

# ZERO WASTE EUROPE LIVE!

16 April 2019 - 2pm CET

## THE TRANSITION STRATEGY TO DEAL WITH RESIDUAL WASTE

**DOMINIC HOGG**

Chairman

at Eunomia Research & Consulting



# Systems and Strategies for Dealing with Residual Waste

Zero Waste Europe Webinar

*Transition Strategy to deal with residual  
waste*

16<sup>th</sup> April 2019

**Dr Dominic Hogg**

**Chairman**

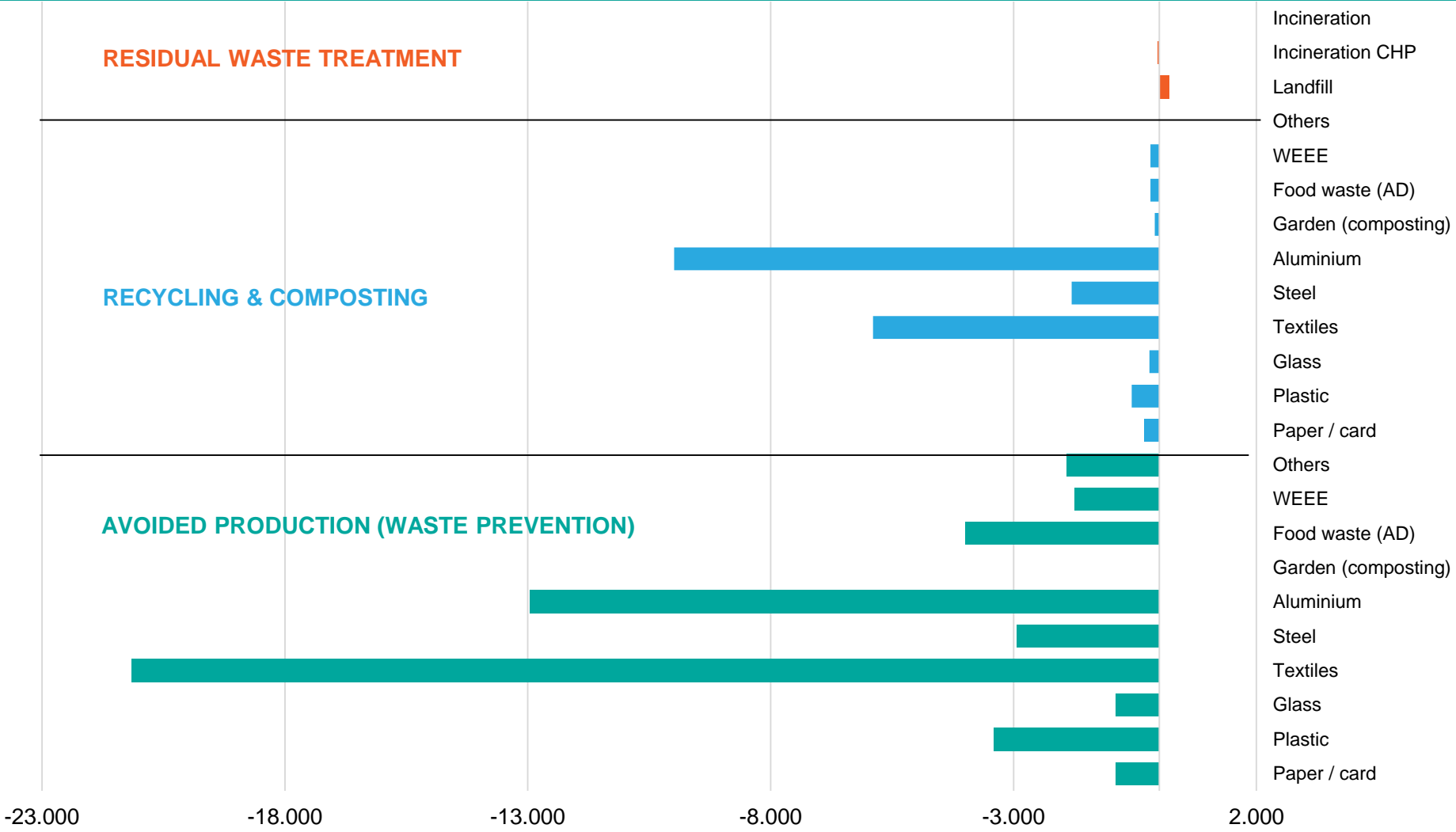
**Eunomia Research & Consulting Ltd**

# Background to Eunomia

- **Research and consulting**
- **Around 90 staff**
- **Offices in EU, Auckland, NZ and New York, USA**
- **Values-driven business**
- **Appraisal of residual waste treatment technologies since 2002**
  - **Cost-benefit analysis / CBA**
  - **Options appraisal**
  - **Citizen panels**
- **Procurement strategy (project structures, financing, joint working, payment mechanism)**
- **Design of related policy instruments**
  - **Taxes / allowance trading / restrictions / levies**

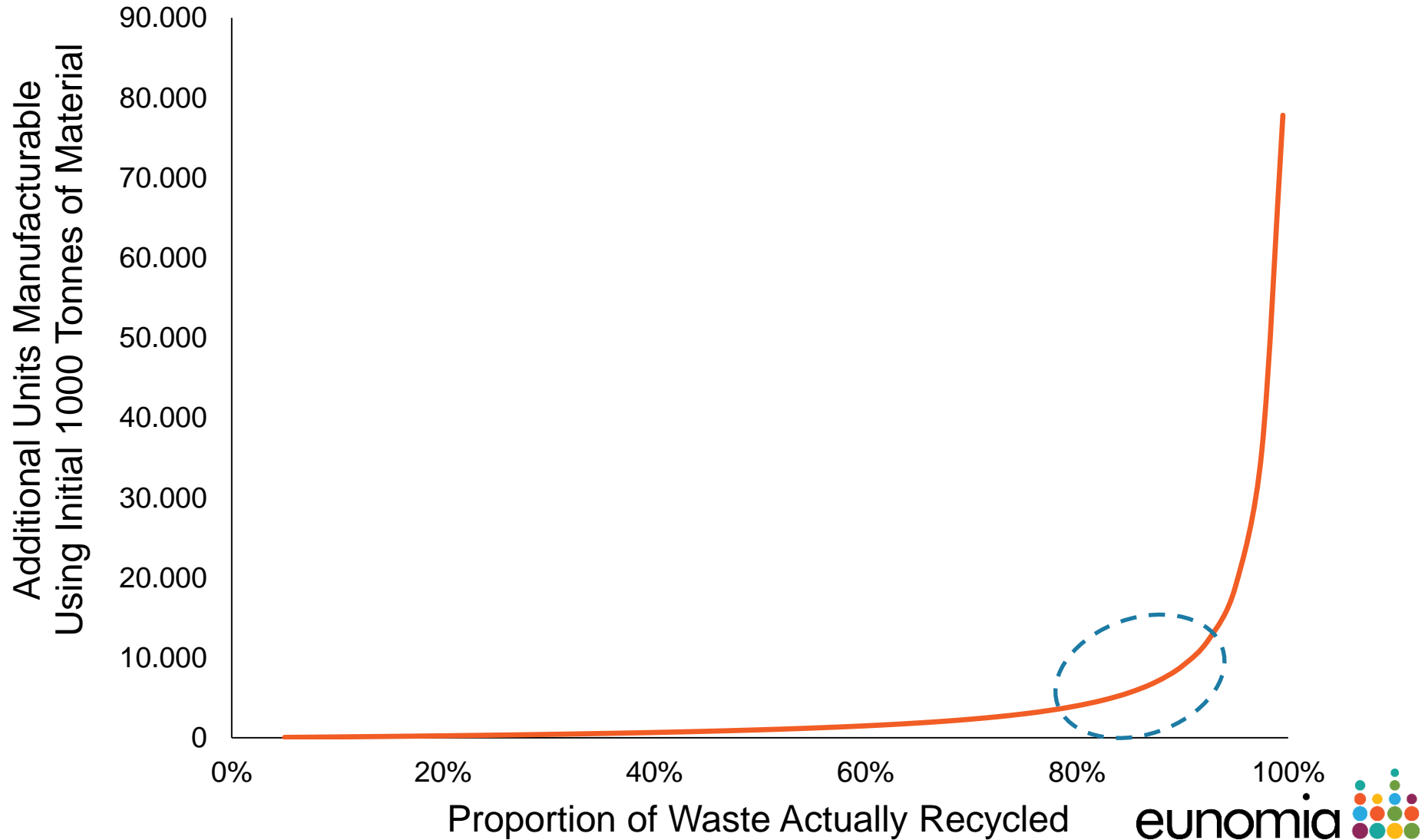
# Why Recycling and Prevention?

# GHG Impacts

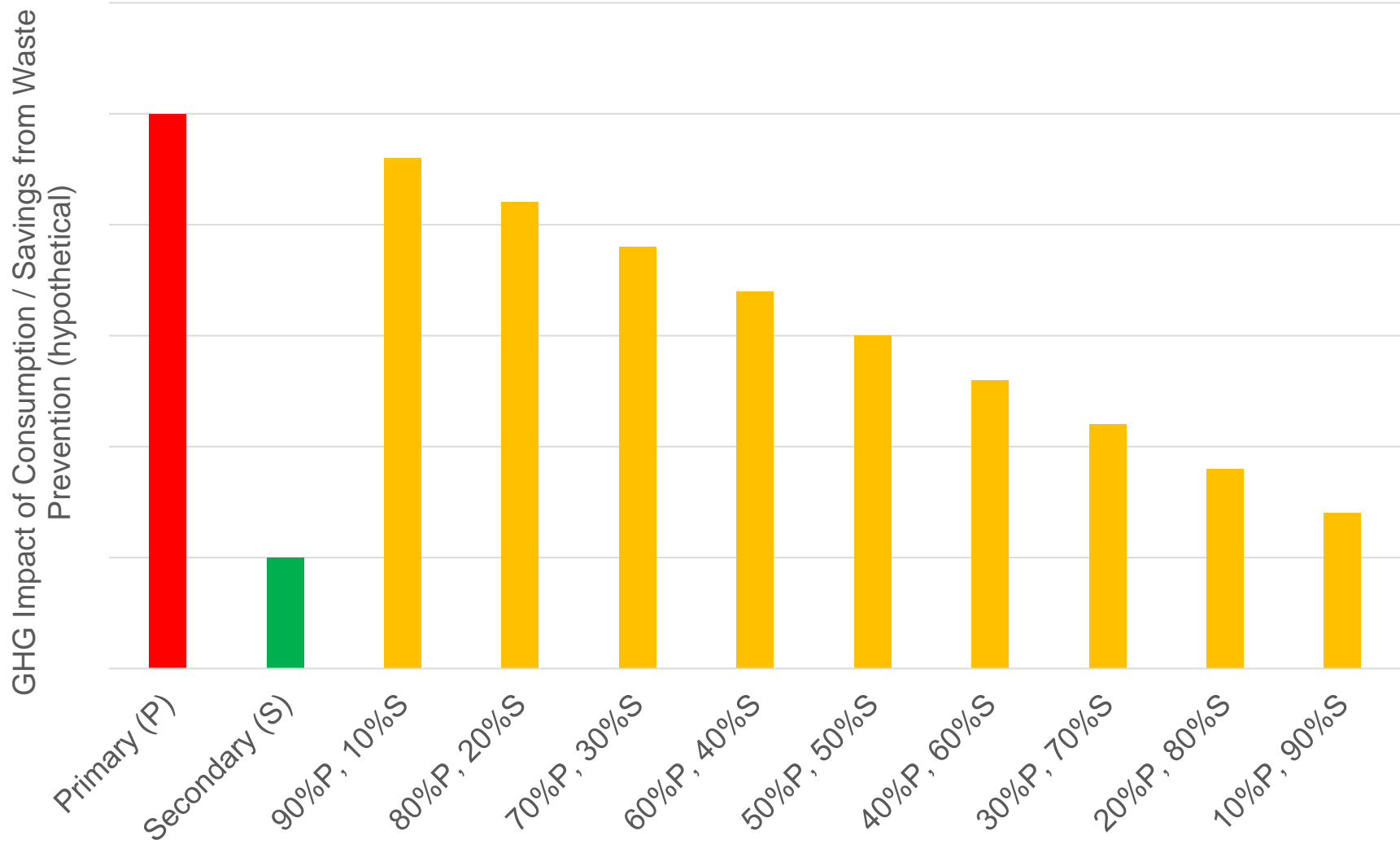


Emissions, kg CO2 equivalent per tonne of waste managed

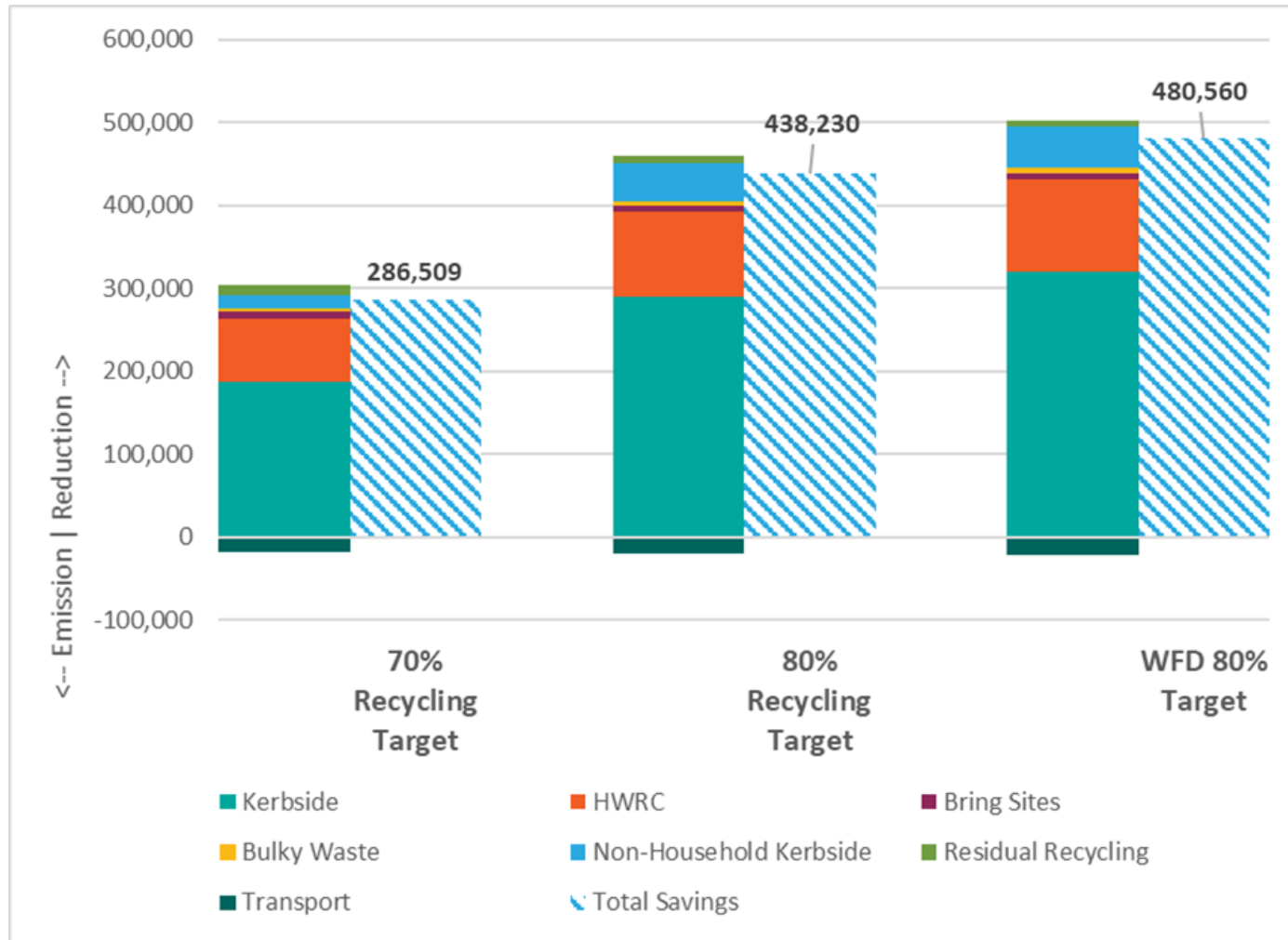
# Effect of higher recycling rates on resource use...



# ... and on Impact of Consumption



# Moving to High Recycling Rates



Source: Eunomia



## Point 1:

***Recycling and waste prevention generally make good sense from the perspective of resource use and climate change***

# Incineration and Landfill

# Evolution in Recycling Rates

- **In a local context, recycling rates can increase swiftly**
- **Further change may be slower but will not take forever**
- **How much residual waste capacity?**
- **Of what type?**

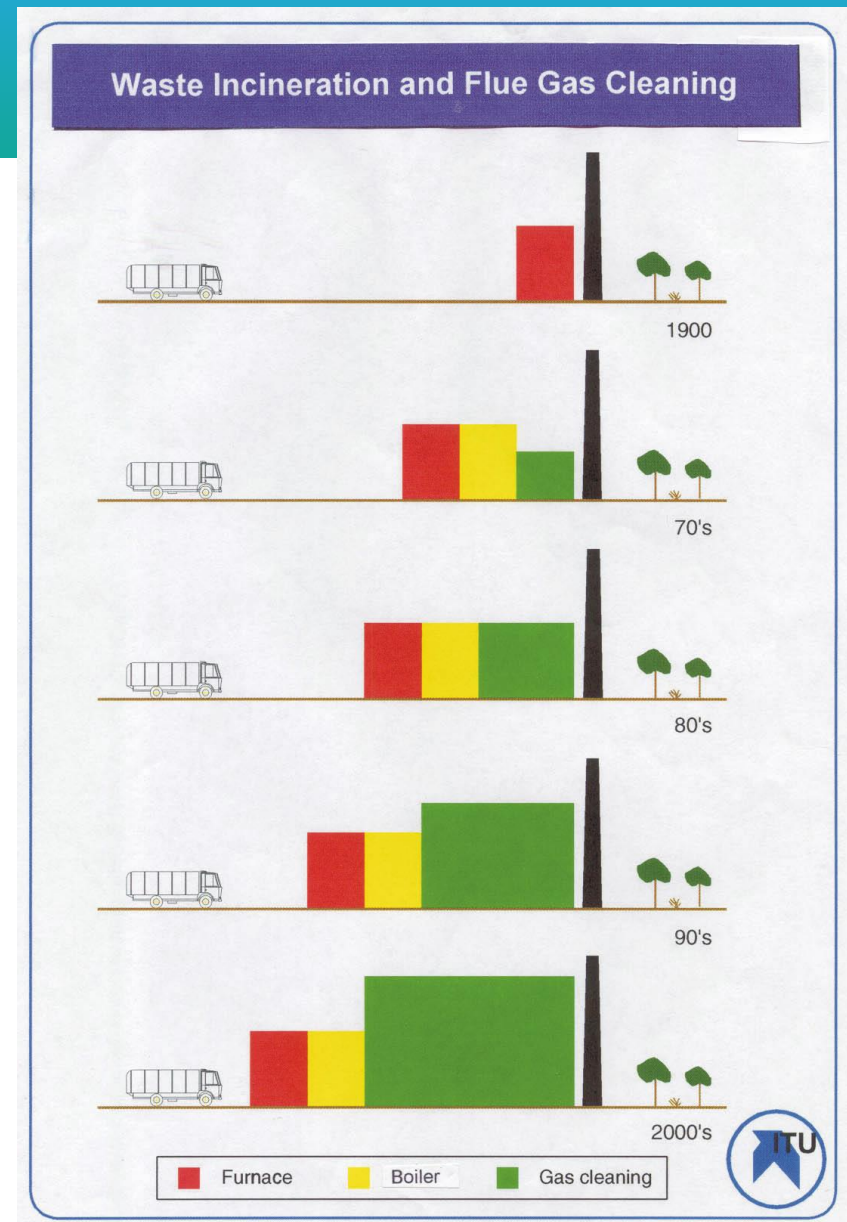
# Landfill

- **Highly Flexible**
  - Not constant throughput
  - Composition 'doesn't matter'
- **Cheap**
  - As regulations bite, sites get bigger
- **Emissions**
  - Methane (GHG)
  - VOCs, PAHs
  - Leachate
- **Other Impacts**
  - Disamenity
  - Plastic leakage

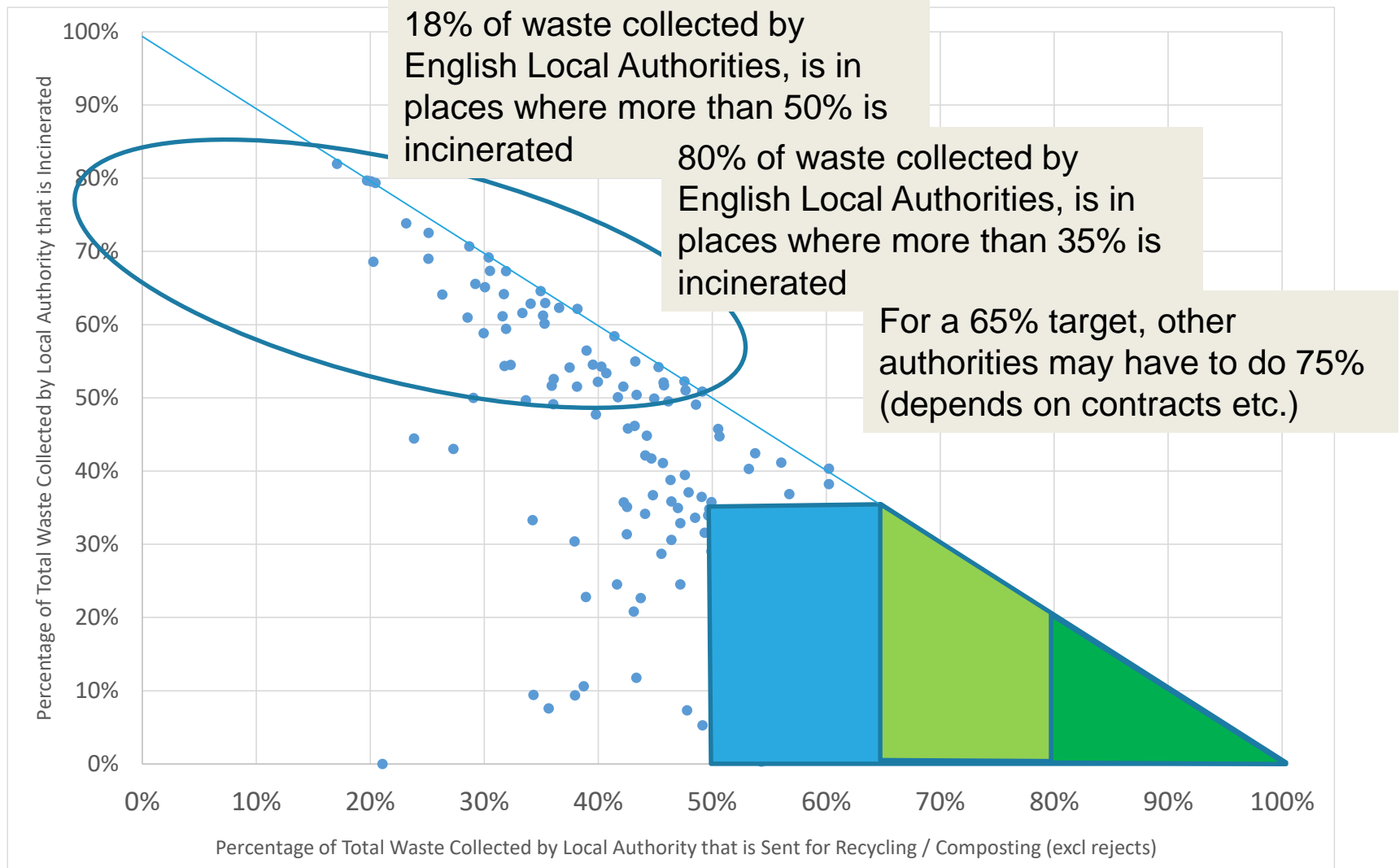


# Incineration

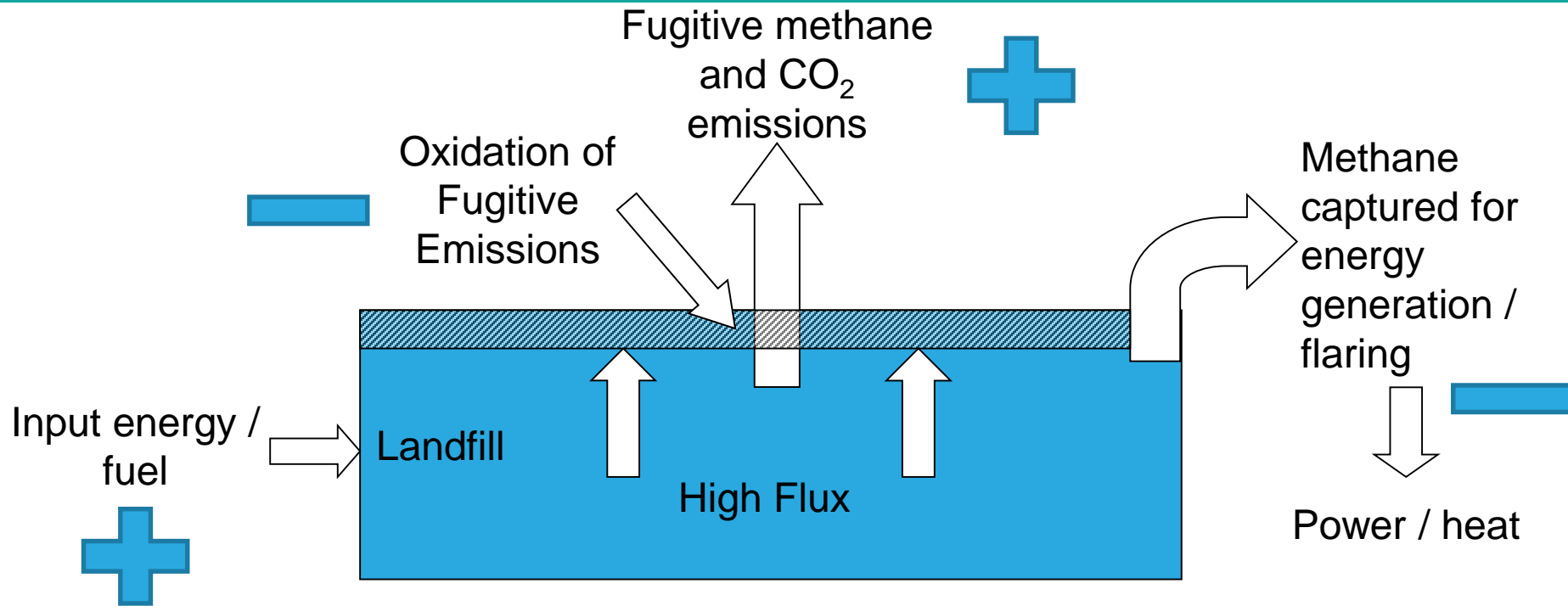
- **Relatively Inflexible**
  - Prefers constant throughput
  - Composition matters (and determines maximum throughput)
- **Capital intense**
- **Emissions**
  - Fossil CO<sub>2</sub> (GHG)
  - NO<sub>x</sub>
  - Various others
  - Ash residues
- **Other Impacts**
  - Disamenity



# Can Incineration Hinder Recycling? England 2017/18



# GHG Balances - Landfill



Only Non-fossil Carbon Degrades

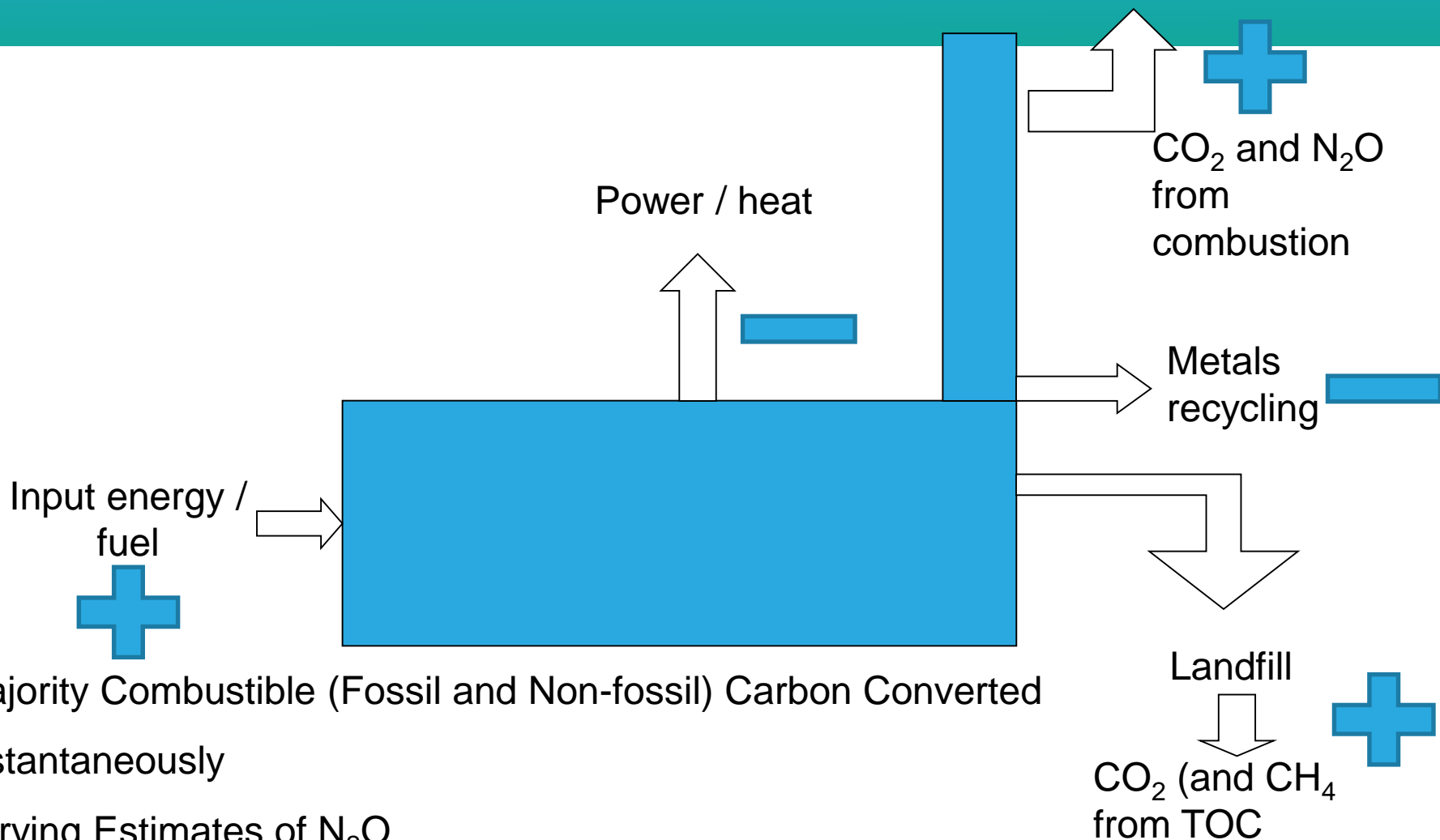
Some of Which Degrades Over a Long Period of Time

Only Fugitive (uncaptured) Element Contributes to Methane Generation

Some Offset from Energy Recovery (net energy deliverer)

Captures and Offsets?

# GHG Balances - Incineration



Majority Combustible (Fossil and Non-fossil) Carbon Converted

Instantaneously

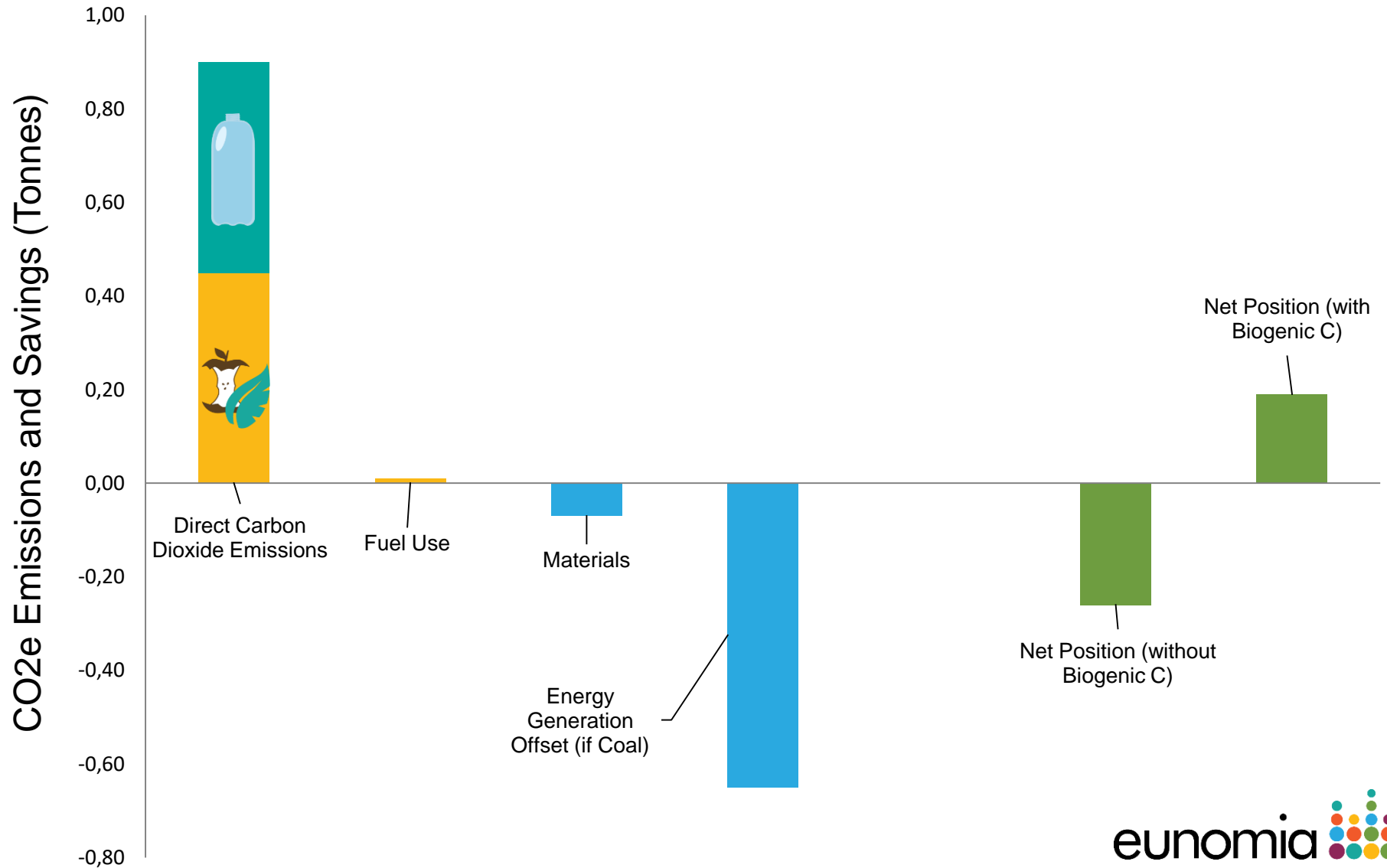
Varying Estimates of N<sub>2</sub>O

Higher (than landfill) Offset from Energy Generation (net energy deliverer)

Offset from recycling metals



# GHG Balance for Incineration (If offset is against coal)



# But We Want the Energy System to Decarbonise



Department for  
Business, Energy  
& Industrial Strategy

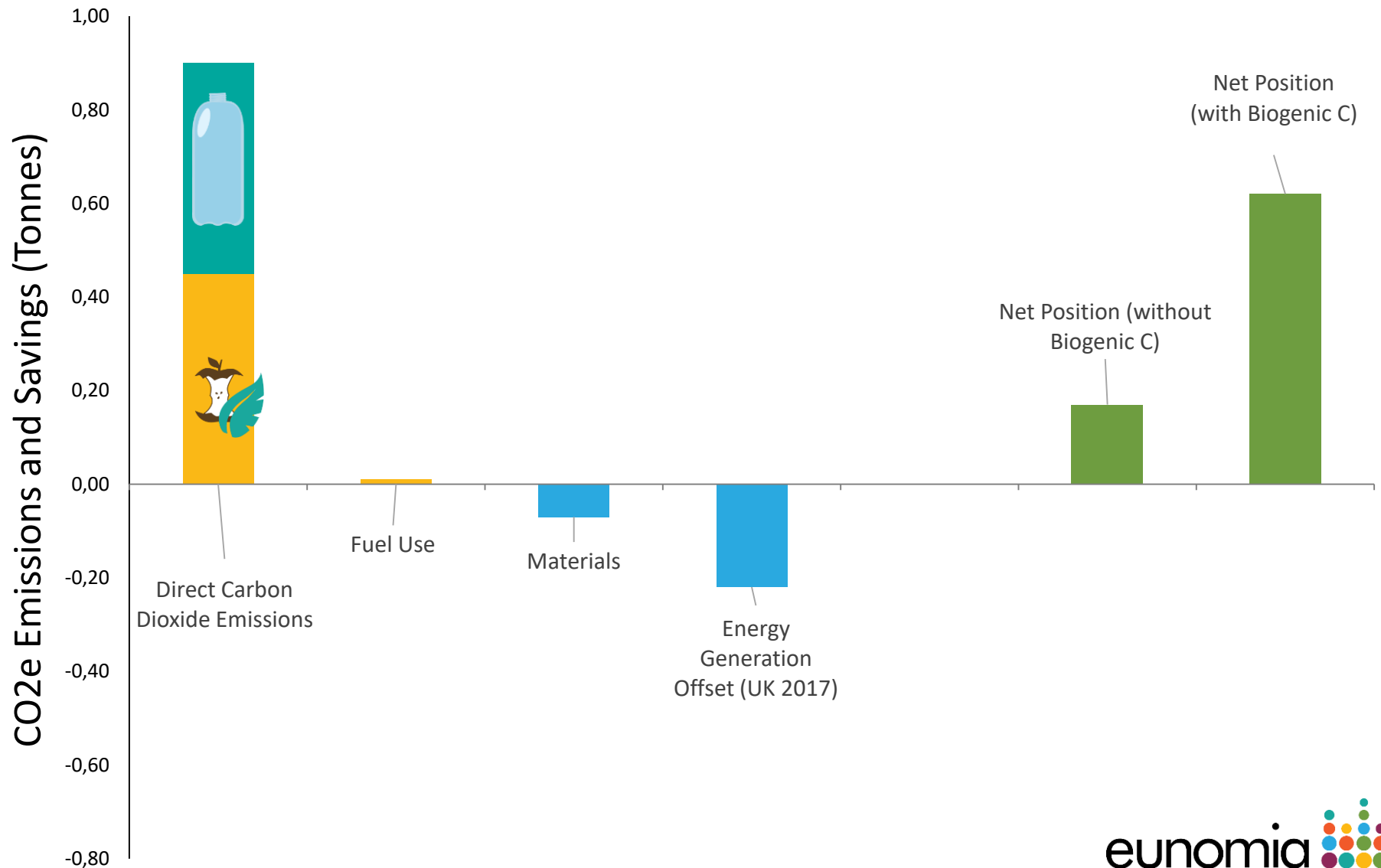
March 2017 Update

Marginal Intensity of Electricity Generation (kg  
CO<sub>2</sub>/kWh)

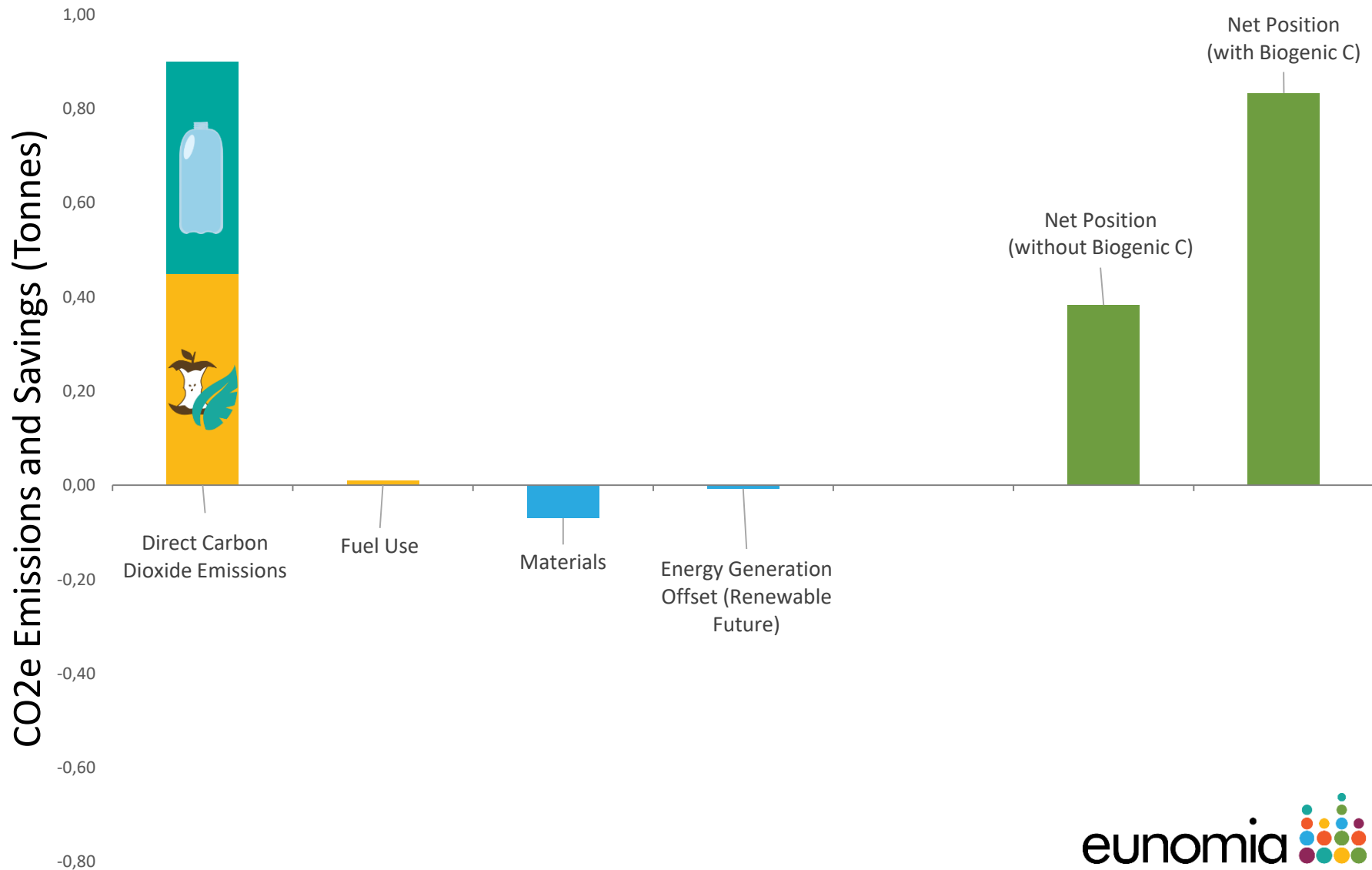
2010 2012 2014 2016 2018 2020 2022 2024 2026 2028 2030 2032 2034 2036 2038 2040 2042 2044 2046 2048 2050 2052 2054 2056 2058 2060

Year

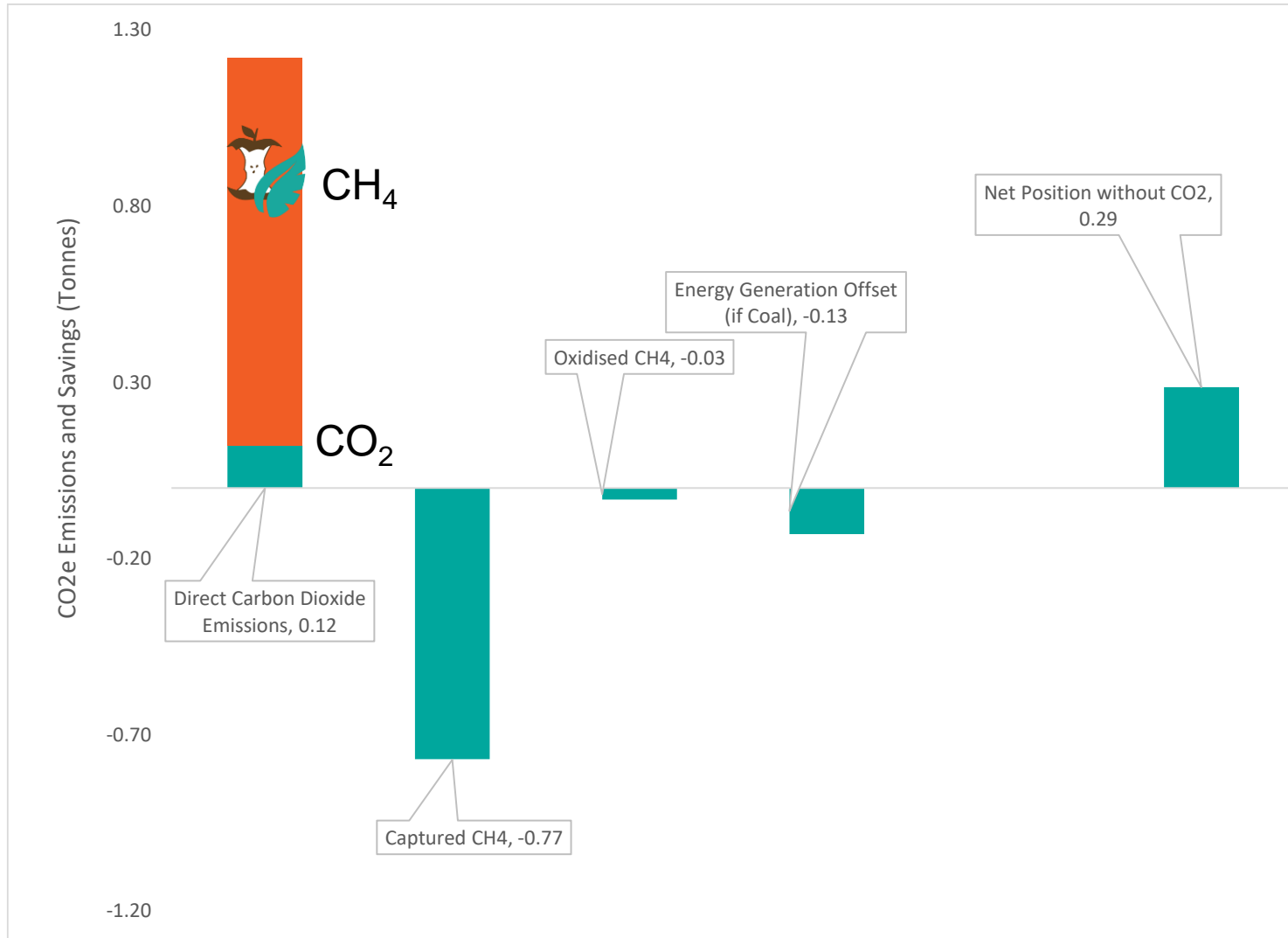
# GHG Balance for Incineration (If offset is against 2018 UK marginal source)



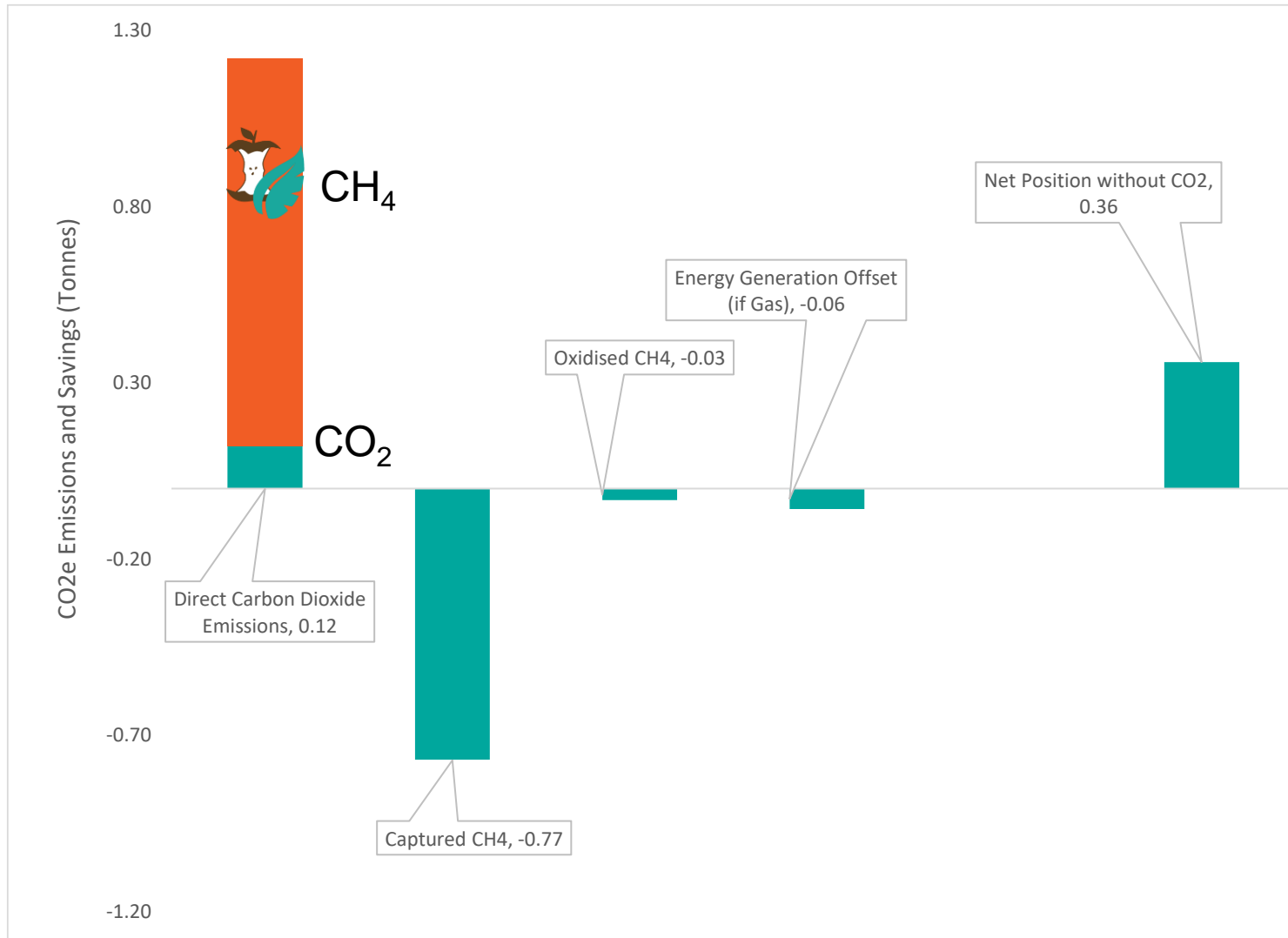
# GHG Balance for Incineration (If offset is against Renewables)



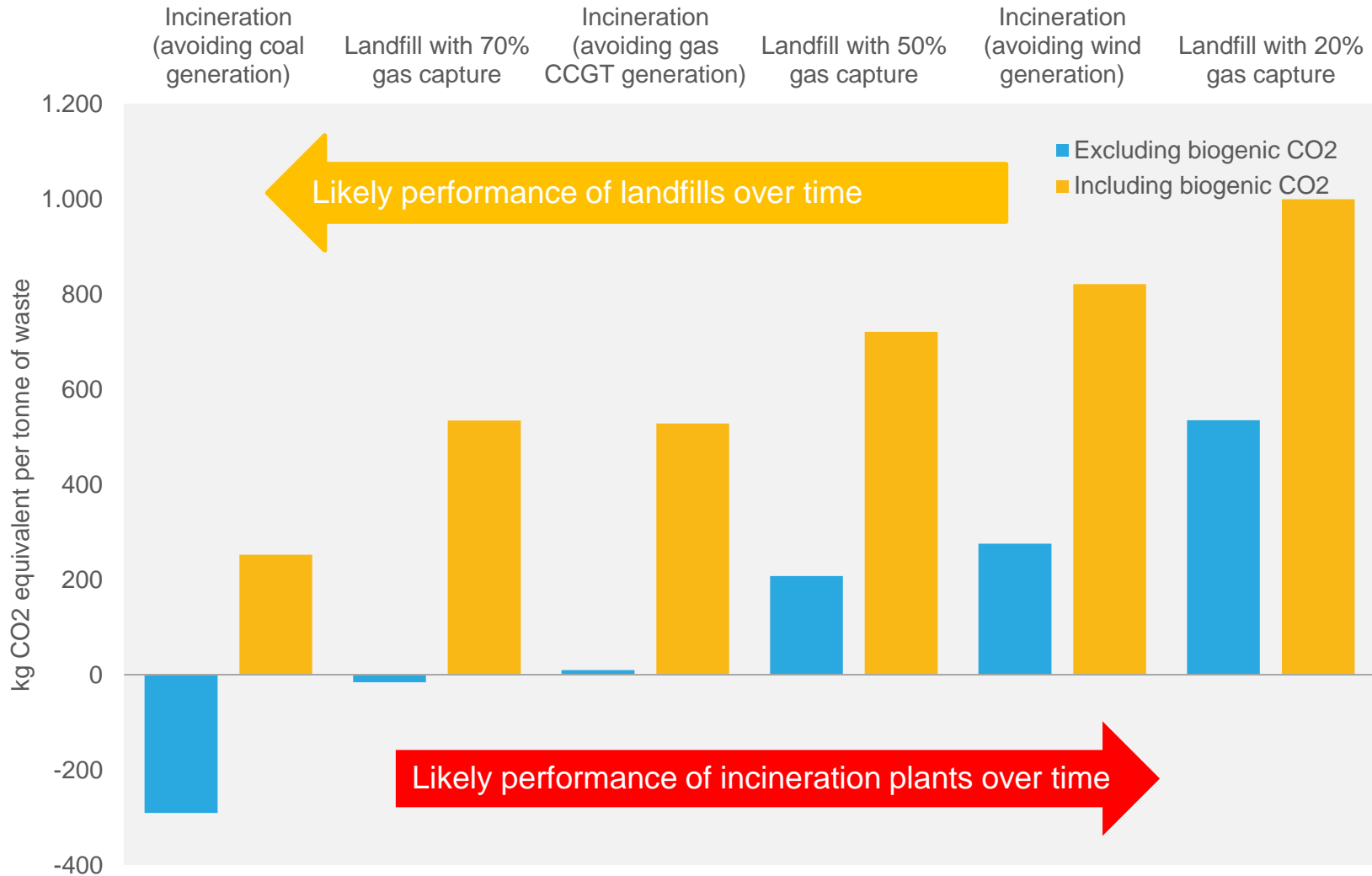
# GHG Balance for Landfill (If offset is against coal)



# GHG Balance for Landfill (If offset is against gas)



# Residual Waste Treatments



## Point 2:

***As energy systems decarbonise, the GHG benefits of incineration decline: the fossil C in residual waste can (depends on composition) lead to incineration becoming a worse option than landfill once the landfill gas is well captured and  $\text{CH}_4$  is converted to  $\text{CO}_2$***



# What Could Sorting of Mixed Waste Add?

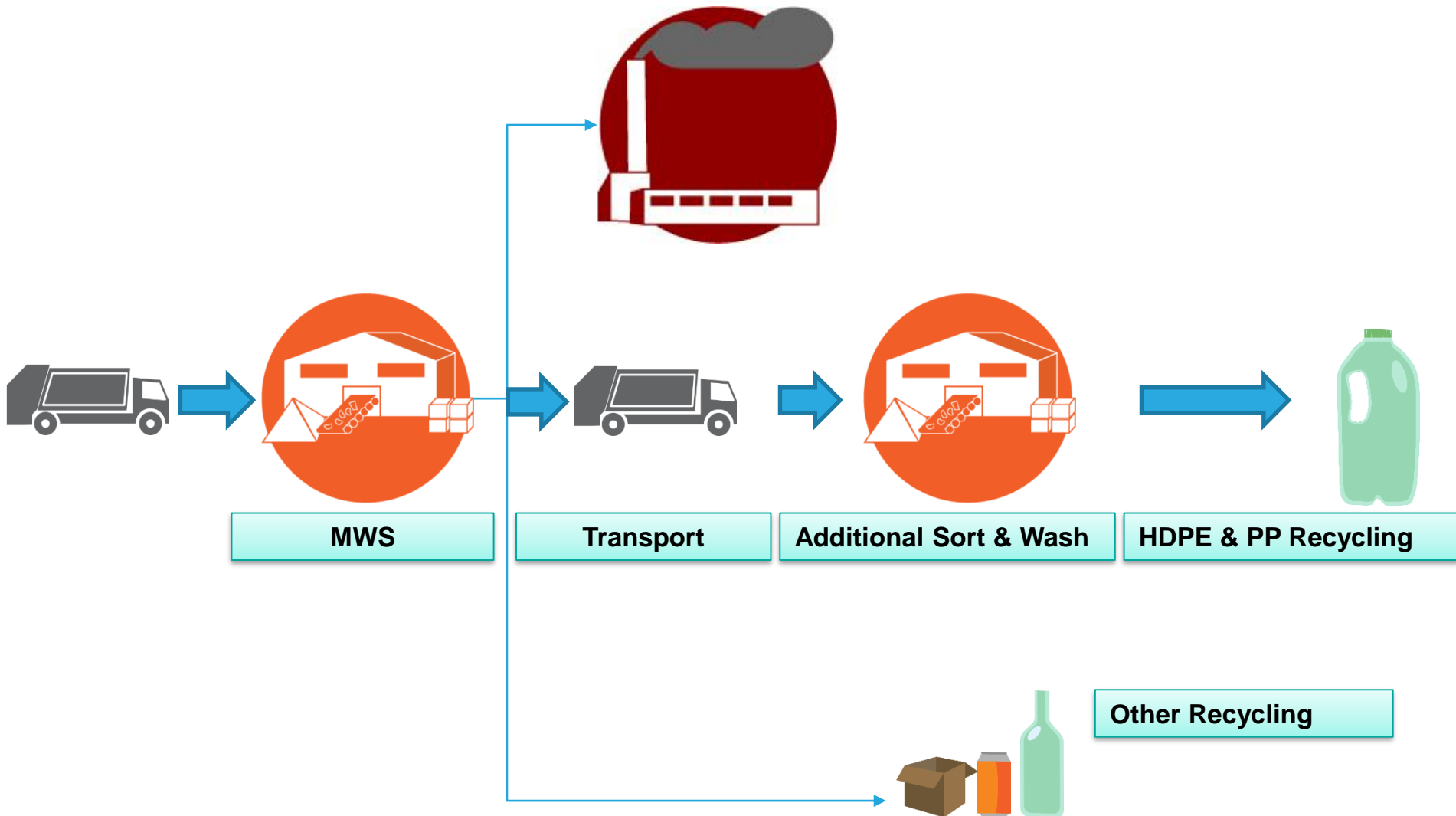
# From 'Dirty MRF' to 'second bite'

- **Bad old days**
  - Only low quality materials
  - Paper and card, metals, 'compost-like output'
- **Resolution / speed of sorting technology**
  - **Marketable outputs**
    - Metals
    - Plastics
    - Separated by polymer...
    - ... and colour...
    - and hot-washed
    - Paper / card
    - Glass
    - (and 'inerts')

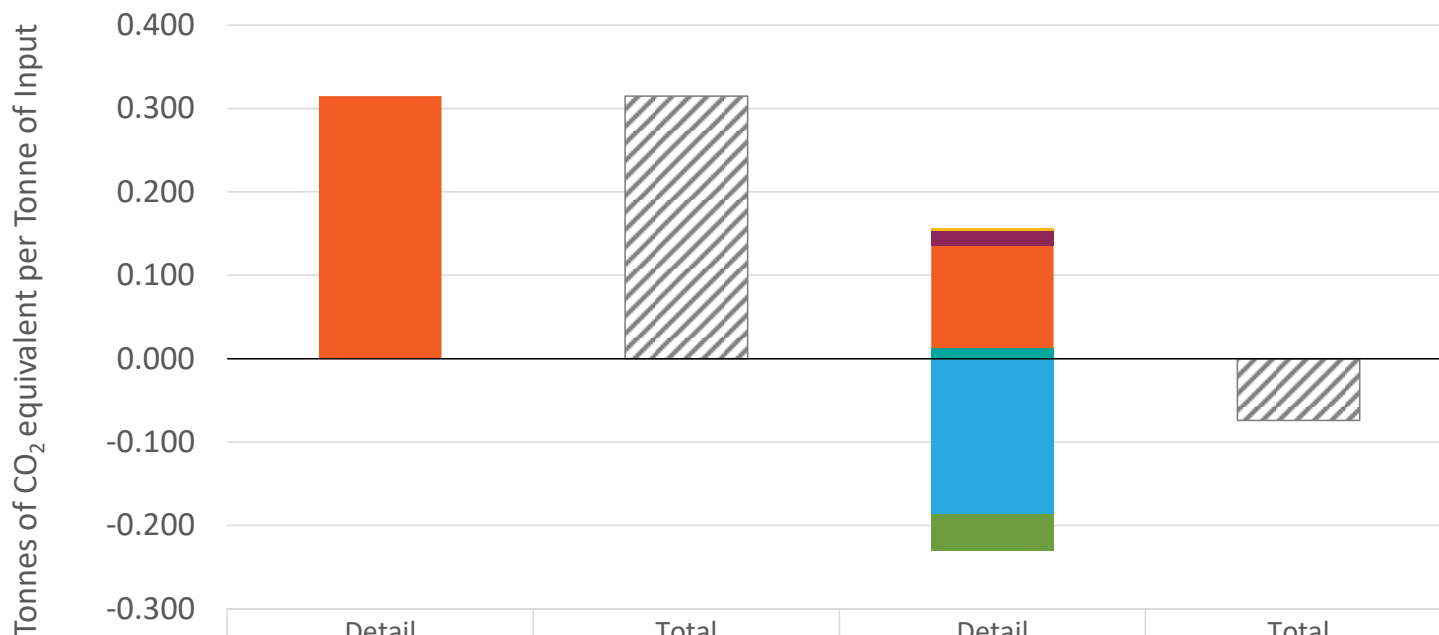
# Direct to Incineration



# MWS Prior to Incineration



# Incineration Results



	Detail	Total	Detail	Total
	Direct Incineration		MWS & Incineration	
☑ Total		0.315		-0.074
■ HDPE & PP Recycling			-0.044	
■ Other Recycling			-0.186	
■ Additional Sort			0.002	
■ Transport			0.018	
■ Incinerator	0.315		0.123	
■ MWS			0.013	

# Direct to Landfill

Values in tonnes of CO<sub>2</sub> eq.  
per tonne of input



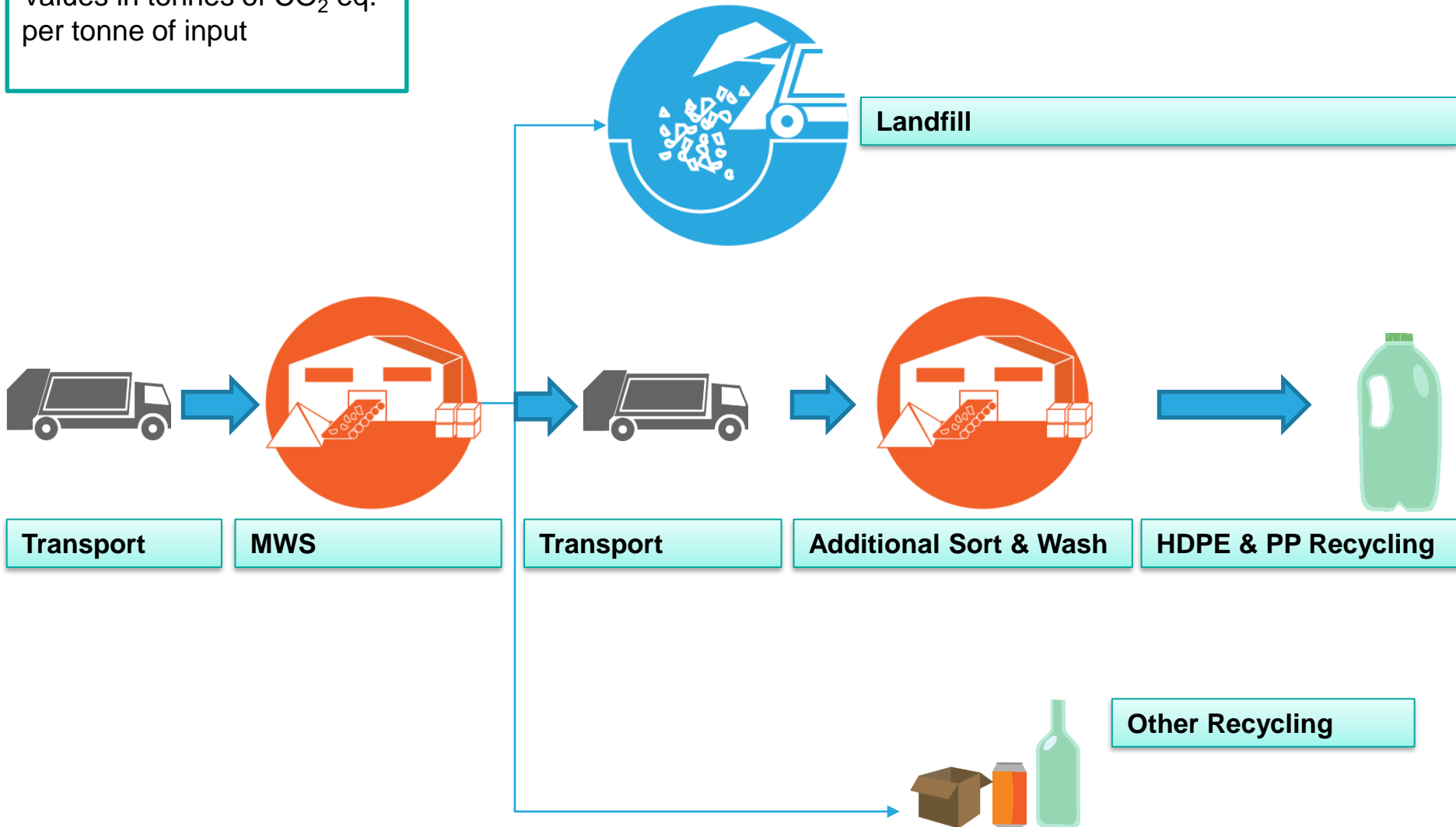
**Transport**



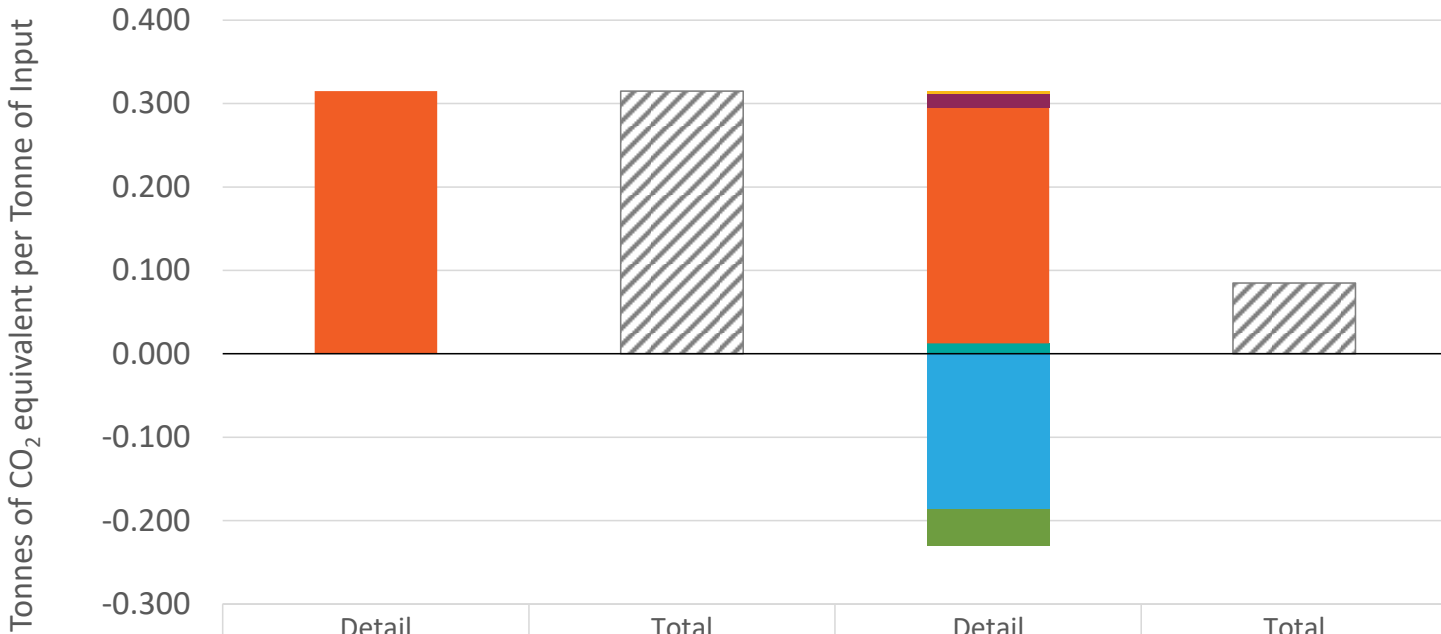
**Landfill**

# MWS Prior to Landfill

Values in tonnes of CO<sub>2</sub> eq. per tonne of input



# Landfill Results



	Detail	Total	Detail	Total
	Direct Landfill		MWS & Landfill	
☑ Total		0.315		0.085
■ HDPE & PP Recycling			-0.044	
■ Other Recycling			-0.186	
■ Additional Sort			0.002	
■ Transport			0.018	
■ Landfill	0.315		0.282	
■ MWS			0.013	



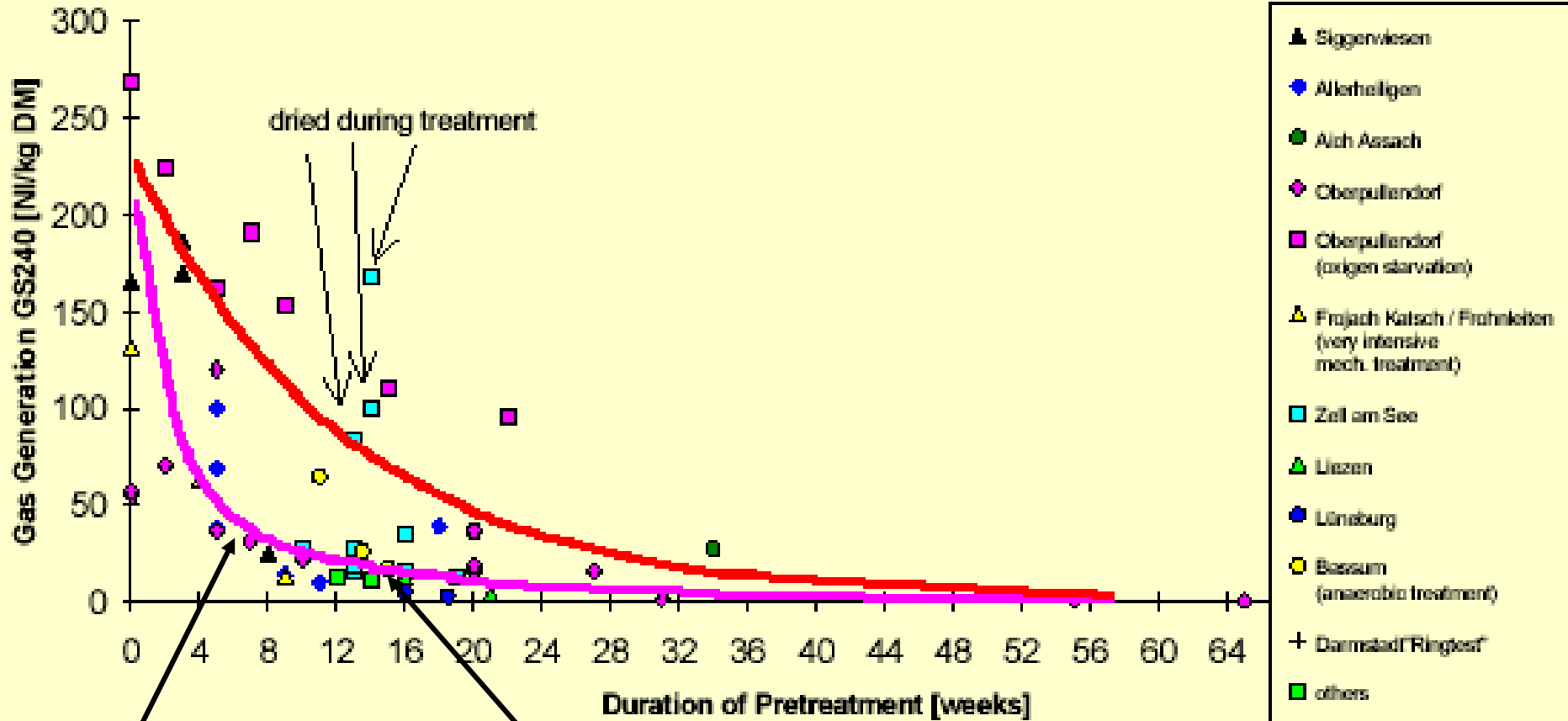
## Point 3:

***Mixed waste sorting improves the performance of both landfill and incineration systems: for incineration, this improvement is boosted by the fact that the source of fossil-derived CO<sub>2</sub> is removed.***

***No one should be sending anything direct to either landfill or incineration any more***

# What Could Stabilisation Further Add?

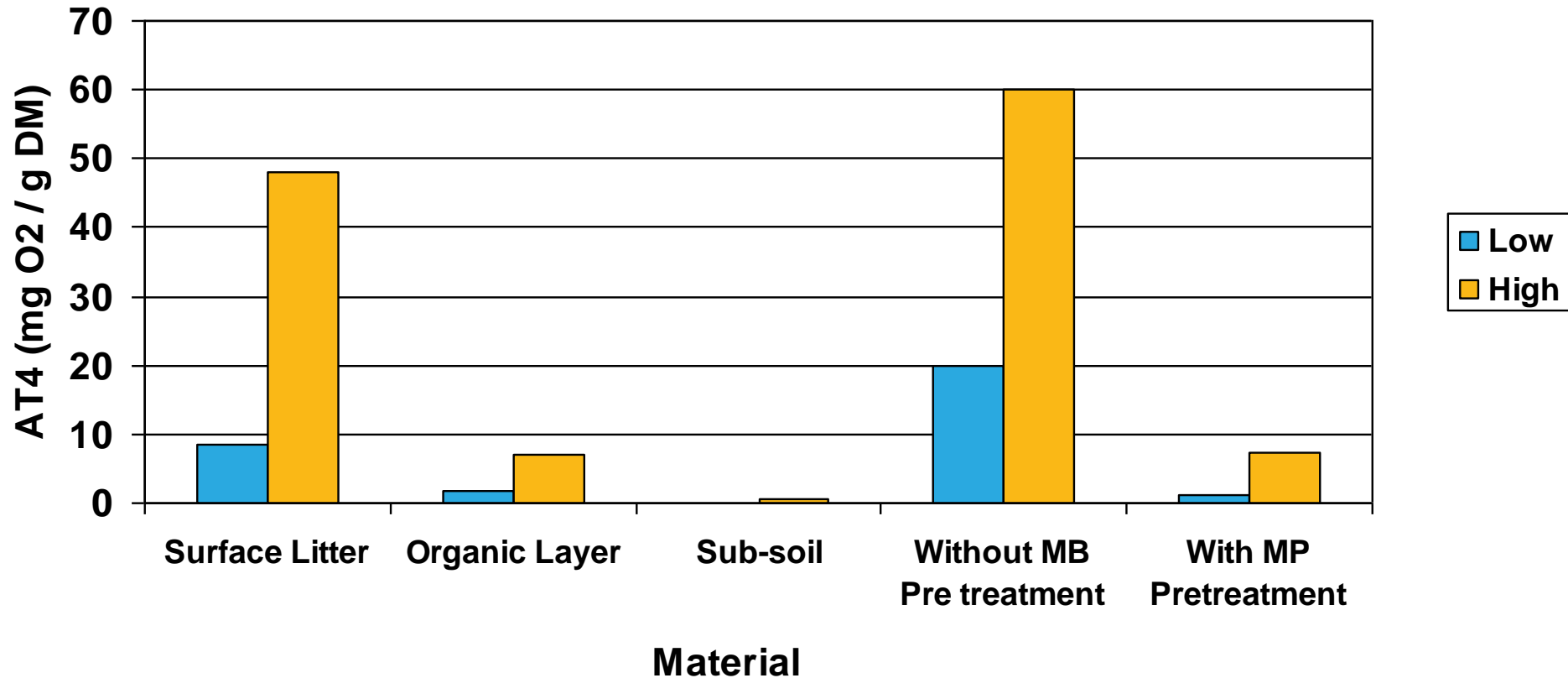
# MBT - Stabilisation



Italian Standard

German Standard

# MBT - Stabilisation



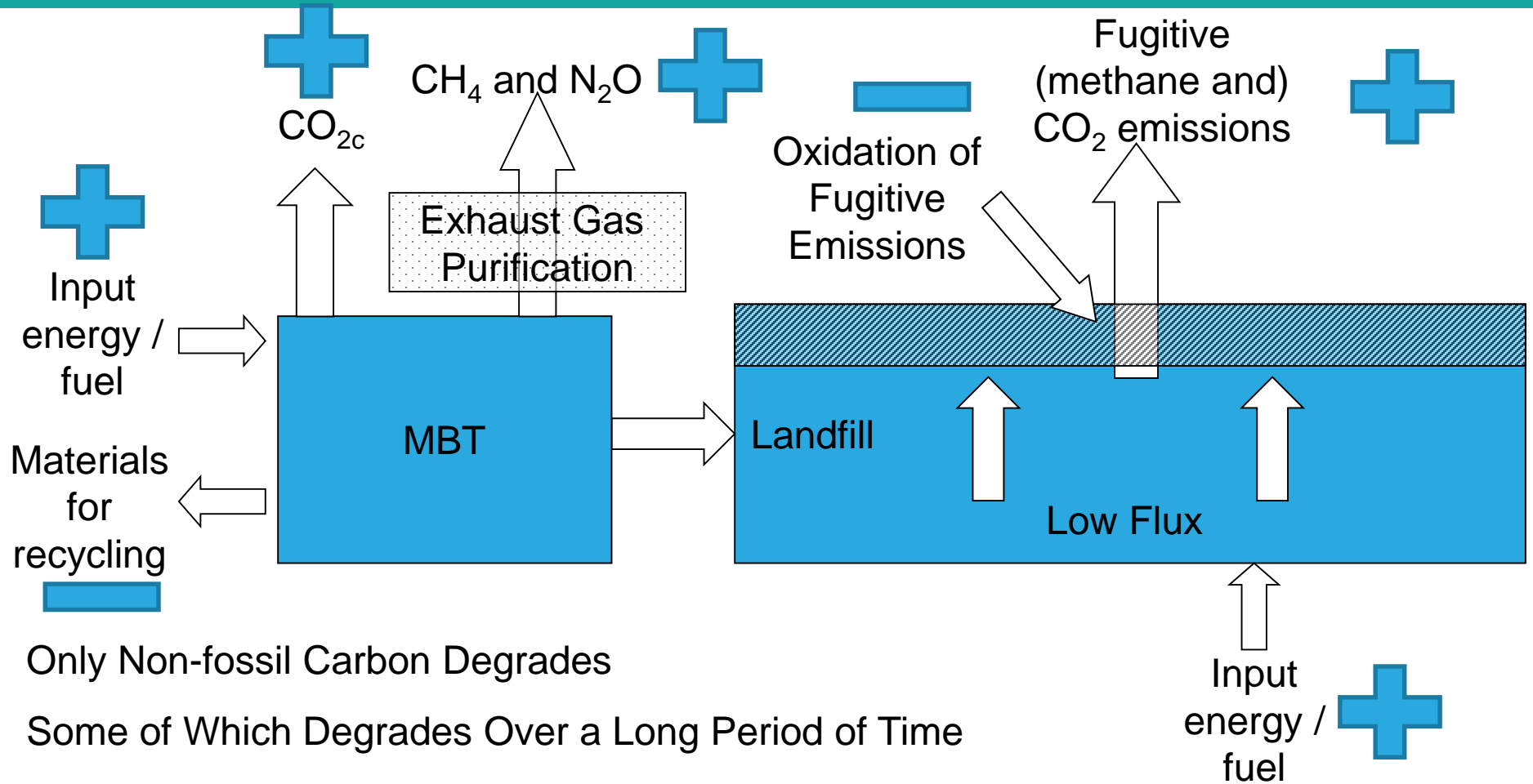
Source: K. Soyez and S. Plickert (2002) (Univ of Potsdam)

# MBT with Stabilisation Prior to Landfill

- **Relatively flexible**
  - **Composition can matter (but some flexibility)**
- **Relatively low capex**
  - **Limited regret from improved recycling / prevention)**
- **Emissions**
  - **Main GHG is CO<sub>2</sub> if ammonia scrubbed prior to biofilter**
  - **Benefits from material recycling**
- **Other Impacts**
  - **Disamenity**



# GHG Balances – Aerobic Stabilisation



Only Non-fossil Carbon Degrades

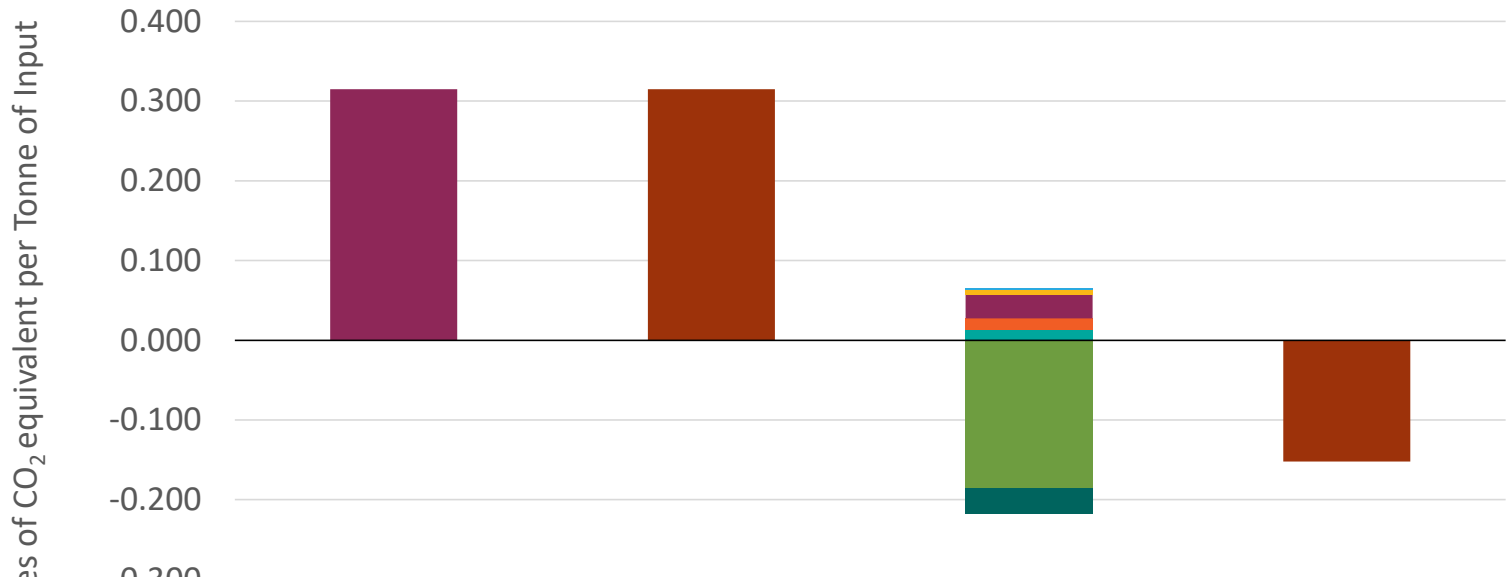
Some of Which Degrades Over a Long Period of Time

Very Low Fugitive (uncaptured) Methane

No Offset from Energy Recovery (net energy user)

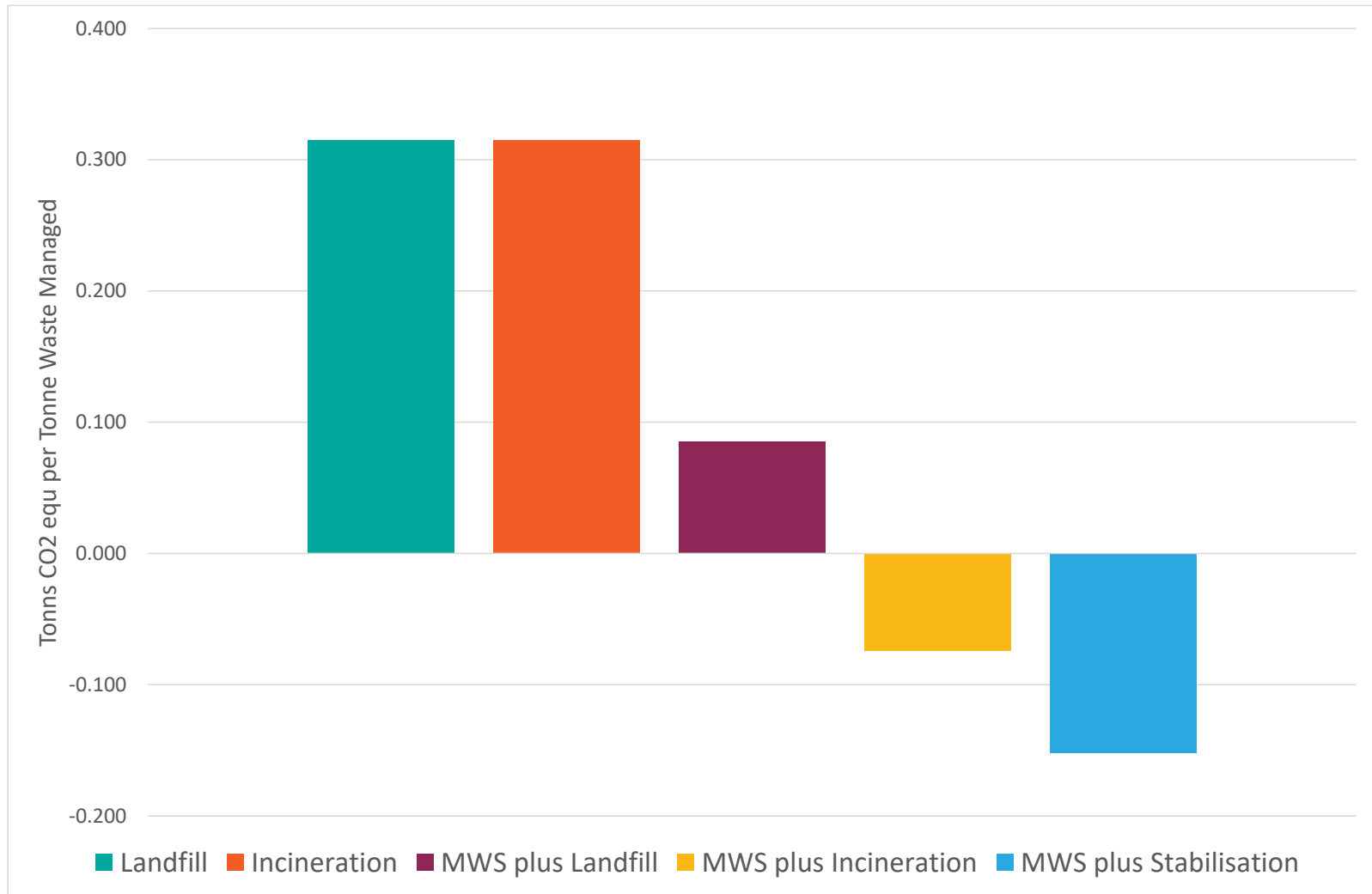
Recycling Offsets (metals (and other))

# Landfill Results



	Detail	Total	Detail	Total
	Direct Landfill		MWS & Stabilisation	
■ Total		0.315		-0.152
■ HDPE & PP Recycling			-0.032	
■ Other Recycling			-0.186	
■ Additional Sort			0.002	
■ Transport			0.006	
■ Landfill	0.315		0.030	
■ Stabilisation			0.015	
■ MWS			0.013	

# Summary





## Point 4:

***Mixed waste sorting coupled to stabilisation of residual waste prior to landfilling is a simple option which may be superior to incineration or landfill on GHG grounds.***

# Summary for Strategy and Policy

# What did we Learn?

- **Mixed waste sorting improves the situation whether for landfill or incineration**
- **If we want a flexible treatment, might not want incineration**
- **But we might not want to landfill direct (GHGs, plastic from blow-off)**
- **So:**
  - **Step 1: Mixed waste sorting**
  - **Step 2: Stabilisation of organic fraction**
- **Relatively low capital commitment**
- **Potentially, lowest GHG emissions**

# Lessons for Policy Makers

- **Don't ban landfilling**
  - You end up with incineration
- **Don't tax all landfill in the same way**
  - Set a lower rate for stabilised biowaste
- **Tax incineration**
  - Focus on:
    - Fossil-derived CO<sub>2</sub>
    - NOx externalities
- **No capital grants**



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