

Climate Change and Residual Waste

**Taking Out The Rubbish: Friends of the Earth
Conference,
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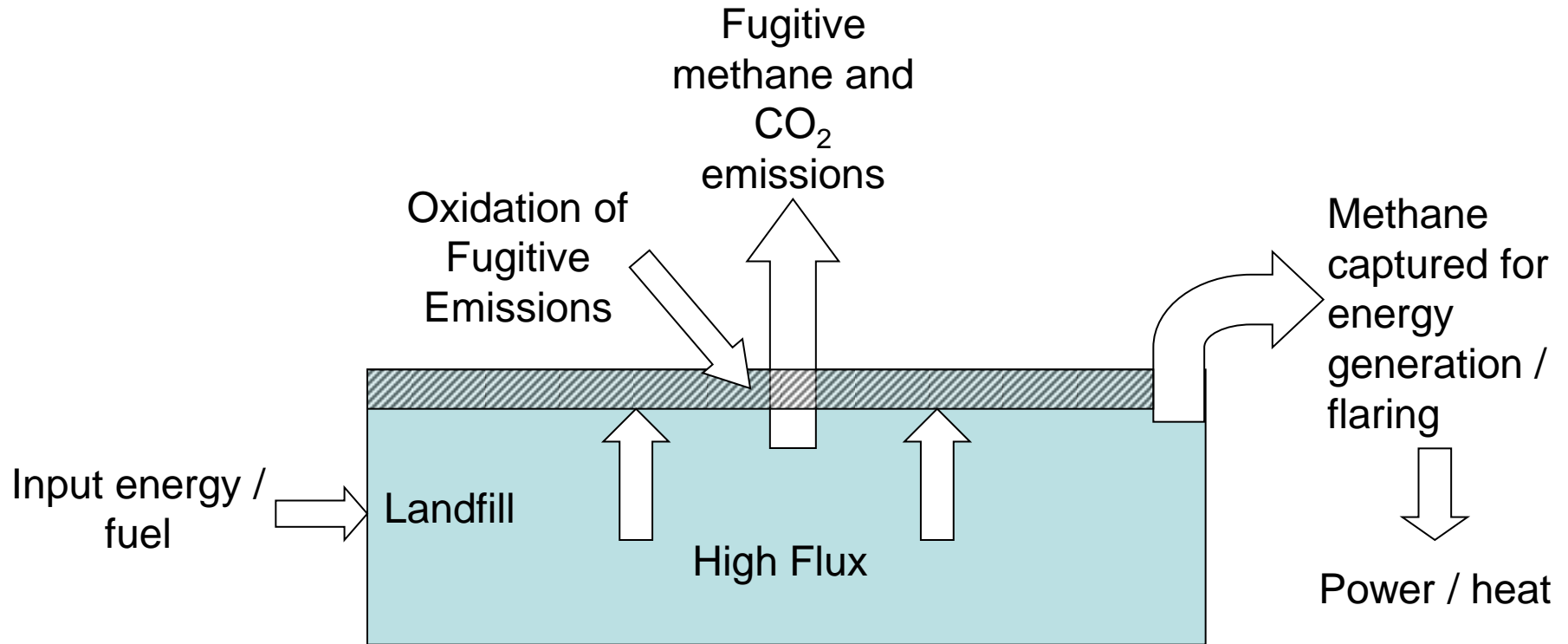
Overview

- **Carbon content of Residual Waste**
- **Comparisons of three residual waste treatment methods**
 - **Landfill**
 - **Incineration**
 - **MBT aerobic stabilisation**
- **A consideration of results within the current taxation regime**

Carbon Intensity of Residual Waste

- **One tonne of residual waste**
 - **Difficult to characterise (so variable)**
 - **NCV - around 9-10 GJ/tonne**
 - **Materials of non-fossil origin**
 - **Some have high moisture content (e.g. food waste)**
 - **Of dry matter, only 40-50% is Carbon (rest is O, H, N, S, etc.)**
 - **Materials of fossil origin**
 - **Lower moisture content**
 - **Of dry matter, high proportion is Carbon (rest is mainly H, some Cl etc.)**
- **Total C, residual waste - 25% (250g) or so of which**
 - **Fossil 100-150 kg or so**
 - **Non-fossil 150-100 kg or so**
- **Non-fossil carbon materials are less well captured by existing recycling schemes, concentrating the fossil carbon**

GHG Balances - Landfill



Only Non-fossil Carbon Degrades

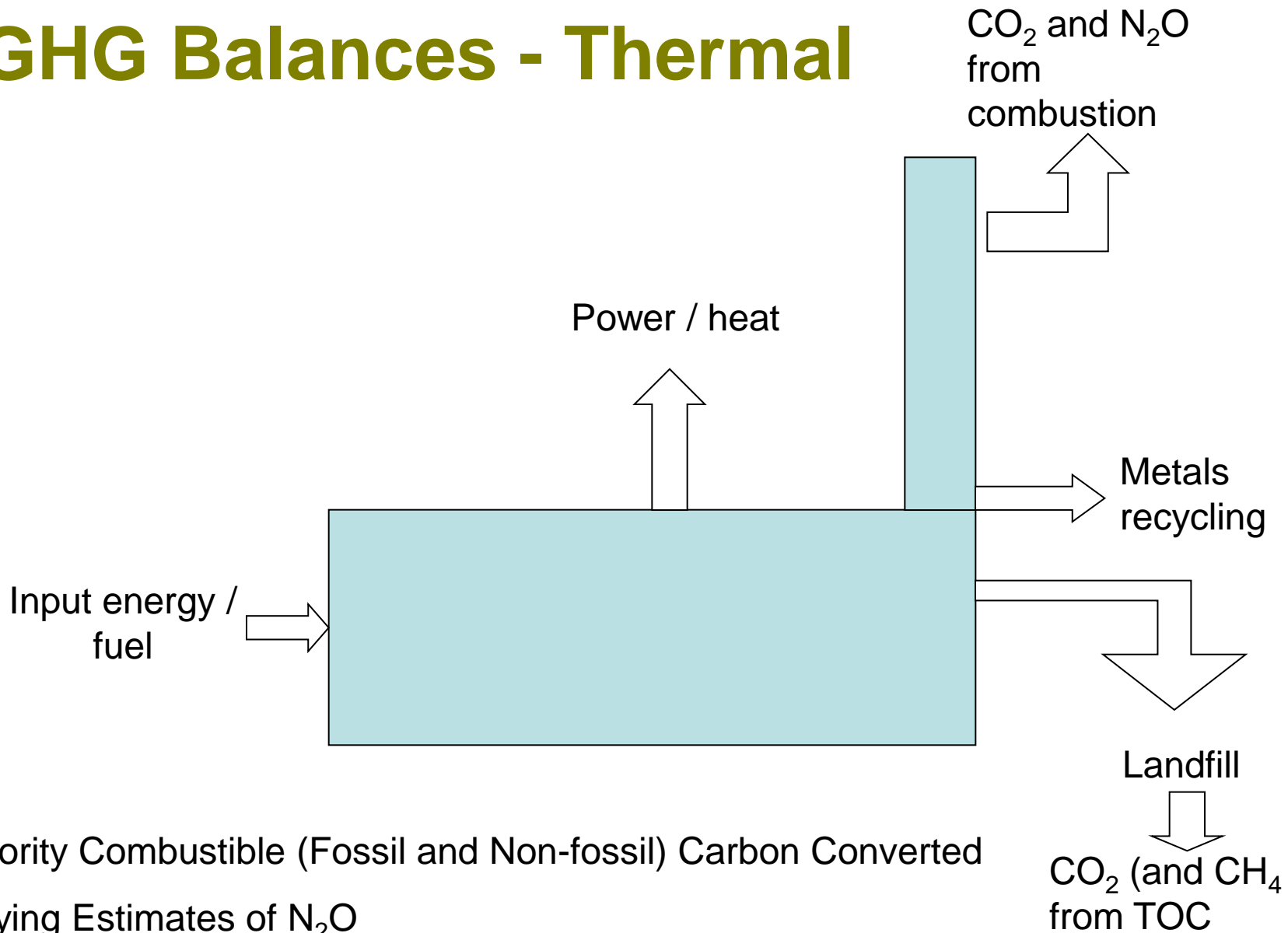
Some of Which Degrades Over a Long Period of Time

Only Fugitive (uncaptured) Element Contributes to Methane Generation

Some Offset from Energy Recovery (net energy deliverer)

Captures and Offsets?

GHG Balances - Thermal



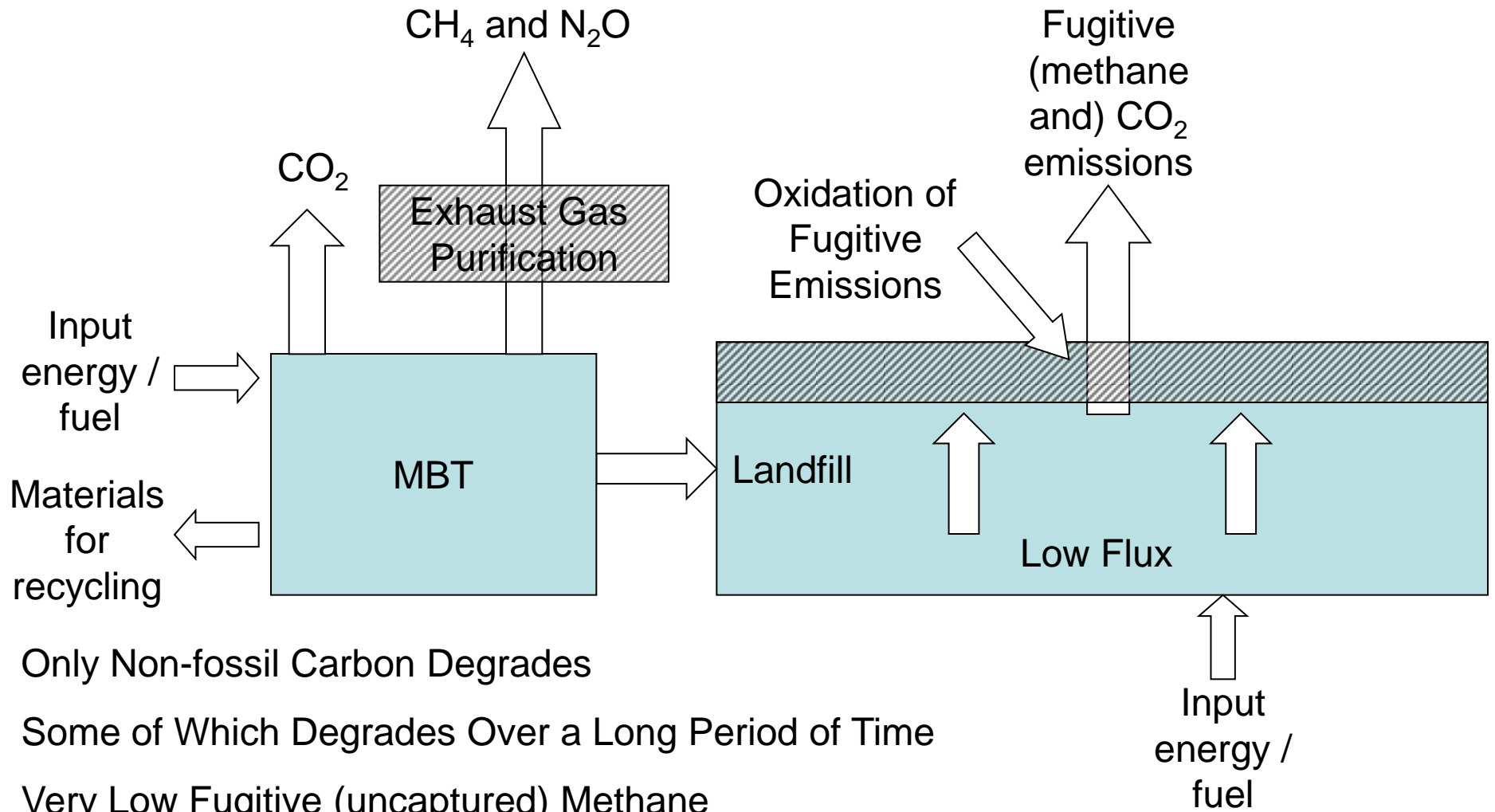
Majority Combustible (Fossil and Non-fossil) Carbon Converted

Varying Estimates of N_2O

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

Offset from recycling metals

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))

Methods of comparison

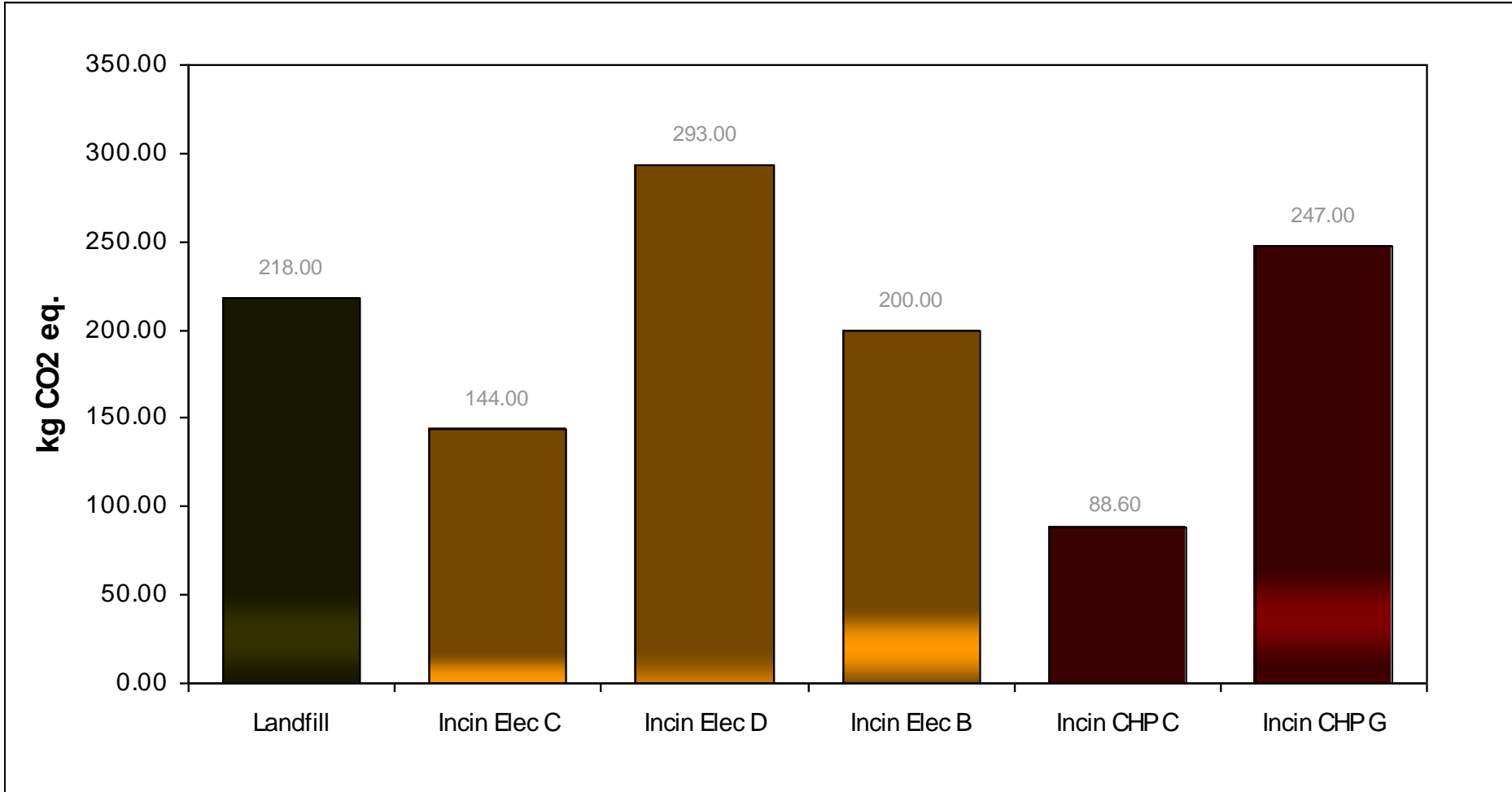
- **Life-cycle Assessment (LCA)**
 - Produces an inventory of emissions (often considers a wide range of pollutants)
 - Pollutants are weighted to calculate impacts
- **Cost Benefit Analysis (CBA)**
 - Produces an inventory of emissions (may be less broad in scope than LCA)
 - Monetary values attached to pollutants
 - Weighed against the cost of treatment options

Greenhouse Gases (Life-cycle Analysis)

Emissions (kg CO₂e)	Landfill	Incineration	MBT (basic stabilisation)
Input energy	2	48	25
Process	478	470	80
Recovered materials		-61	-136
Landfilled residues			78
Output energy Power	-102	-247	
Output energy CHP		-300	
Output energy Heat		-313	
TOTAL Power	378	210	47
TOTAL CHP		157	
TOTAL Heat		144	

Assumes displaced energy source is Combined Cycle Gas Turbine (CCGT)

Some Results from WRATE (an LCA tool)



Assumes displaced energy source is CCGT

External Costs and Benefits

Externality	Incineration with Energy Recovery (£/t)	Landfill (medium) – Gas Flared (£/t)	Landfill (medium) – Gas Used to Generate Electricity (£/t)
Costs	-£19.11	-£9.83	-£12.04
<i>of which:</i>			
CO₂	-£19.09	-£3.82	-£5.73
CH₄	-£0.01	-£5.99	-£6.30
Benefits	+£6.16	n/a	+£2.15
Net Costs	-£12.95	-£9.83	-£9.89

Source: HM Customs & Excise (2004) Combining the Government's Two Health and Environment Studies to Calculate Estimates for the External Costs of Landfill and Incineration, December 2004.

Assumes displaced source of electricity is CCGT

Treasury Landfill Tax Consultation

“While it is proposed that the criterion for lower rating waste should be entirely based on the waste’s inert characteristics, the Government acknowledges that there may be environmental arguments for introducing additional criteria for lower rating waste. However, these would have to be carefully balanced against the need to develop a robust legislative basis for the tax and to comply with European State Aid rules.”

HM Treasury / HM Revenue and Customs (2009) Modernising Landfill Tax Legislation, April 2009

Strategic Perspective – Looking Forward

- **Treatments which generate energy will fare better within analyses where:**
 - **Proportion of energy ‘available’ which is utilised is high (e.g. able to use recovered heat)**
 - **The displacement effect is clearly with respect to more polluting technologies (e.g. assumes substitution for coal)**
 - **Materials which are not a source of energy are recovered**
 - **Materials for which the emissions intensity of energy generation is greater than that of the displaced material are recycled (plastics?)**

Strategic Perspective – Looking Forward

- From a climate change perspective, where residual waste is concerned it is often better:
 - To extract materials for recycling; OR
 - To extract materials for landfilling so as to sequester carbon
- Recycling best today for metals
- Low grade recycling or sequestration may be best for plastics if high grade recycling is not possible
- For biowastes, ‘segregation’ for energy generation may be the preferred option (in which case, AD may have a role to play)
- The most climate friendly approach is not necessarily the one which generates most energy

Is it time to consider.....

- An incineration tax?
- A lower rate of landfill tax for pre-treated wastes?



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