

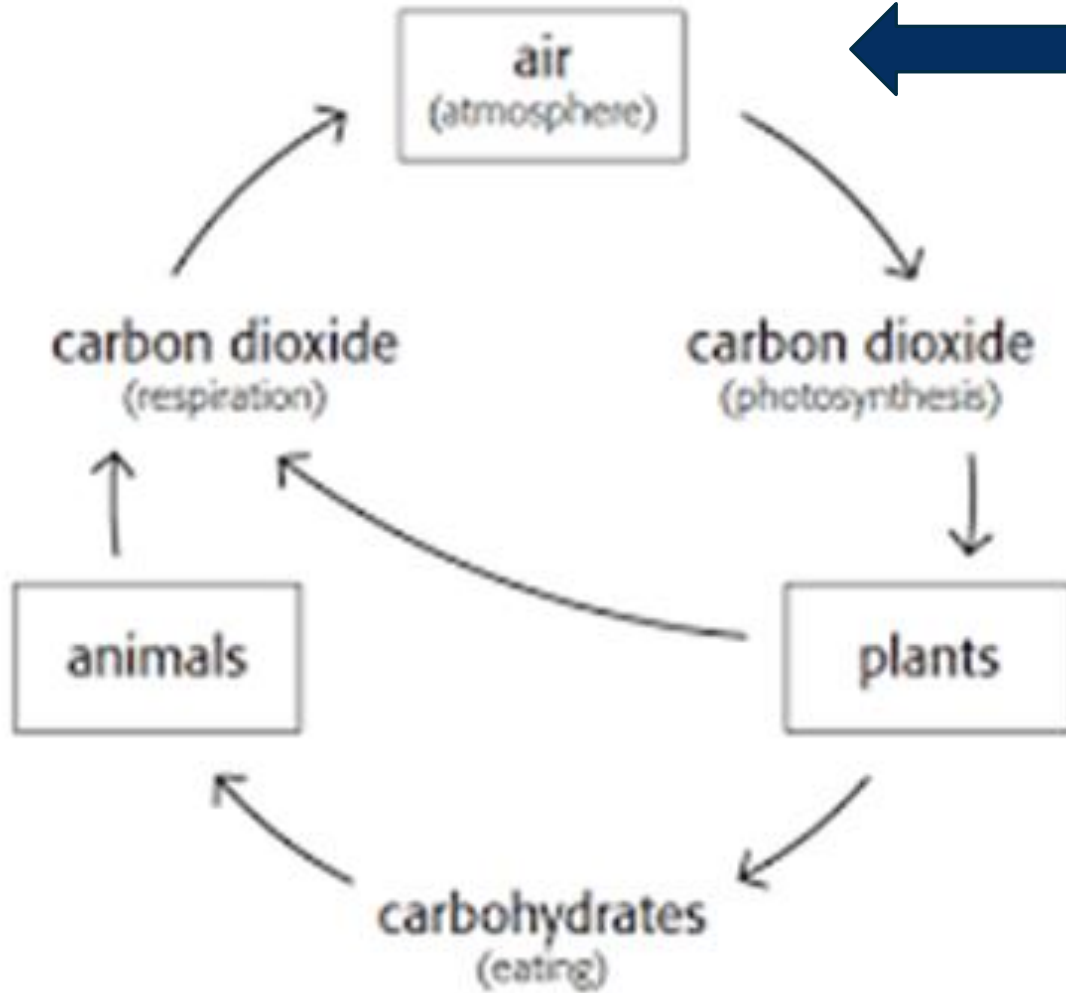
2021 LANDFILL AND TRANSFER STATIONS CONFERENCE

Landfill as part of the circular
carbon economy?

Sam Bateman

Bateman Brothers Consulting P/L

Basic Carbon Cycle of Living Systems



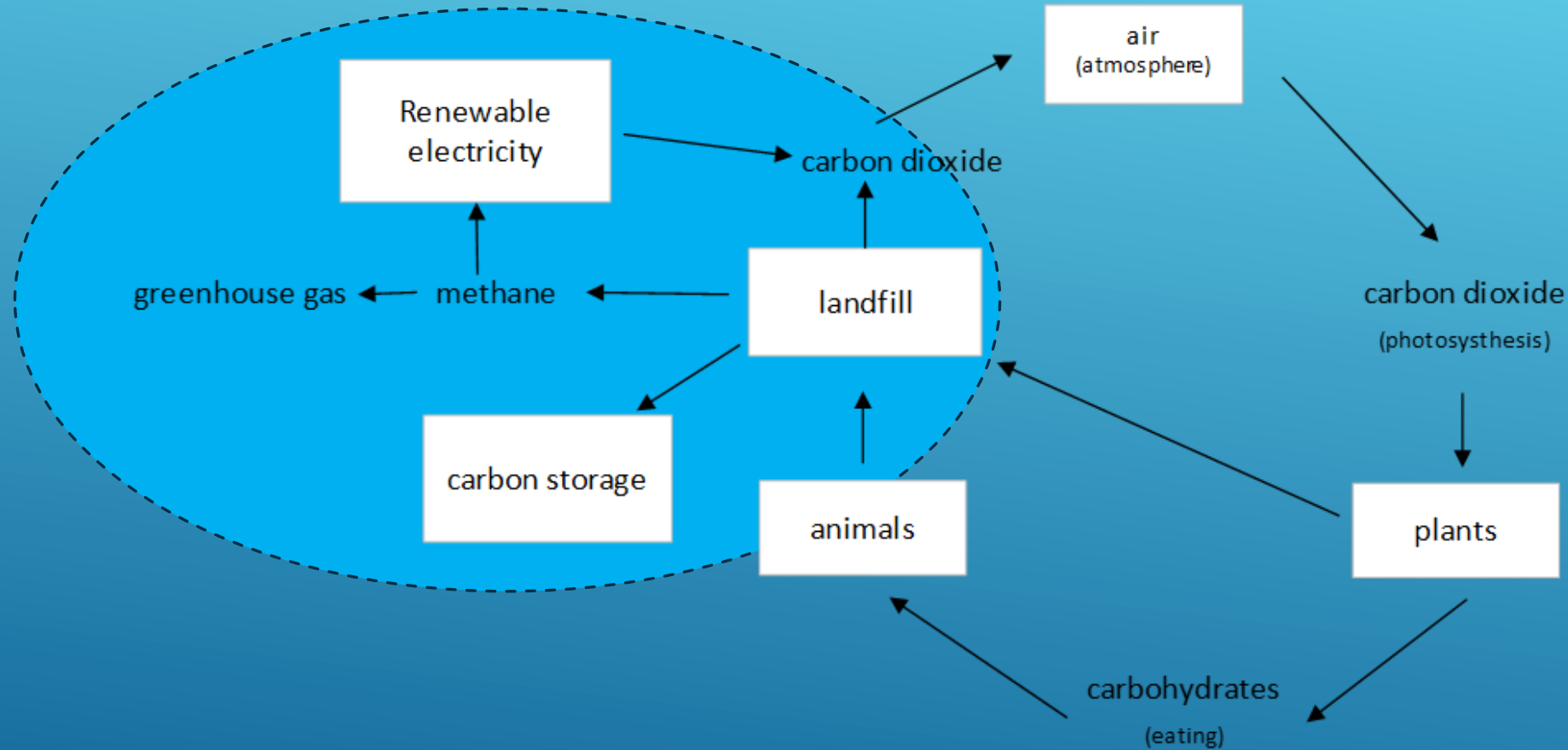
Burning of fossil carbon, coal, oil and gas.

Addition of fossil CO₂



Landfill contribution

Carbon Cycle with Landfill



- ▶ If you want to minimise greenhouse emissions from waste the best place to look is at the landfill.
- ▶ Landfill gas, when burnt in generators, can be used to generate reliable renewable electricity at around 150kWh/tonne of waste input.
- ▶ IPCC notes that “It is also good practice to use a value of 0.5 - 0.6 as a default” – for the proportion of organic carbon that degrades in landfills, thereby leaving 0.4 - 0.5 of organic carbon in long-term storage.
- ▶ The source of carbon storage in the landfill is predominantly wood and paper products, but even food has some storage effect.

Carbon storage in landfill is accepted as scientific fact and included in the Australian National GHG Inventory in the Waste/HWP sector



IPCC 2006 Guidelines for Nat GHG Inventories for Waste


IPCC 2019 Refinement of 2006 Guidelines (wood has DOC_f 0.1)



IPCC 2006 Guidelines for Nat GHG Inventories for Harvested Wood Products

Australian Government UNFCCC National Inventory Report 2019

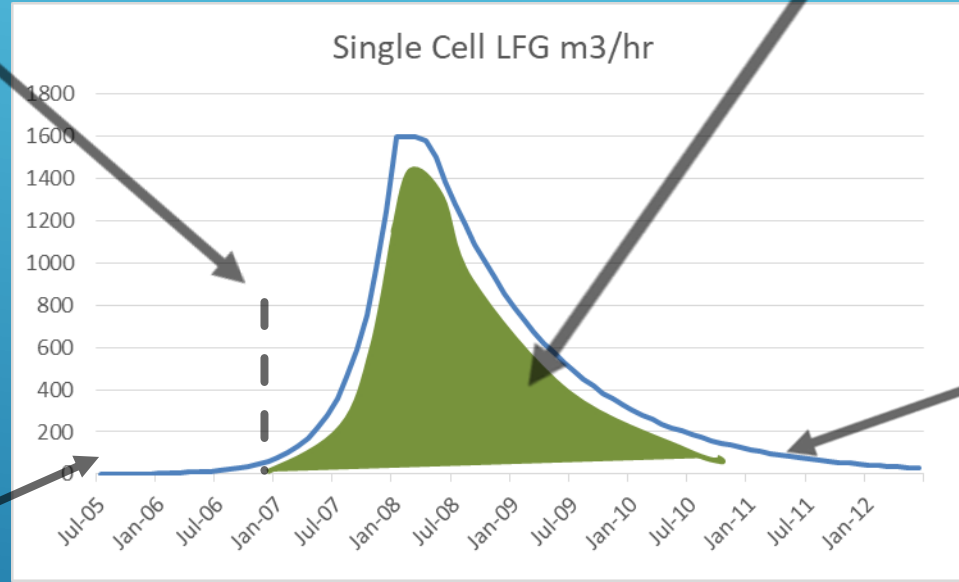


- ▶ Some may say that carbon in landfill will compost when eventually the landfill turns aerobic
 - ▶ Some compost will become methanogenic if it is badly handled.
 - ▶ Allowing landfills to flood when stabilised will preserve the stored carbon.
 - ▶ Lignin is very resistant to anaerobic bacteria and preserves organic carbon in wet conditions just like it did during coal formation 300 million years ago.
- 

Gas extraction starts 18 -24 months after Cell starts



Peak gas generation captured



Long tail with low gas generation easily oxidised in cover soils

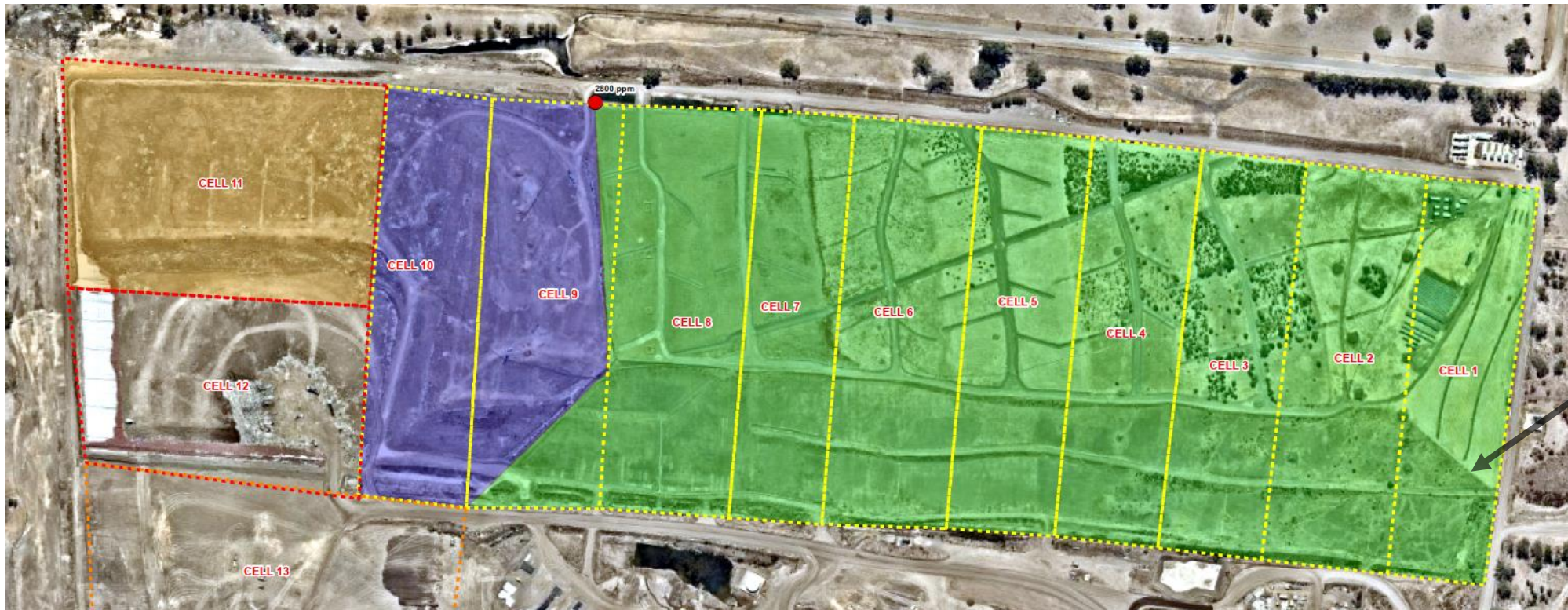
Delayed methane generation at start of Cell

Life time collection efficiency was found to be > 85% based on direct measurement of the surface emissions

To show what can be achieved, this plan shows the latest methane surface monitoring at Hanson's Wollert Landfill.

The green areas were final cover and the blue, a PhytoCap under construction and they all had gas extraction.

Apart from one hot spot, the methane emissions were < 100 ppm on the green area and < 200 ppm on the blue area.



This Cell started in 2000

- ▶ Landfill gas generation modelling is notoriously difficult as conditions in each landfill are different.
- ▶ The amount of gas collected is the only reliable measurement as a surrogate of the generation and if surface monitoring shows very little fugitive emissions, the capture rate is high.
- ▶ The USEPA puts it in a nutshell: “Because CH₄ emissions from landfill gas are a major source of CH₄ emissions in the United States, emission controls that capture landfill CH₄ are an effective reduction strategy.”
- ▶ But Australian governments continue to hit landfills with huge levies and promote diversion such as FOGO

- ▶ The Council, where I live, introduced FOGO last year claiming large GHG savings.
- ▶ I was able to obtain a consultancy report that was the source of these claims.
- ▶ When I back calculated the LFG collection efficiency to achieve the GHG savings claimed it was 30-33%
- ▶ Also it didn't account for the emissions from the electricity used to compost the FOGO.
- ▶ The MWRRG published a Guideline in 2018 *Introducing a kerbside food and garden organics collection service*
- ▶ In this guideline there is a section on methane from landfills quoting "only 30-50 per cent of emissions from food organics are likely to be captured at most landfills."

Uses very low (30-33%)
LFG collection
efficiencies



Claimed GHG benefits of
F O G O

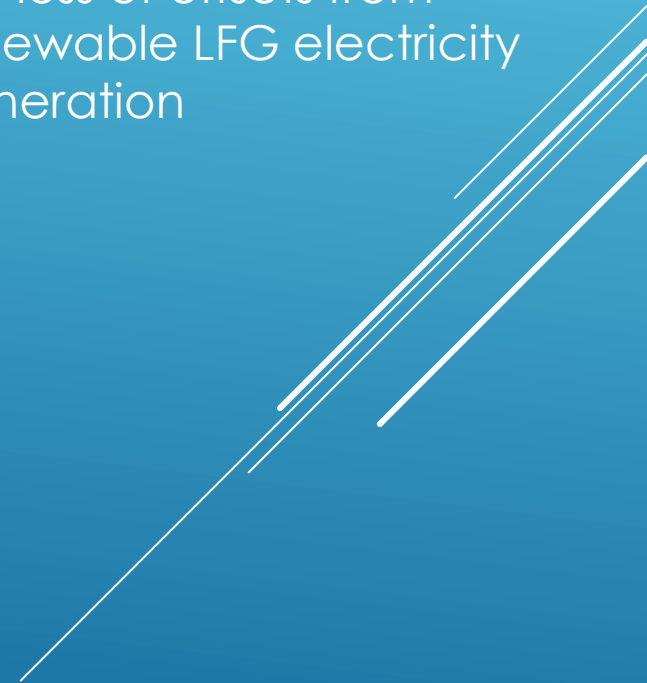
Doesn't take
account of loss of
carbon storage



Doesn't take account of
the loss of offsets from
renewable LFG electricity
generation



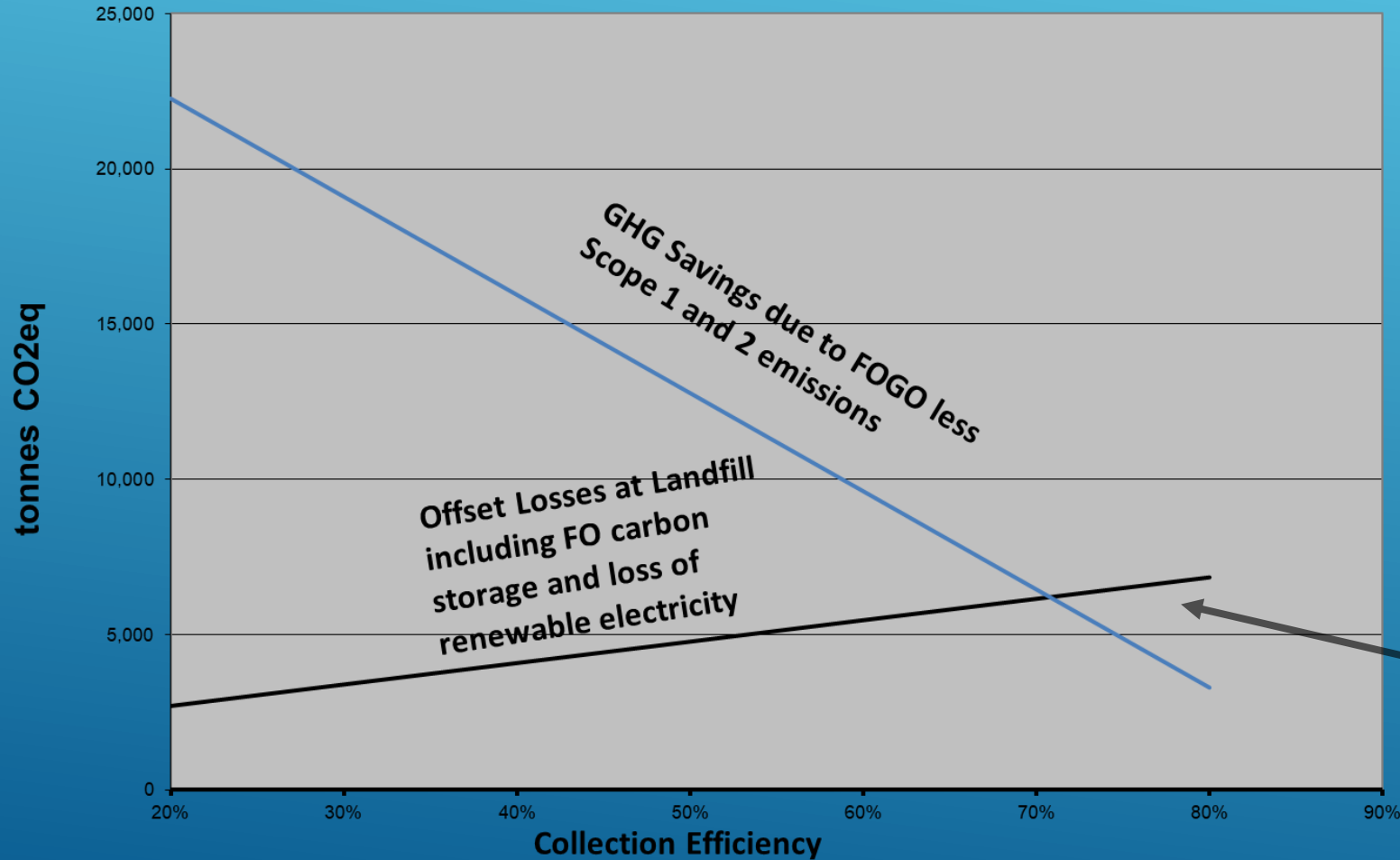
Doesn't take account of the
electricity used for enclosed
composting



Low CE gives high FOGO GHG savings.
Low CE gives low LFG electricity offsets

High CE reduces FOGO GHG savings
High CE gives high LFG electricity offsets

GHG comparison v collection efficiency per tonne of waste



See what happens when you start to increase LFG collection efficiency

This is where you should be aiming for

- ▶ Instead of playing around with huge Landfill Levies and doubtful diversion schemes, which just cost everyone a lot of money, especially for organics, public policy should concentrate on methane capture at landfill and gain all the benefits that brings at minimum cost.
 - ▶ The time to bring in organics diversion is when the electricity generation in Australia is 100% renewable. Then the GHG benefits will be real.
- 