after using toxic compost from major recycler

ABC News
14 February 2021

A herbicide in green waste from a Council caused widespread plant deaths

Organics in a circular economy



or WtE?

Seek to maximise the safe capture of materials and energy from both clean and contaminated organic wastes

- FOOD & AGRICULTURAL PRODUCTS
- CONTAMINATED ORGANIC WASTE (i.e. with other rubbish)
- NUTRIENTS
- HEAT
- BIOENERGY

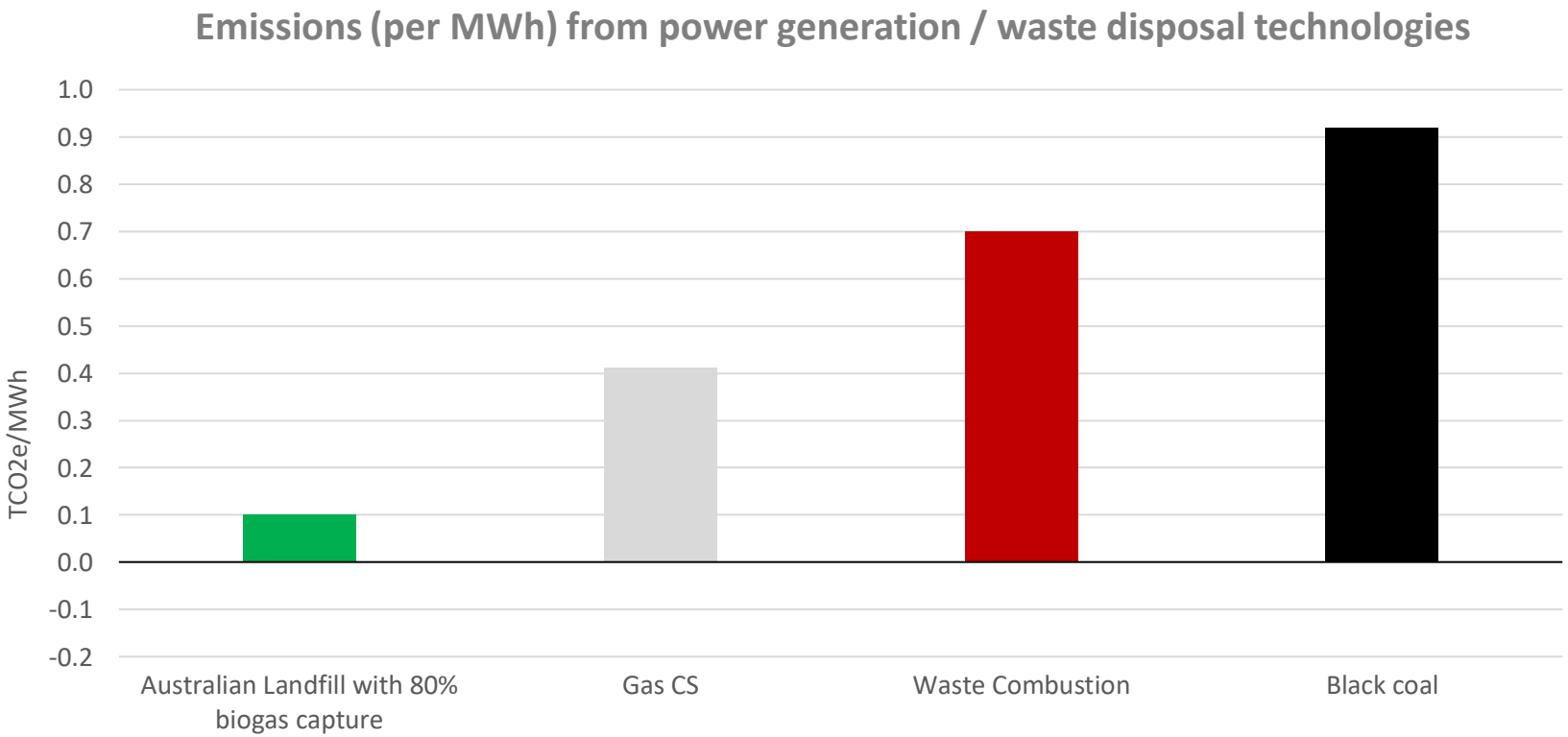
LF BIOGAS = LANDFILL BIOGAS CAPTURE
AD = ANAEROBIC DIGESTION

Assessment processes - comparative emissions

Working together to ensure net carbon abatement benefits

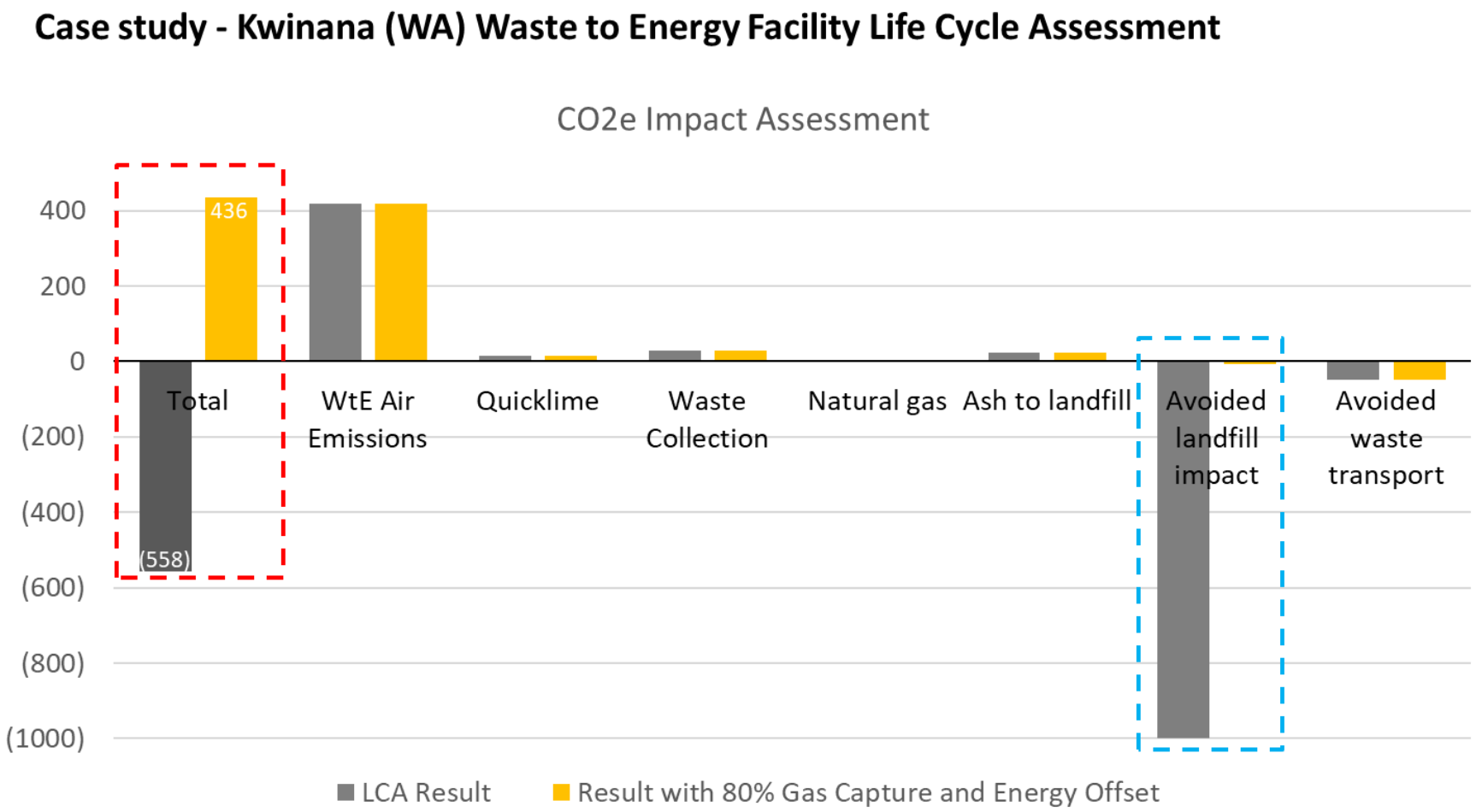
Modern landfills with >85% gas capture rates and power generation (offsetting fossil fuel generation) provide **an emissions neutral outcome** (and potentially a net reduction)

Combustion WtE facilities **can never offer an emissions neutral outcome** due to the emissions associated with burning plastics, which are fossil fuels (made from oil)



Assessment Processes – baseline assumptions

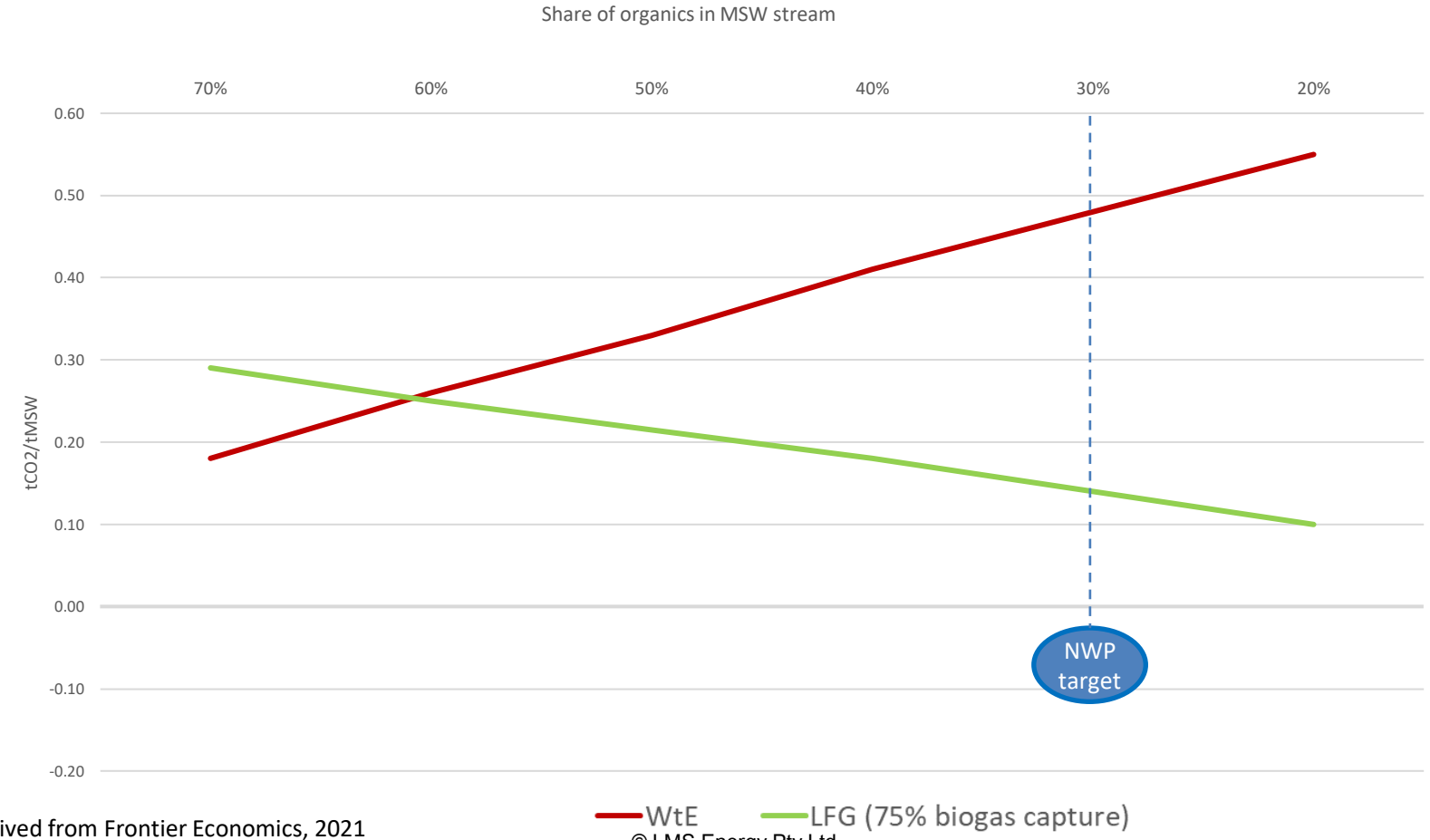
Need to cater for landfill gas capture in combustion energy from waste assessments



Assessment processes – future focus

Combustion WtE has progressively worse emissions outcomes than landfills with 75% biogas capture as organic waste share declines and renewable energy increases

Emissions comparison with grid intensity of 0.4tC02/mwh
(ie. approx. 2030 target for most States with increased renewables)



Derived from Frontier Economics, 2021

Assessment processes – future focus

These long-term outcomes are being recognised overseas now

The Guardian, 16/11/2020

*"Last year waste incineration gave rise to **13%** of the greenhouse gas emissions associated with electricity generation, even though it provided only **2.4%** of the UK's electricity."*

Politico, 17/9/2020

"Denmark wants to cut its greenhouse gas emissions to 70 percent below 1990 levels in the next decade …

As a result, Denmark intends to reduce its incineration capacity by 30 percent over the next decade ... it will need to close seven incinerators."

Assessment processes – achieving accuracy

Asking questions to help ensure we can reach our goals using EfW

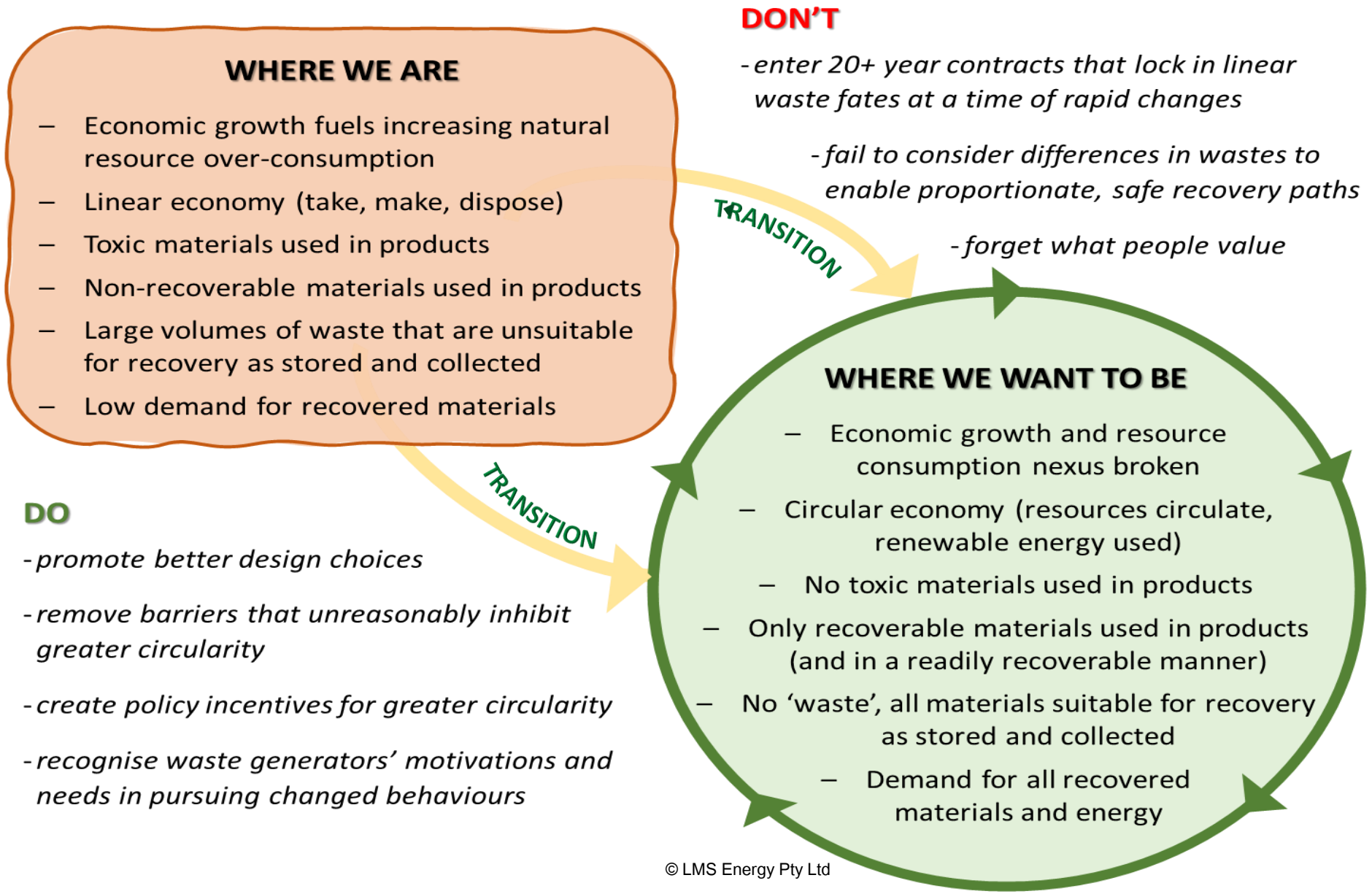
1. What is the accurate baseline to use in assessing alternative scenarios?
    - What energy capture is occurring at landfills servicing the area?
    - How would modern, well-managed landfills compare?

2. What will the grid intensity be over the lifetime of the proposal?
    - Use a grid intensity that relates to the full lifetime, not commencement

3. What will the waste makeup be over the lifetime of the proposal?
    - Consider how waste is likely to change over time and what this would mean for the technology's performance

In summary

Identifying what needs to change



Summary

Landfill biogas facilities provide positive renewable energy and emissions outcomes from contaminated organic waste

Ensure the **accurate assessment of emissions from mass burning of waste** or risk not reaching emission targets

In the **transition to a circular economy**, overarching environmental outcomes need to be considered

Thank You

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