Department for Transport

Low Carbon Fossil Fuels

Workshop November 2019

Moving Britain Ahead

June 2019

Department for Transport

Welcome

Richard Bruce – Director ETI

Moving Britain Ahead

June 2019

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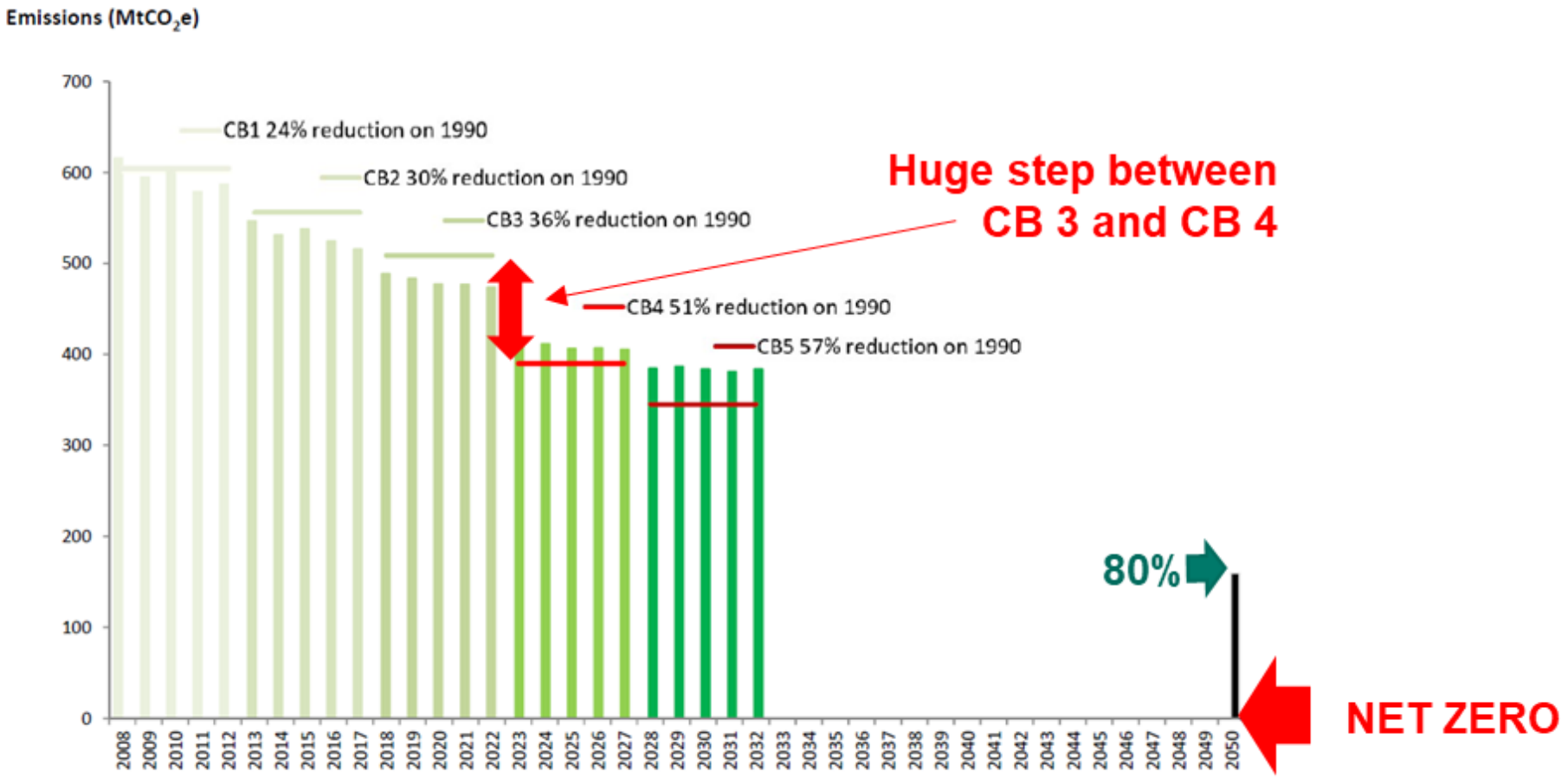
Legally binding carbon targets



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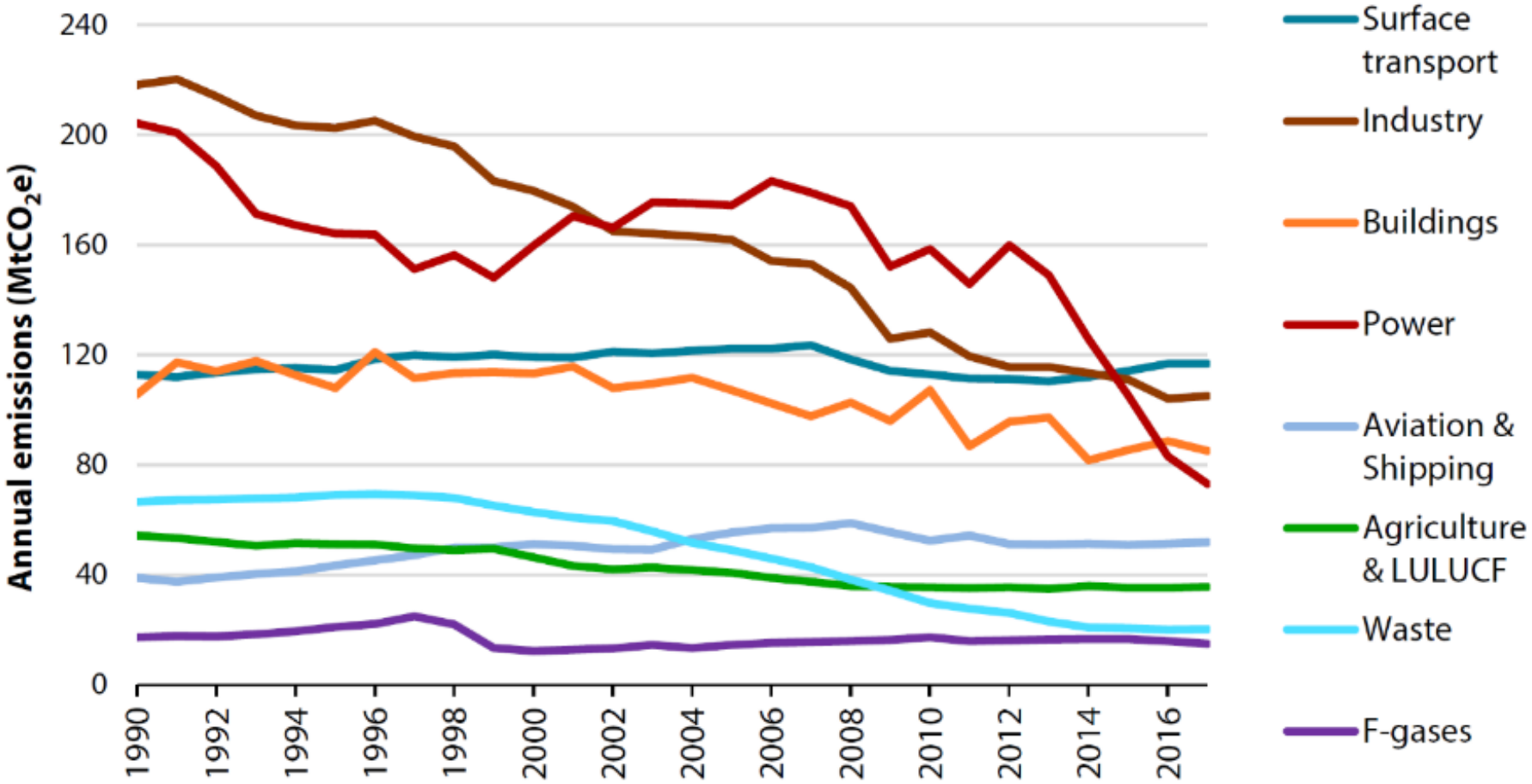
Transport emissions not falling



BEIS (2019) Final UK GHG emissions national statistics

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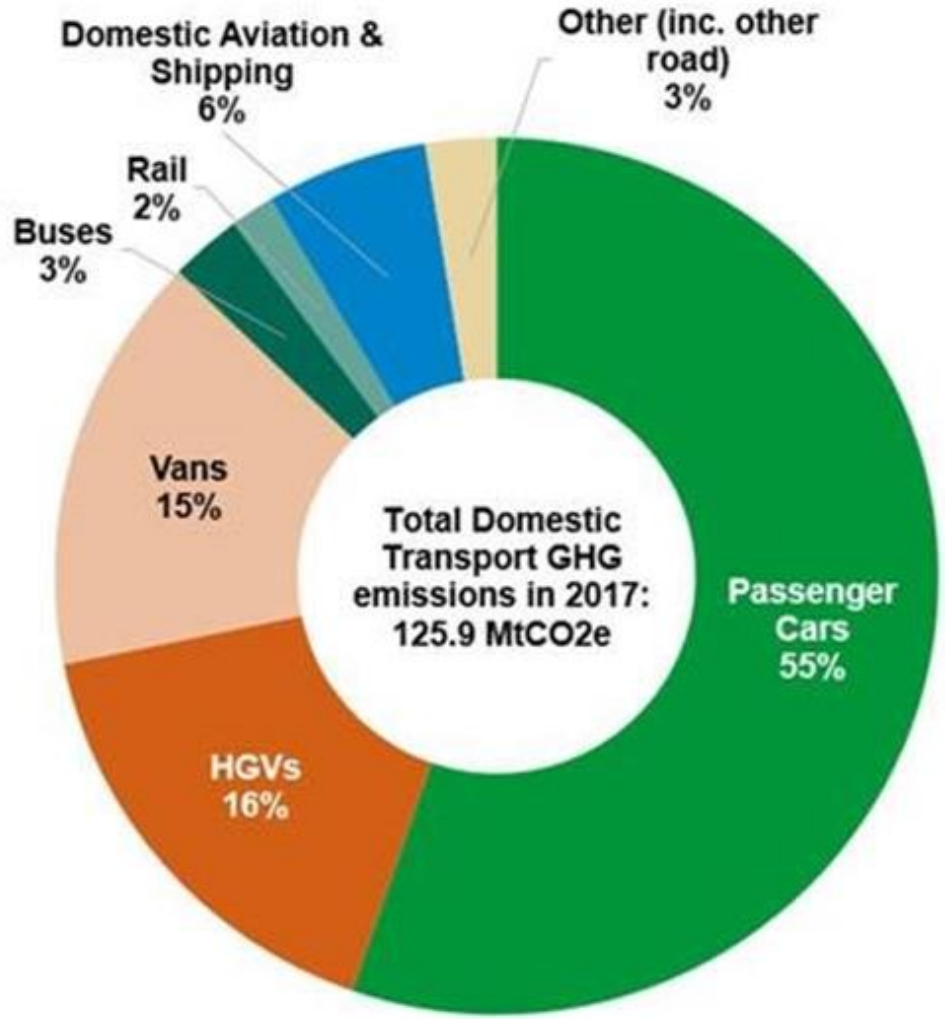
86% of transport emissions from roads



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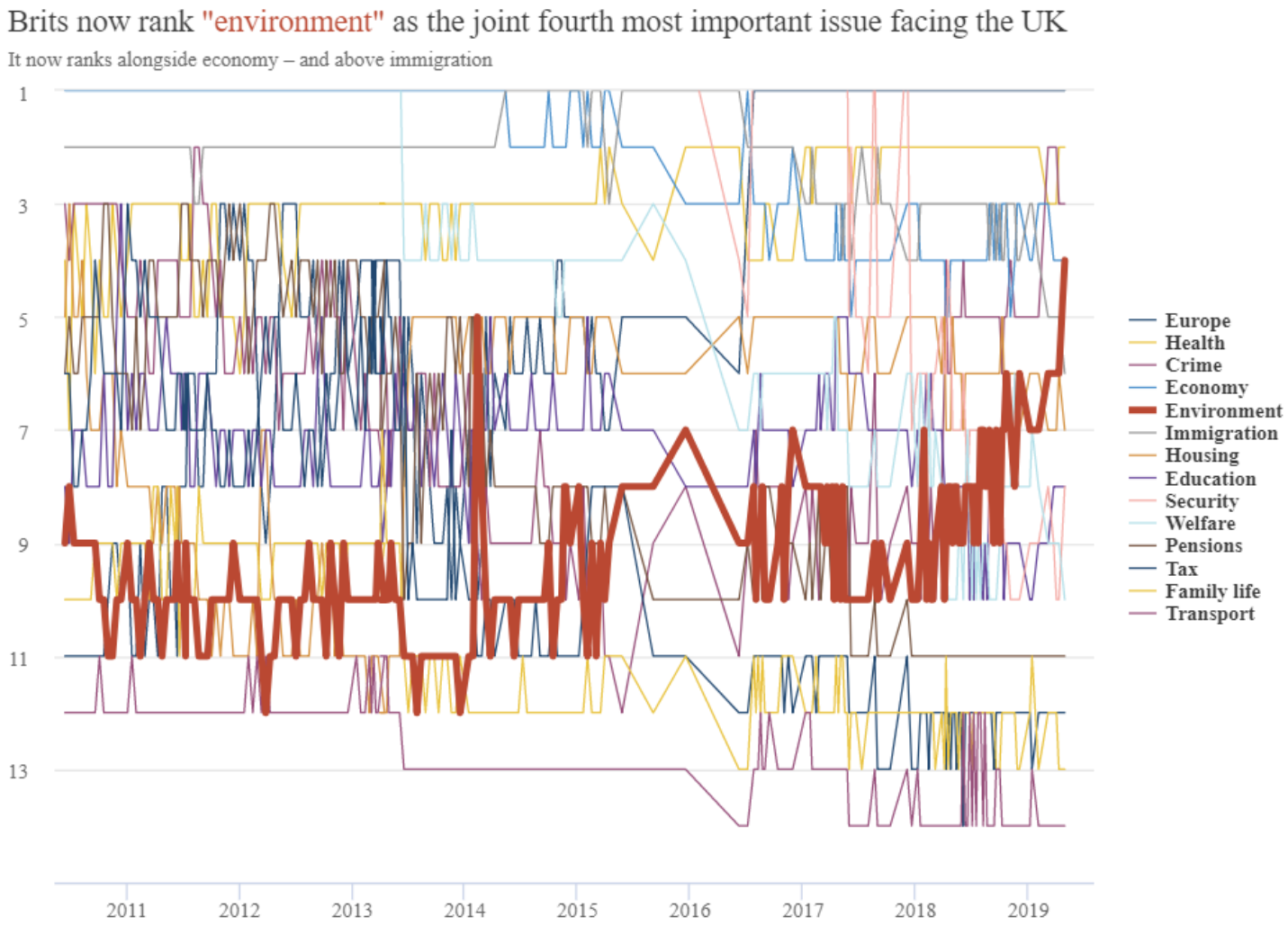
Public attitudes are shifting



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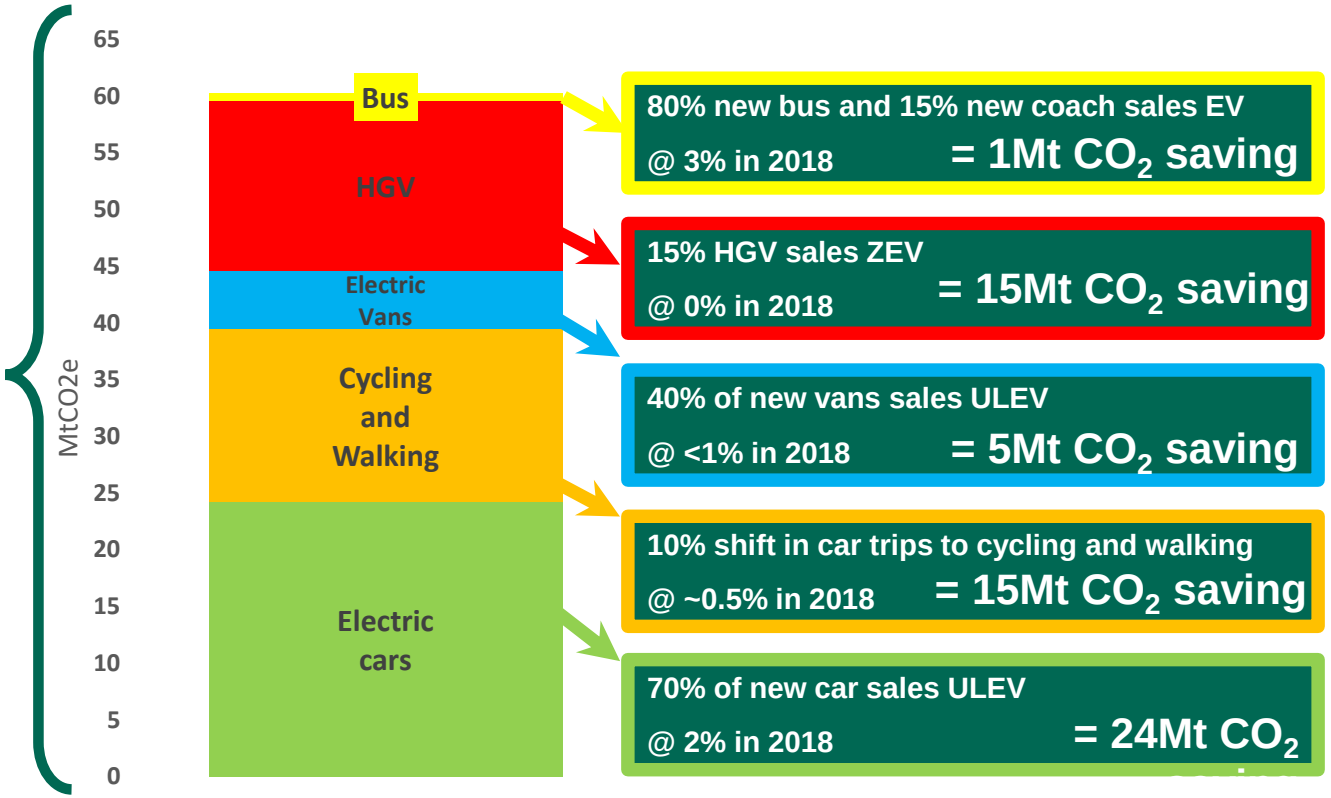
Meeting Carbon Budget 5 (CB5) is challenging…

60Mt CO_2 emissions savings from the transport sector required to meet CB5 (over years 2028-2032)*



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Why are we here?

- **R**enewable **T**ransport **F**uel **O**bligation **(RTFO)**
  - Has been operating since 2008 – saves ~ 2.5 Mt CO_2/year
  - Is one of the Government's main policies for reducing GHG emissions from fuel supplied for use in transport
  - Typically has rewarded biofuels – though there is support available for renewable transport fuels of non-biological origin
  - Top 3 feedstocks include…

Used cooking oil

Wheat

Starch slurry

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What are ‘low carbon’ fossil fuels?

Low **c**arbon **f**ossil **f**uels (LCFFs) are transport fuels made from fossil derived wastes that are not suitable reuse or recycling, or cannot be avoided.

We need to understand if LCFFs deliver GHG emission savings

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Today's workshop

- 10.20. Claudia Amos- Anthesis. Perspectives on waste
- 10.40. Carly Whittaker- DfT. Greenhouse gas accounting methodology
- **11.30. Quick Break**
- 11.45. Understanding risk
- 12.15. Hazel Schofield- DfT. Next steps and the future of LCFFs

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Perspectives on Waste

Claudia Amos - Anthesis

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Anthesis is a specialist global sustainability services and solutions provider founded on the belief that sustainable business practices are at the heart of long-term commercial success.

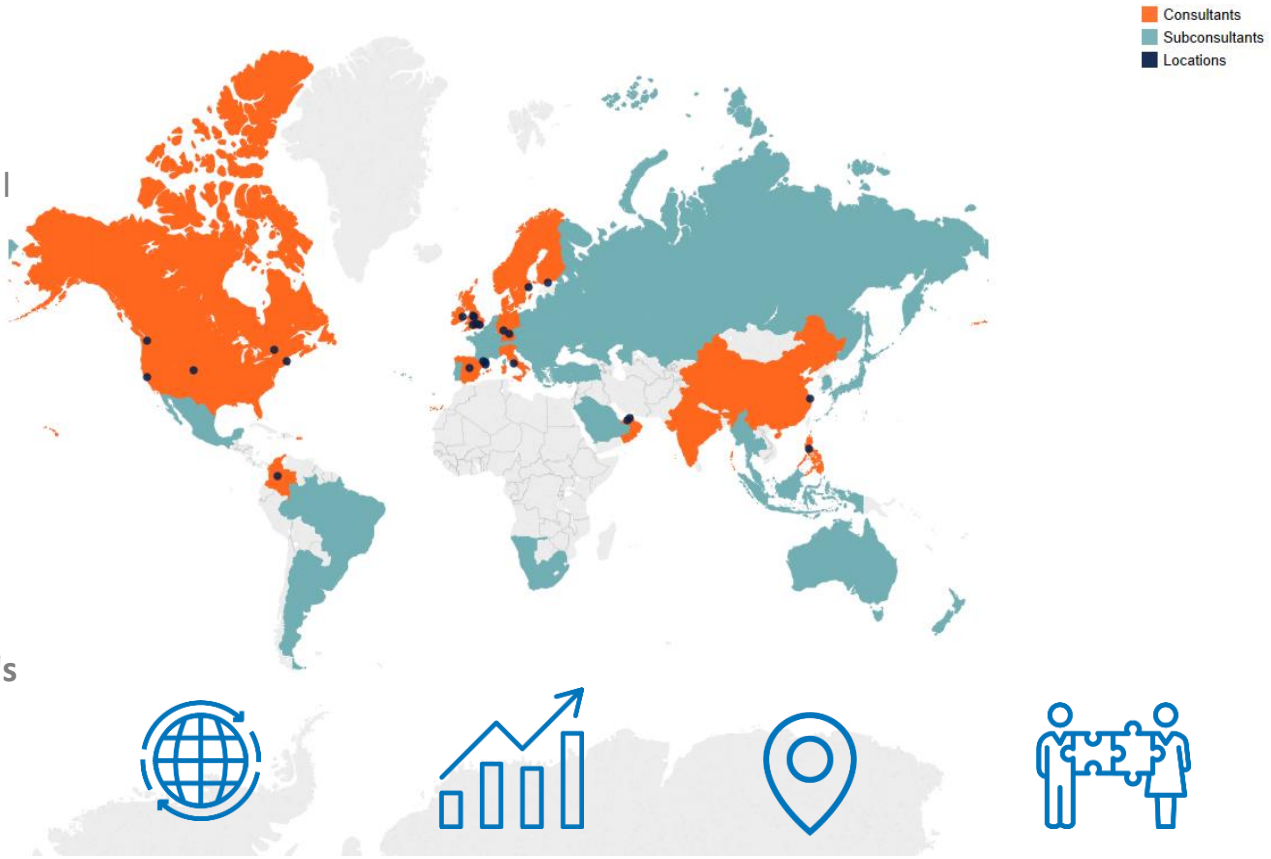
We develop value-driven sustainability strategy which is underpinned by technical experience and delivered by innovative, collaborative teams across the world. We not only develop solutions for clients, but act as a delivery partner too.

We combine the **reach** of big consultancies with the **deep expertise** of our practice leaders from across the globe.

We specialise in working with both local public and private sector clients and large, global corporations. Building productive, lasting relationships with clients is at the heart of our approach.

Global sustainability services company

- We blend **Consulting, Technology and Managed services**
- **Launched in March 2013** to meet market demand for an international firm providing commercially relevant sustainability services
- **Over 450 staff** globally; 12 countries, 20 offices. **UK headquartered.**
- Ranked in The Sunday Times **SME Export Track 100 2018**
- Named in Sunday Times Virgin Atlantic Fast Track 100 2018, the league table that promotes **Britain's fastest growing private companies**
- Featured in top 100 of FT1000 **Fastest Growing Companies in Europe 2018**
- Proud to be in London Stock Exchanges 1000 **Company to Inspire Britain** for 2nd year running



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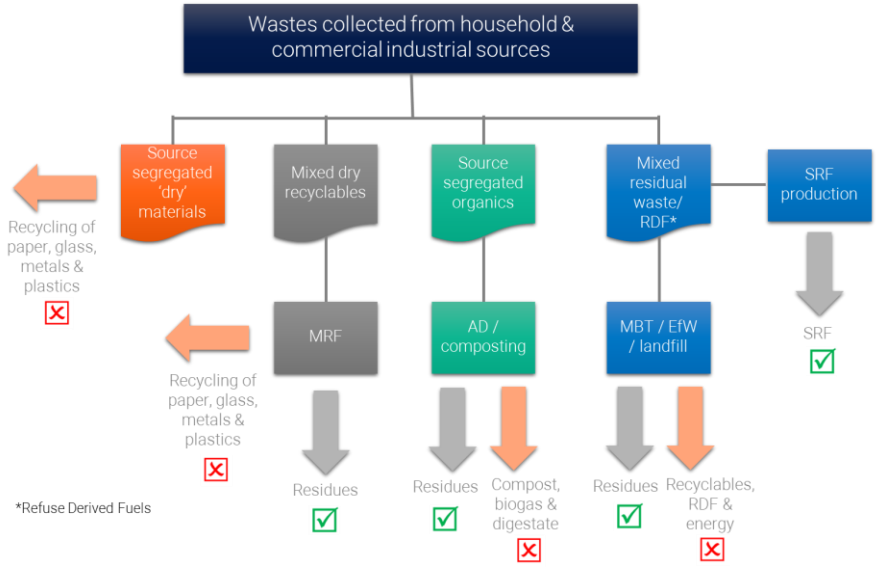
Potential secondary fossil feedstock types:



Code	Waste stream	Non-biogenic percentage (mass) of total waste stream which is
SW1	Non-biogenic fractions of residual mixed waste (black bag/bin waste) derived from households (and some businesses) via Local Authority collections (carried out by the Local Authority and private third-party contractors).	30 - 40%
SW2	Non-biogenic fractions of residual mixed waste derived from commercial & industrial premises collected via private contractors.	30 - 40%
SW3	Non-biogenic fractions of solid recovered fuels (SRF), which are meeting the required CEN or customer specifications of the cement, steel and power plants in the UK & Europe	30%
SW4	Non-recyclable fossil waste plastic being collected as a separated waste stream from households, commercial and industrial premises	100%
SW5	Non-recyclable fossil waste rubber being collected from commercial premises	60%
SW6	Residue streams from material sorting and separation facilities	30 - 40%
SW7	Residue streams from composting and AD processes	100%

- Currently 'non-recyclable' wastes following the waste hierarchy;
- Most waste are a heterogenous mixtures of biogenic and fossil fractions varying by nation, season and source;
- Non-biogenic has been defined as 'fossil' fraction for modelling.

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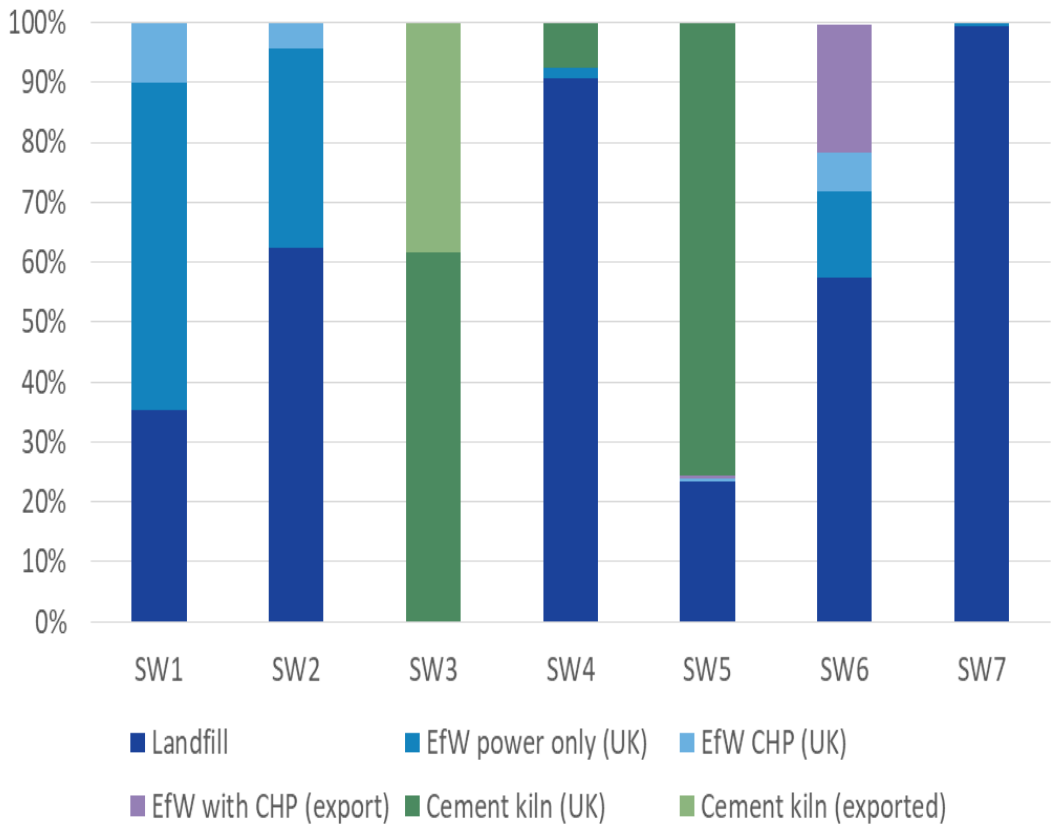
‘End of life fate’ – waste management destinations:



Source: E4tech

- Waste destinations determined by availability of waste management infrastructure
  in the UK & abroad
- Historic data to enable mass balance calculations and modelling of waste flows for each UK region
- Average probability of the EoL fate for each waste was :
  - calculated for the whole of the UK;
  - based on a weighted average of the proportion of each waste going to each EoL fate in each UK nation.
- Waste destinations likely to change in future with more recycling and landfill diversion and increasing UK EfW capacity
- More accurate results will be available on a ‘case by case’ assessment with detailed comparison along the value chain

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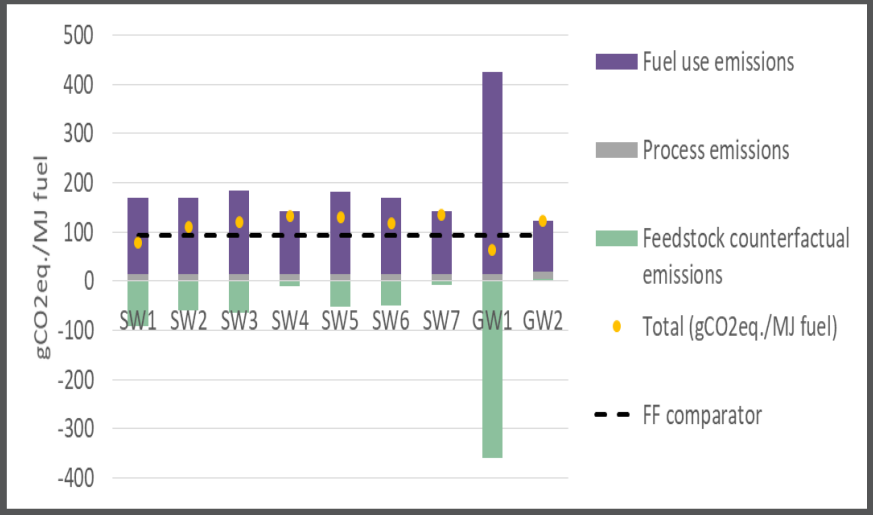
Modelling outcomes & interpretation

Estimated fuel GHG emissions for all feedstocks



Source: E4tech

Modelling approach & calculations

	DIRECT FUEL EMISSIONS				FEEDSTOCK EMISSIONS		
$WTW\ GHG_{fuel}$ =	Sorting etc, production process emissions	+	Transport emissions + Fuel ICE emissions	+	emissions from replacing utility generated in previous fate	-	Emissions from previous fate

Source: E4tech

- The policy context for LCFF has not been considered, but mixed waste diversion (incl. biogenic fraction) from landfill is an important issue;
- GHG intensity has been estimated, based on AVERAGE
  - Weighted historic end of life fates
  - GHG intensity for replacing heat & power
- And
  - a single assumption for process emissions
  - Landfill as carbon storage
- Little GHG savings when compared to fossil fuel counterfactual when comparing average waste management options
- Across the different waste management options, the diversion of feedstock from UK EfW to transport fuel production is likely to reduce GH emissions
- Alignment of LCFF and secondary fossil feedstock with Government waste policy crucial for success

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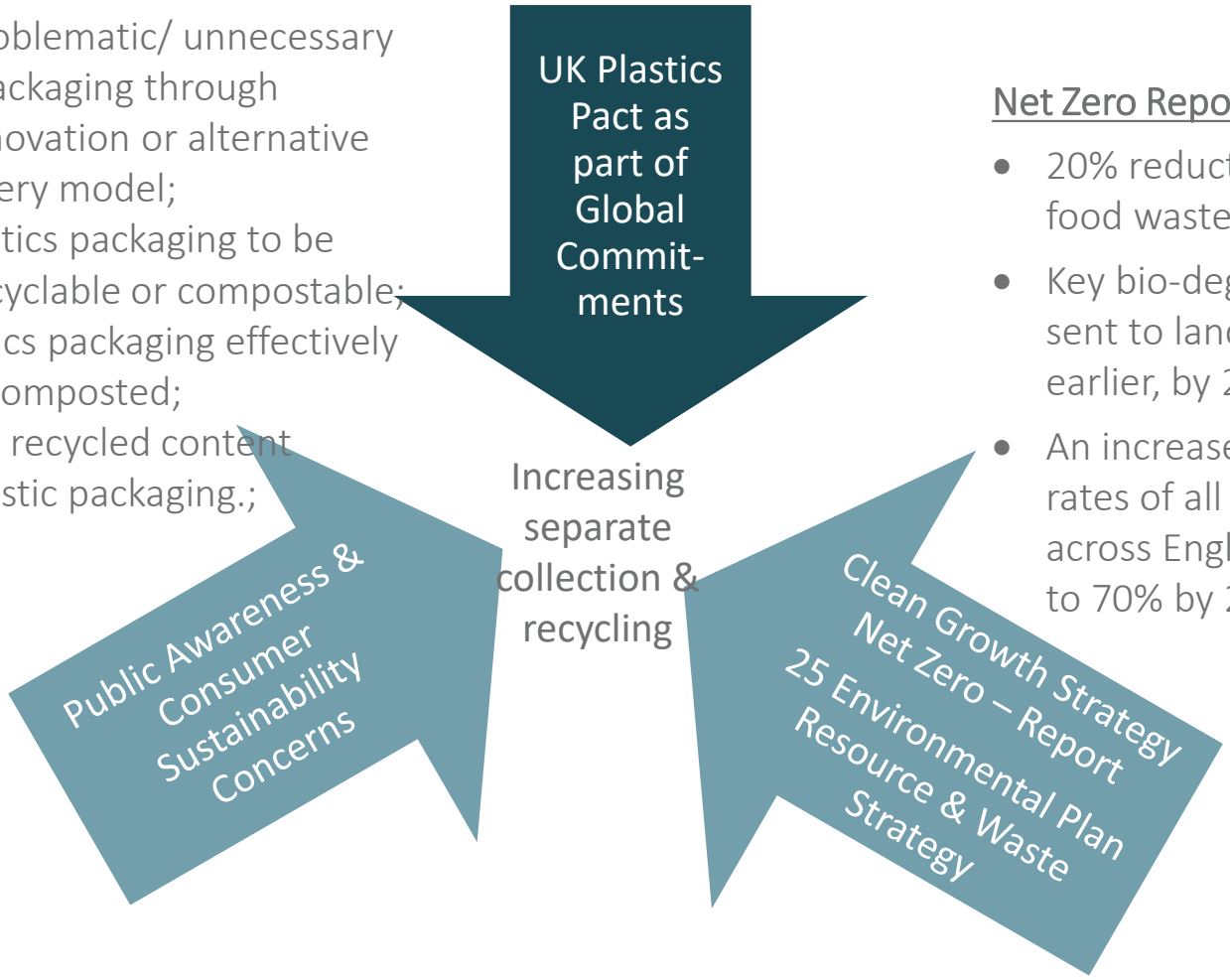
Market Push & Pull to create a more circular supply chains – Example Plastics

UK Plastic Pacts for 2025[1] commitments:

- Eliminate problematic/ unnecessary single-use packaging through redesign, innovation or alternative (reuse) delivery model;
- 100% of plastics packaging to be reusable, recyclable or compostable;
- 70% of plastics packaging effectively recycled or composted;
- 30% average recycled content across all plastic packaging.;



Net Zero Report

- 20% reduction in avoidable food waste by 2025
- Key bio-degradable waste sent to landfill is eliminated earlier, by 2025 at the latest.
- An increase in recycling rates of all municipal waste across England and the DAs to 70% by 2025

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Resource & Waste Strategy – Publication & Consultation

2020
- 50% recycling rate for household waste

2022
- Plastics tax on the production and import of plastic packaging that has less than 30% recycled content *

2023
- *Legislation for mandatory separate food waste collections, combined with food waste reduction measures**
- *EPR for packaging to come into force* to ensure costs of recycling are covered by producers, in particular for plastics packaging waste*
- *Roll-out of a Deposit Return Scheme (DRS) for plastics bottles, cans and glass**

2030
- 75% recycling rate for packaging*

2035
- 65% recycling rate for MSW
- Municipal waste to landfill 10% or less

Strategic RWS Aims:

1. To work towards all plastic packaging placed on the market being recyclable, reusable or compostable by 2025;
2. To work towards **eliminating food waste** to landfill by 2030;
3. To **eliminate avoidable plastic** waste over the lifetime of the 25 Year Environment Plan;
4. To double resource productivity by 2050; and
5. To **eliminate avoidable waste** of all kinds by 2050.

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Future UK plastics recycling & recovery as an example for secondary fossil fuel recovery

Regulatory or Legislative policies or proposals	Probability	Relevance/Potential Impact	Volume & type of plastics waste	Volume segregated plastics for recycling	Demand Recycled Plastics
The Circular Economy Package	M- H	Increased segregation of single stream and mixed stream plastics. Reduction of single use plastics / packaging material from virgin material.	↓	↑	↑
Resources and Waste Strategy	H	Increased segregation of single streams and mixed stream plastics. Waste minimisation, reduced use of virgin plastics.	↓	↑	
Extended Producer Responsibility Reform (EPR)	H	Increased recycling of plastics; potential change in composition due to increased use of 'easy to recyclable' plastics and bioplastics. Changed PRN charging and distribution structure.	↓	↑	↑
Consistency in Collections	H	Types of plastics collected may change (i.e. recyclable v non-recyclable) and segregated volumes are likely to increase. Less contamination due to food collected separately.		↑	
Plastic packaging tax	H	Increased demand for recycled plastic and/or switch from plastics to other materials e.g. glass and therefore potentially reduced plastics volumes.	↓	↑	↑
DRS	H	Increased volumes of clean recyclable plastics collected separately		↑	
Bioplastics	M - H	More complex mixed and source segregated plastic waste streams for composting and recycling.	↓	↑	

Note: ↑ Increase ↓ Decrease

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Contact Us:

Claudia Amos, Technical Director

0044 7904 164251

Claudia.Amos@anthesisgroup.com

www.anthesisgroup.com

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Discussion: The future of LCFFs

- How long will LCFF feedstocks be available?
- How will the feedstocks change in composition?

- Considering Defra targets:
  - Short term- decreased landfill, increased recycling, food waste collections
  - Longer term- reduced use of disposable plastics

- BEIS announced their Clean Steel Fund (open consultation until 21st November)
  - One option is introducing hydrogen to steel mills

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Principles of the GHG assessment Methodology

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Overview

- Our objective
- Recent study: GHG impacts of diverting waste to LCFF
- Issues with landfill
- Further questions and next steps

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Our Objective

- The objective is to decarbonise transport
  - RTFO: Supports renewable transport fuels that meet GHG emission saving criteria

- We recognise that LCFFs are not renewable but are not suitable reuse or recycling, or cannot be avoided..

- therefore we want to understand the potential GHG emission savings that can be achieved by LCFF

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Our Objective

- We aim to develop a GHG assessment methodology in order to be able to distinguish between LCFFs that **do** and **do not** deliver GHG emission savings.

- Set an appropriate level of reward

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What fuels and feedstocks are we considering?

60-70%
Mixed wastes

40+%
Waste rubber

60-70%
Sorted residues from waste processing streams

Waste industrial gases

Aviation fuel

Hydrogen

Drop in fuels

Synthetic natural gas

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Research performed

Our research so far has focused on understanding the GHG emission saving potential of LCFFs

- Can they deliver GHG emission savings?

- We have engaged with numerous LCFF producers/potential producers in order to understand their process and the feedstocks used.

- We have spoken with OGD
  - BEIS – industrial heat, grid decarbonisation, incineration, carbon budgets
  - Defra – tyres, waste recycling etc.

- We have published 2 reports on sustainability risks of LCFFs and this is the 2nd LCFF workshop.

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Recent research

- Focuses on current uses of the fossil waste **in the UK**
- Looked at fossil waste streams but **excludes recyclable portion.**
- Includes wastes such as:

Sorted residues from several waste processing streams
e.g. SRF, composting residues, unrecyclable plastics

Waste rubber

Fossil fractions of residual mixed waste from households, or C&I

Blast furnace, steel mill and refinery waste gases

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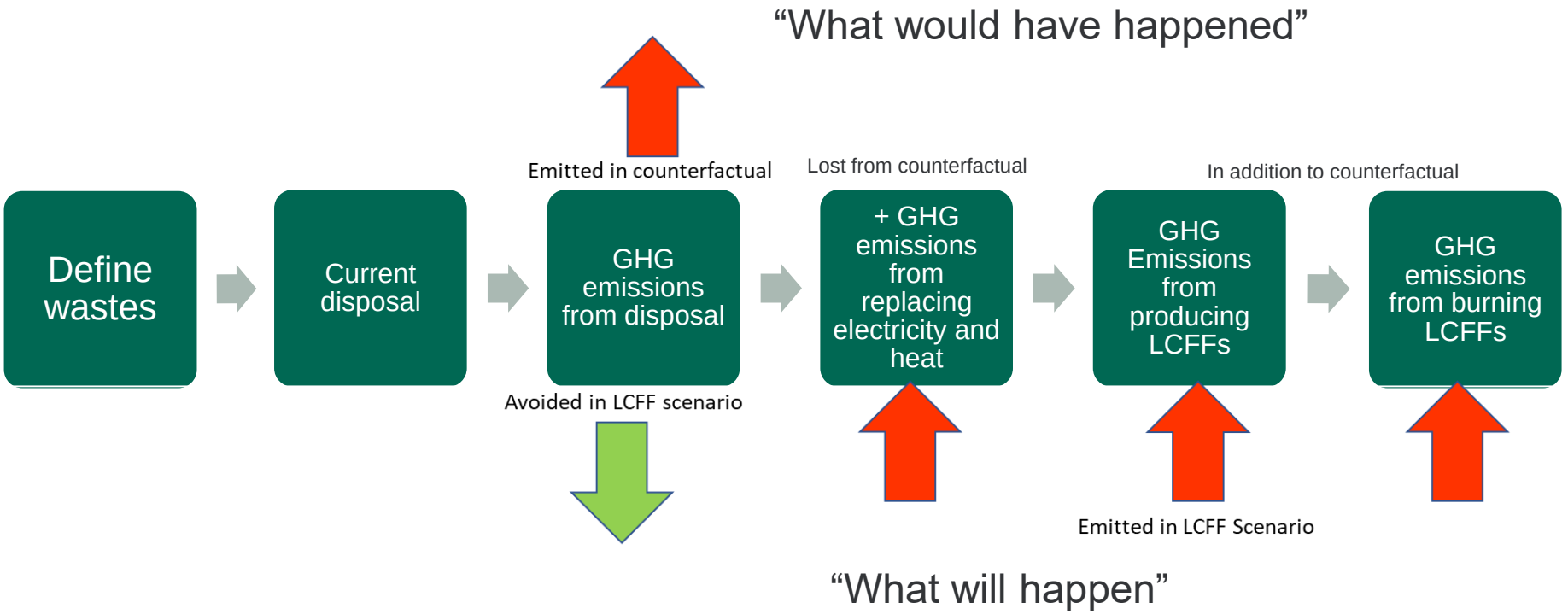
Calculating the GHG emission savings

- Calculates GHG emissions from ….



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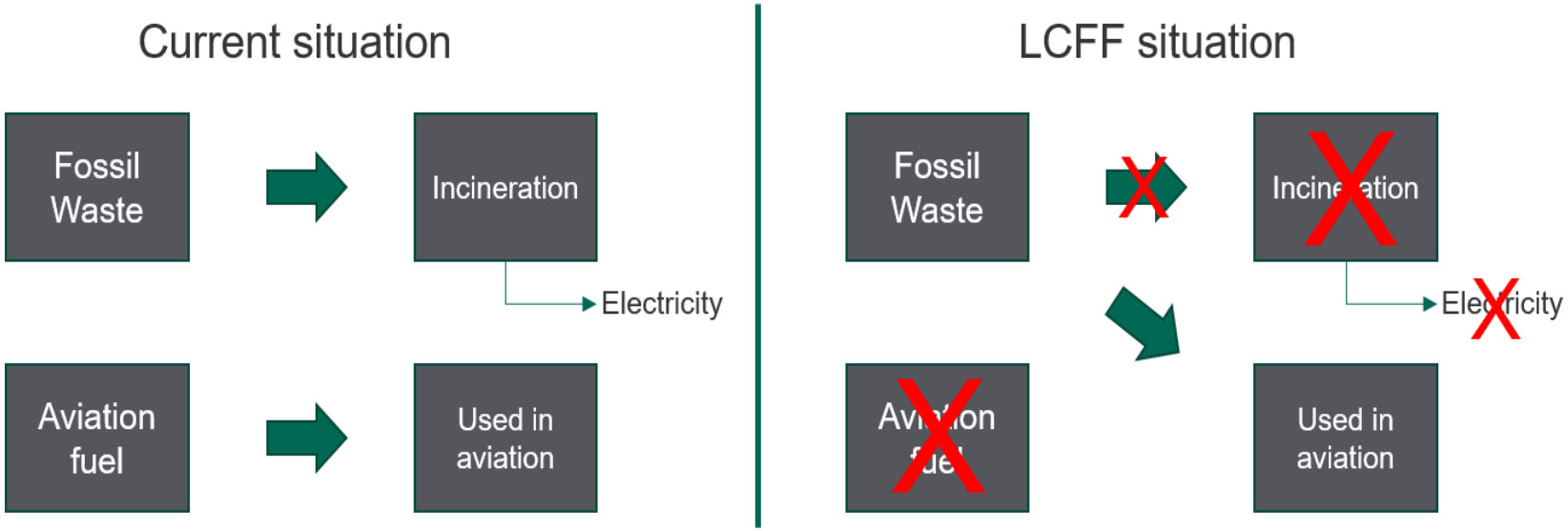
Calculating the GHG emission savings



X = avoided GHG emission

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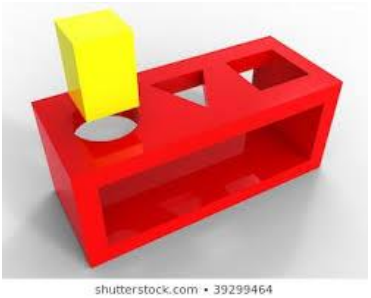
Why are we using a counterfactual?

- We do not tend to use a counterfactual for biofuels- and are not considering this

- Fossil wastes are fossil carbon

– difficult to see any GHG emission savings without considering the counterfactual



Purpose of study was to understand current disposal of LCFF feedstocks

And quantify GHG impacts from displacing waste from these current disposal routes to LCFF

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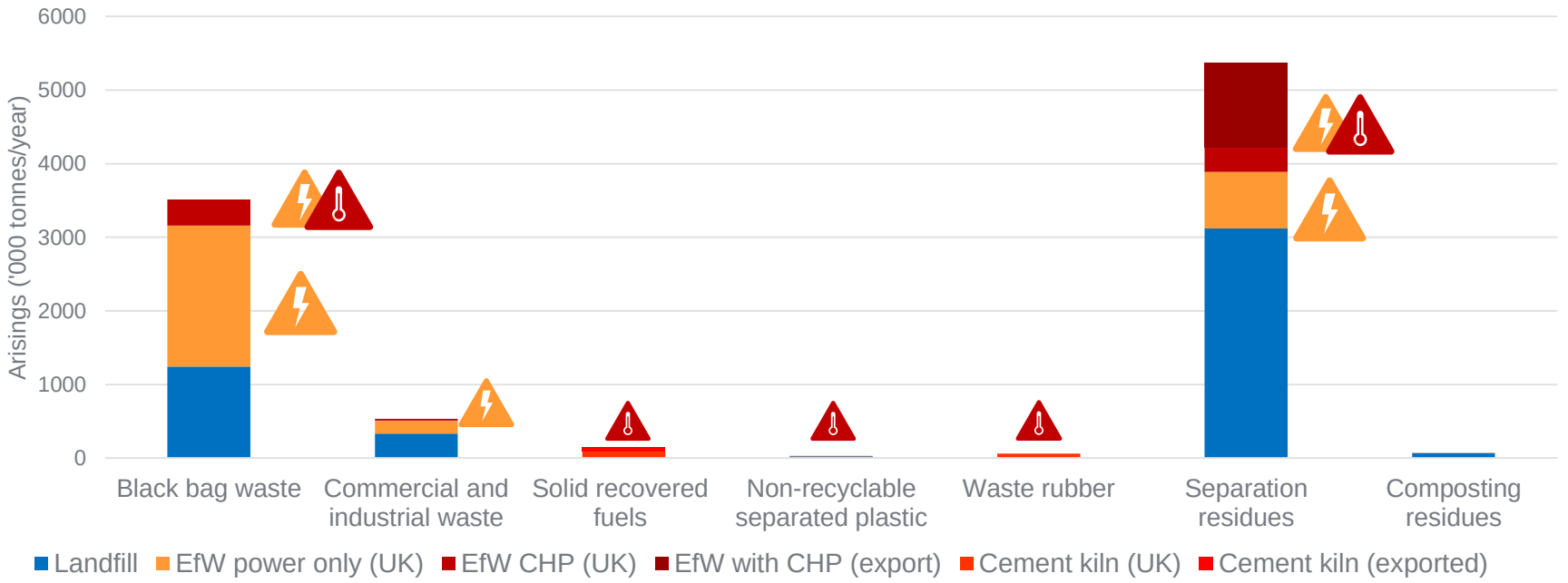
Current disposal: Solid Wastes



Black bag waste and separation residues ~ 23-30 MT

Landfill is the most common end-of-life fate (49%)

Followed by EfW (29%) and EfW CHP (19%). A small amount (2%) is used for heat only.

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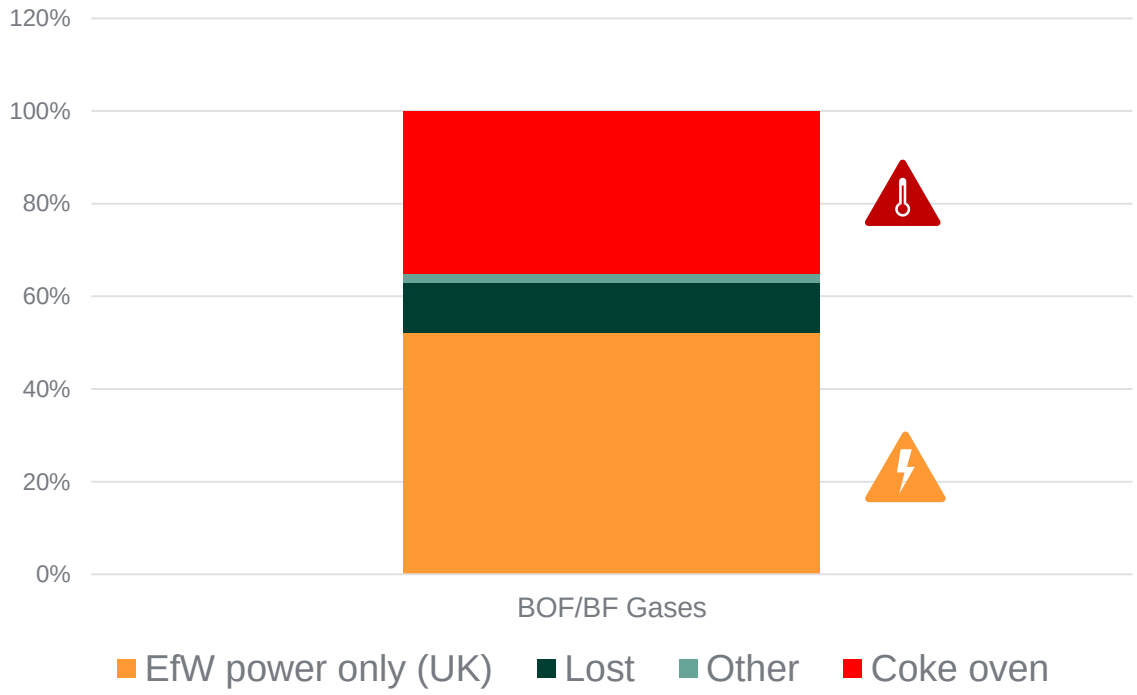
Current disposal: Fossil Gases



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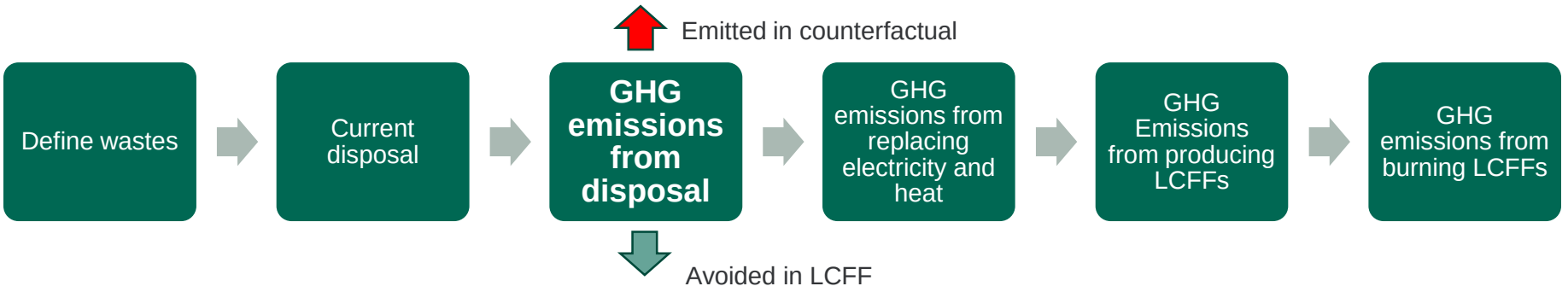
The GHG emissions from disposal

- Landfill – covering landfill (small GHG)
- Energy from waste (EfW) GHG emissions from **combusting** the waste to generate heat or power
- These emissions are avoided in the LCFF scenario



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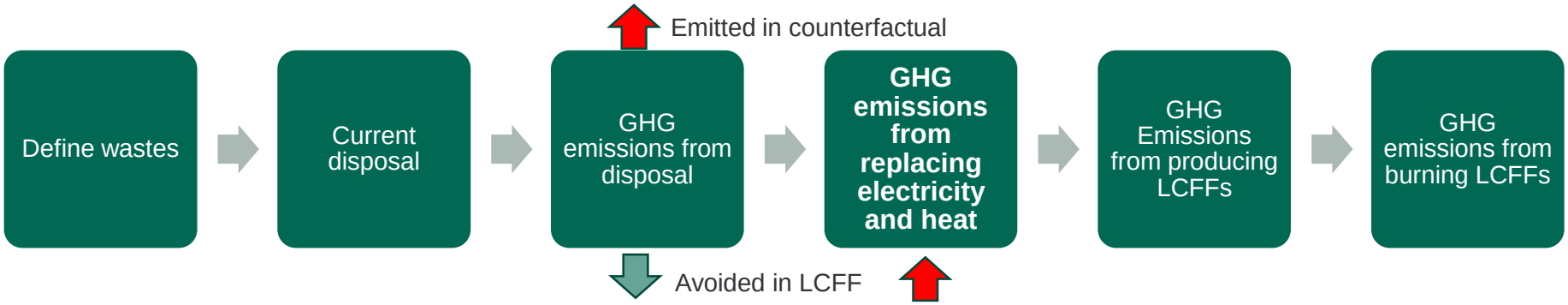
The GHG emissions from replacing electricity and heat

- The heat and electricity needs to be replaced… but what with?
- **Also need to think how this may change over time**

Landfill	EfW (power)	EfW (CHP)	Export CHP	Heat only (cement kilns)	Export cement kiln (EU av. Mix)	Gases only: Coke ovens
No replacement	Grid average electricity	**Grid average electricity and natural gas**	**Grid average electricity in country** and natural gas	Cement kiln mix (coal, natural gas, biomass)		Natural gas



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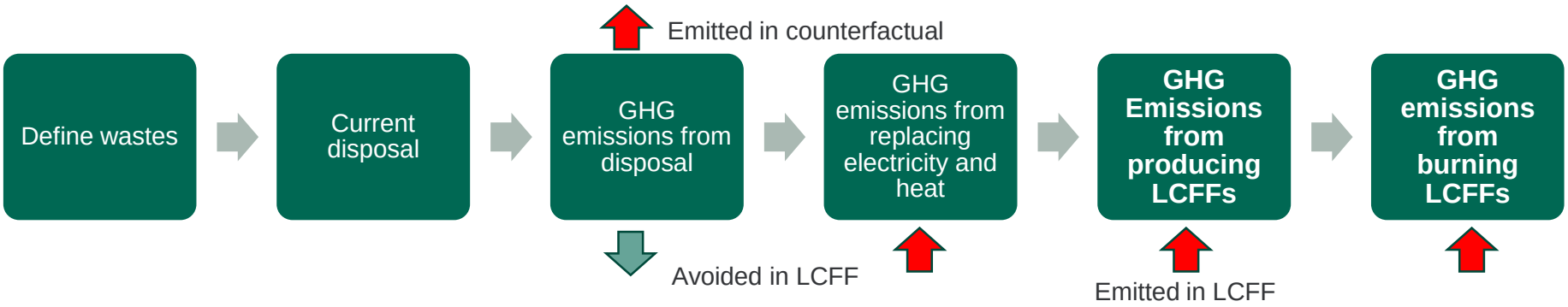
Processing and Combustion

- GHG Emissions from producing LCFFs
  - Are there any opportunities to capture carbon?

CO_2

- Unlike biofuels, CO_2 emissions from burning LCFFs are accounted for
  - This is fossil CO2



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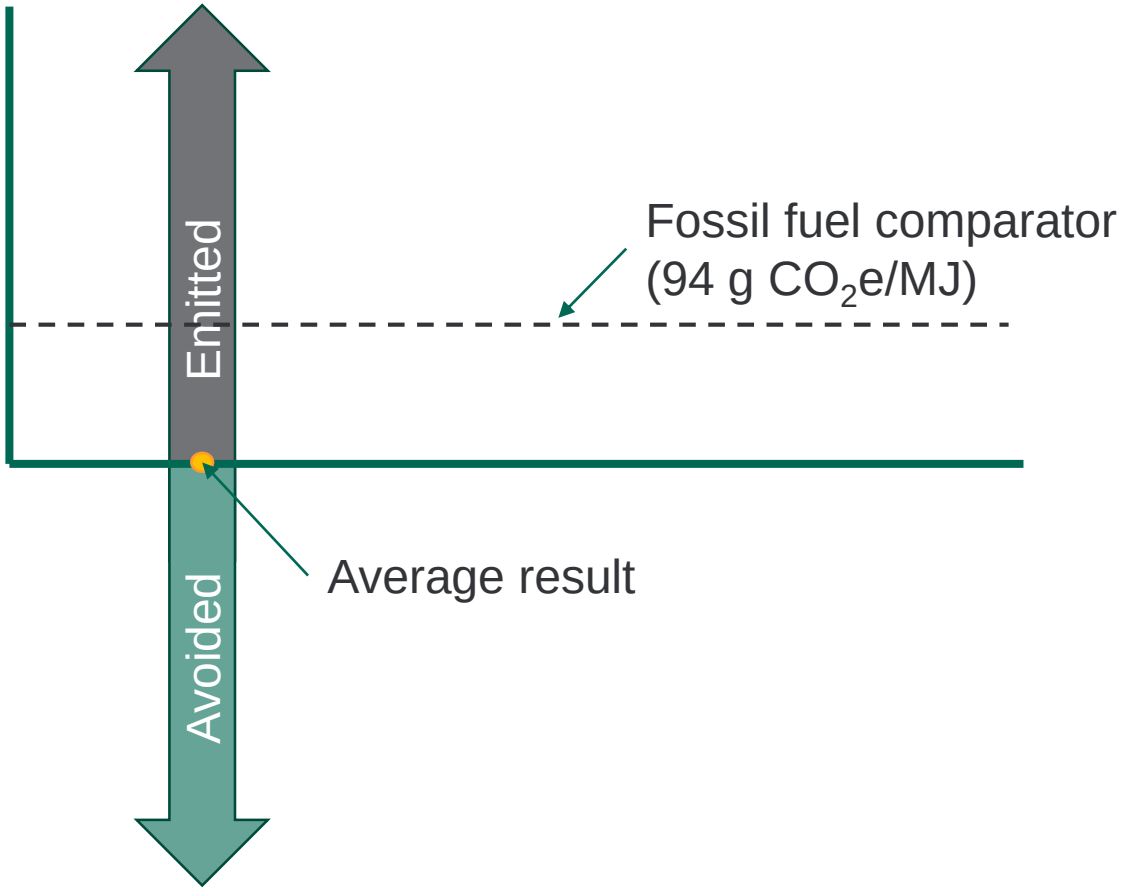
Results

Emitted when we make LCFF

- Combustion emissions
- Energy ‘penalty’

Avoided when we make LCFF

- Emissions from incineration



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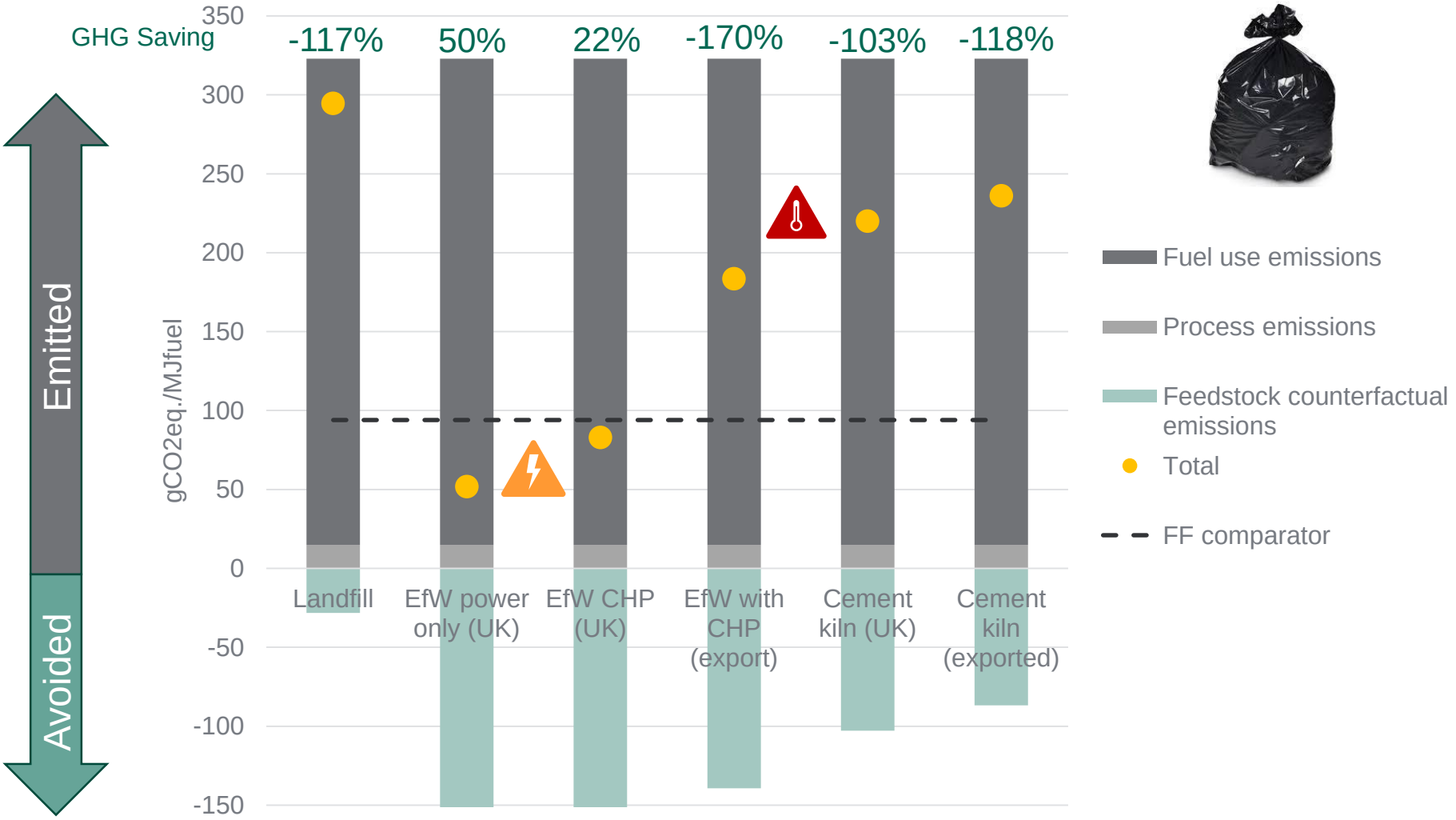
The counterfactual affects the results: Plastics



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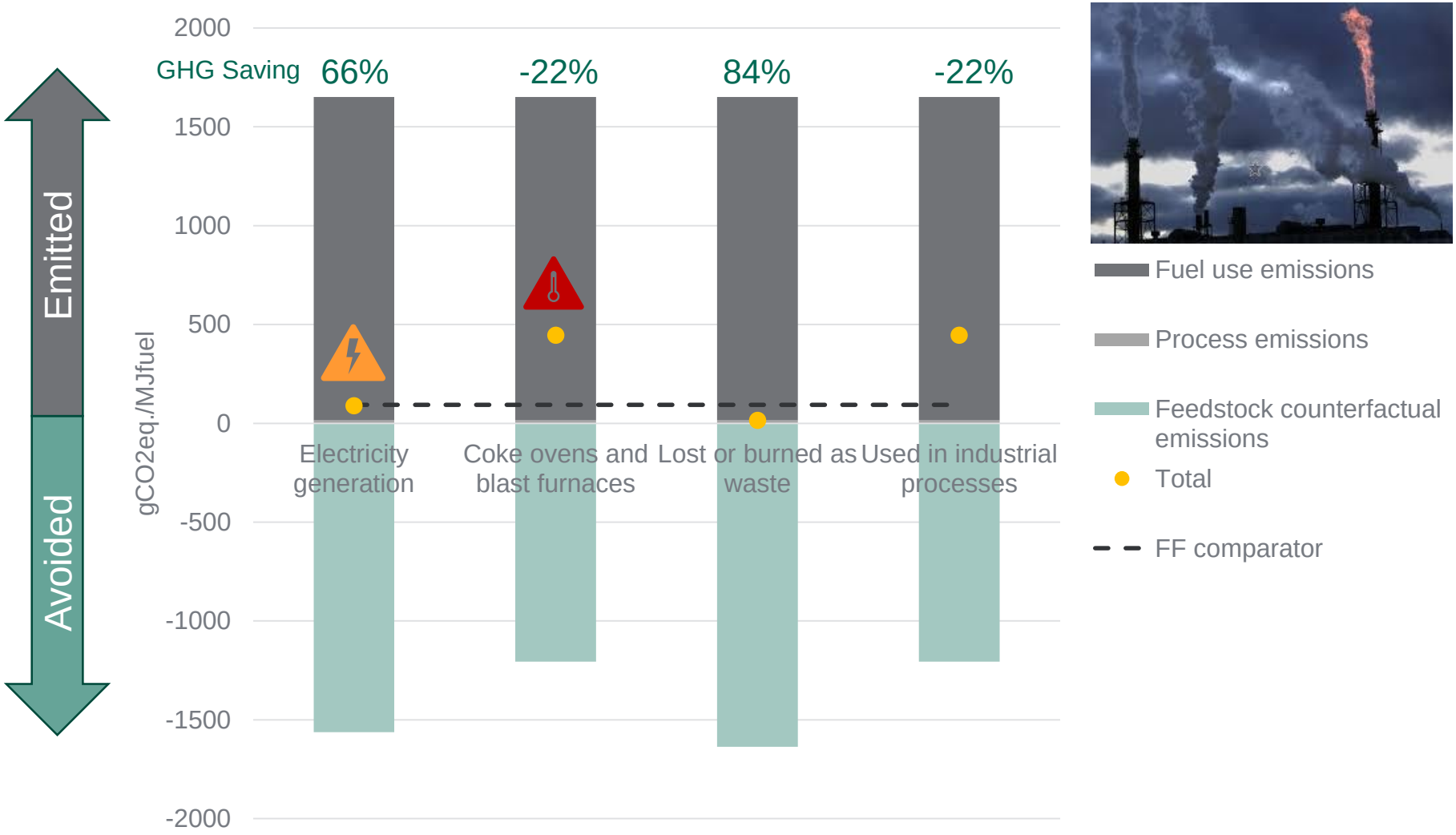
The counterfactual affects the result: Gases



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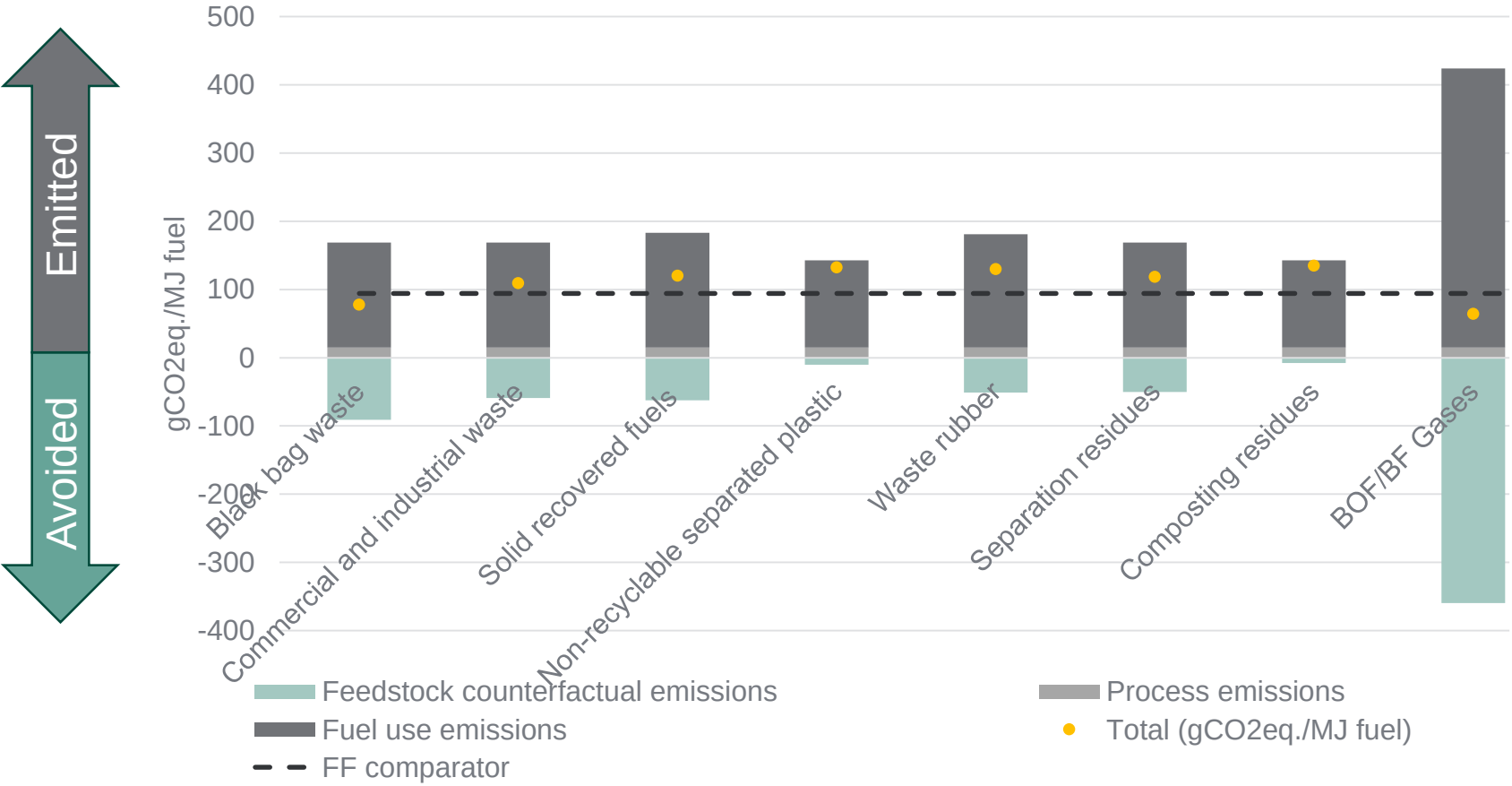
Results from study: Using average end of life



- **Based on current mix of end of life option**
- Most LCFFs have a GHG emission factor <u>similar or higher to the fossil fuel comparator</u>

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Conclusions from analyses

- Landfill acts as a store of carbon
  - But does it?
- If LCFF feedstocks are diverted from heat then the GHG emissions increase because the heat is replaced by natural gas, or coal.
- If LCFF feedstocks are diverted from EfW then there are GHG emission savings, because the average grid emissions are lower than incinerating waste.
- **At this point- are there questions?**
- **(next up- landfill)**

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Let's talk about landfill

- Is landfill an appropriate counterfactual for LCFF feedstocks?
  - By 2035 the proportion of municipal waste to landfill will be reduced to 10%
  - Means that between now and then approx. 9Mt of LCFFs feedstocks will be moved from landfill
  - **Landfill not an option we should compare against**
- Does it act as a carbon store?
  - There is a considerable biological component of the waste would degrade and be emitted as methane.

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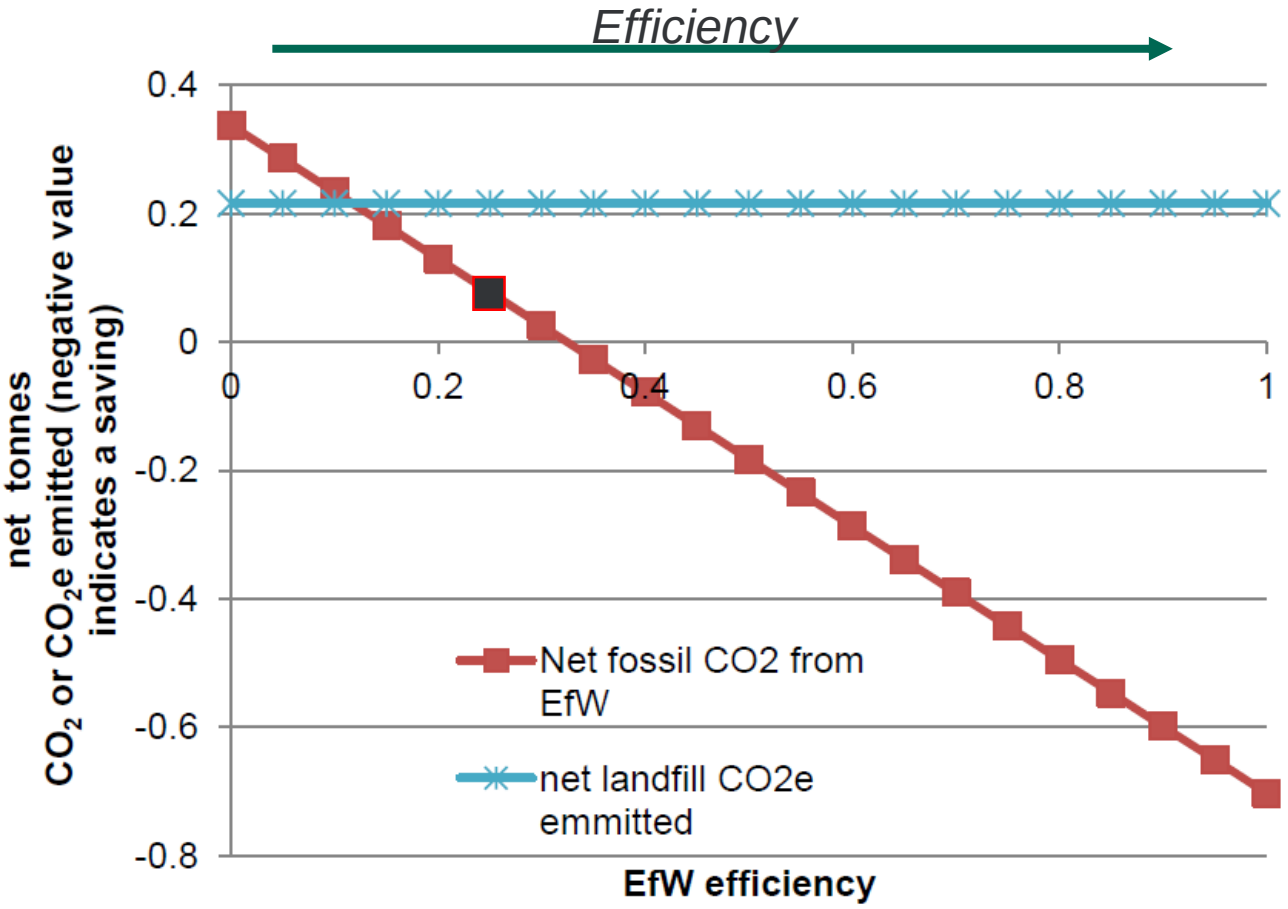
Defra Study

Chart 1. Variation in CO_2e emissions from EfW and landfill with EfW plant efficiency for the same tonne of waste



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Remodel

- Could remodel with biogenic methane emissions ..but
  - Much larger modelling exercise
  - We know that it's good to avoid landfilling biomass
  - What about 100% fossil feedstocks?

- Change of question: If material is diverted from landfill- where would it go?
- Many incinerators have heat recovery capacity but it's not used.
- Heat use in industry represents around 2% of use
- Next most viable use is incineration for electricity generation?

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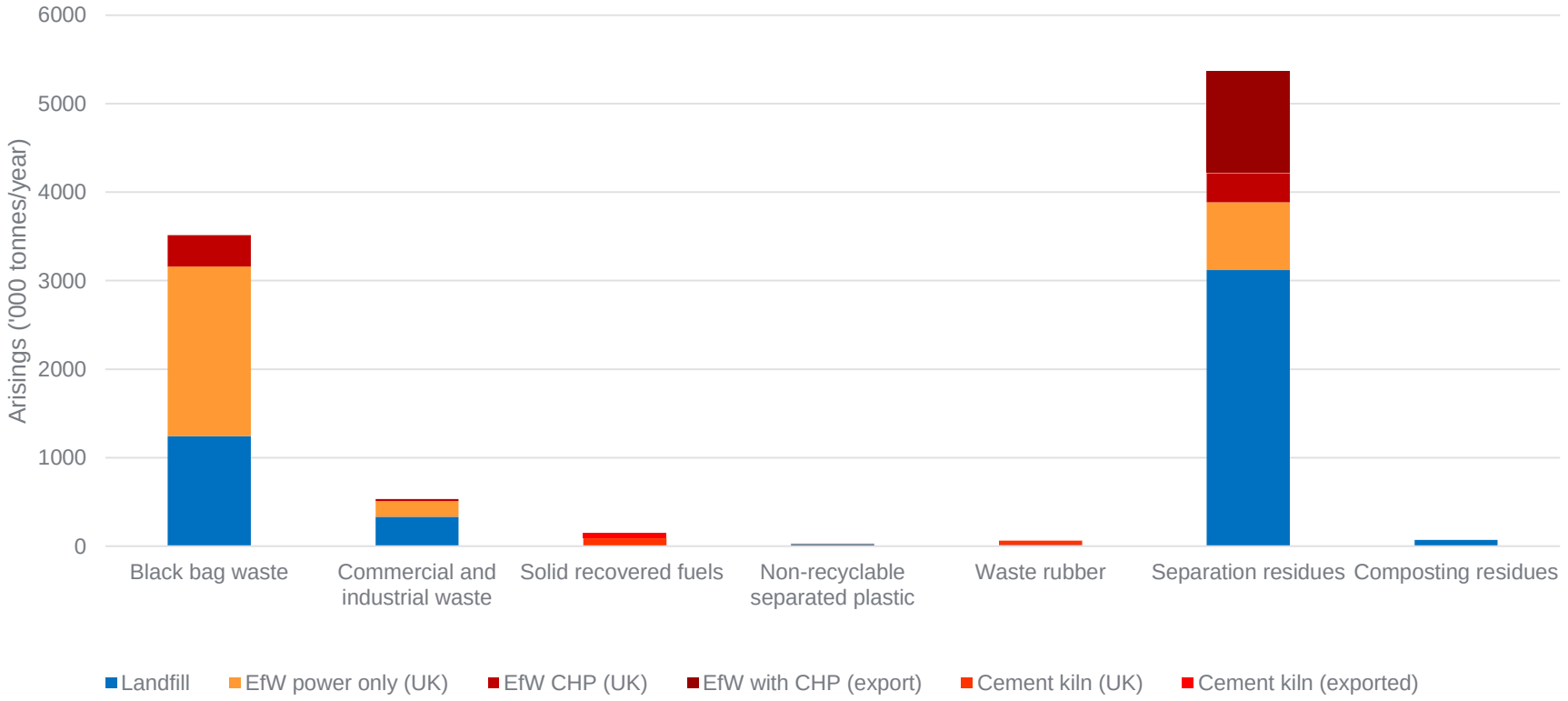
Overview of uses



If we assume that all landfilled waste goes into electricity generation…

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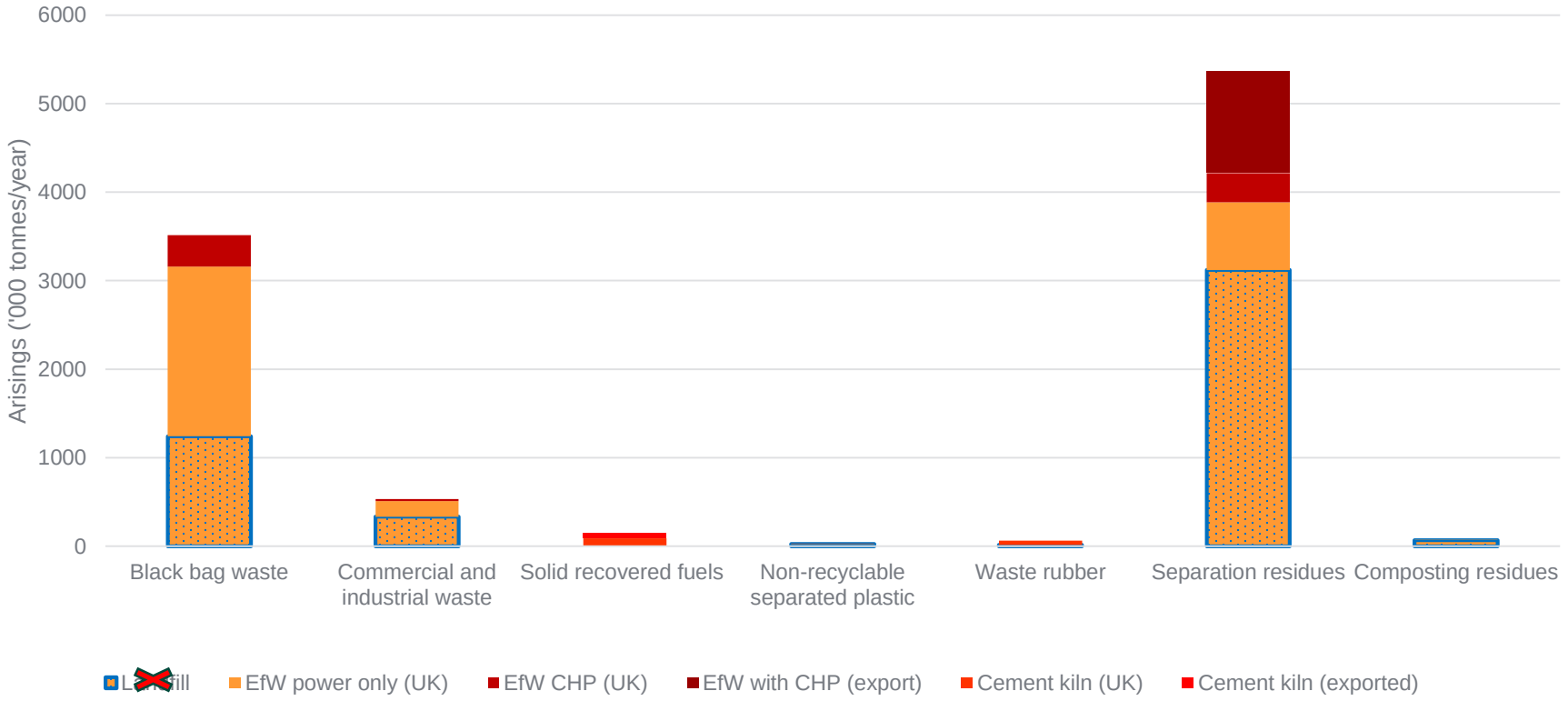
Overview of uses



If we assume that all landfilled waste goes into electricity generation…

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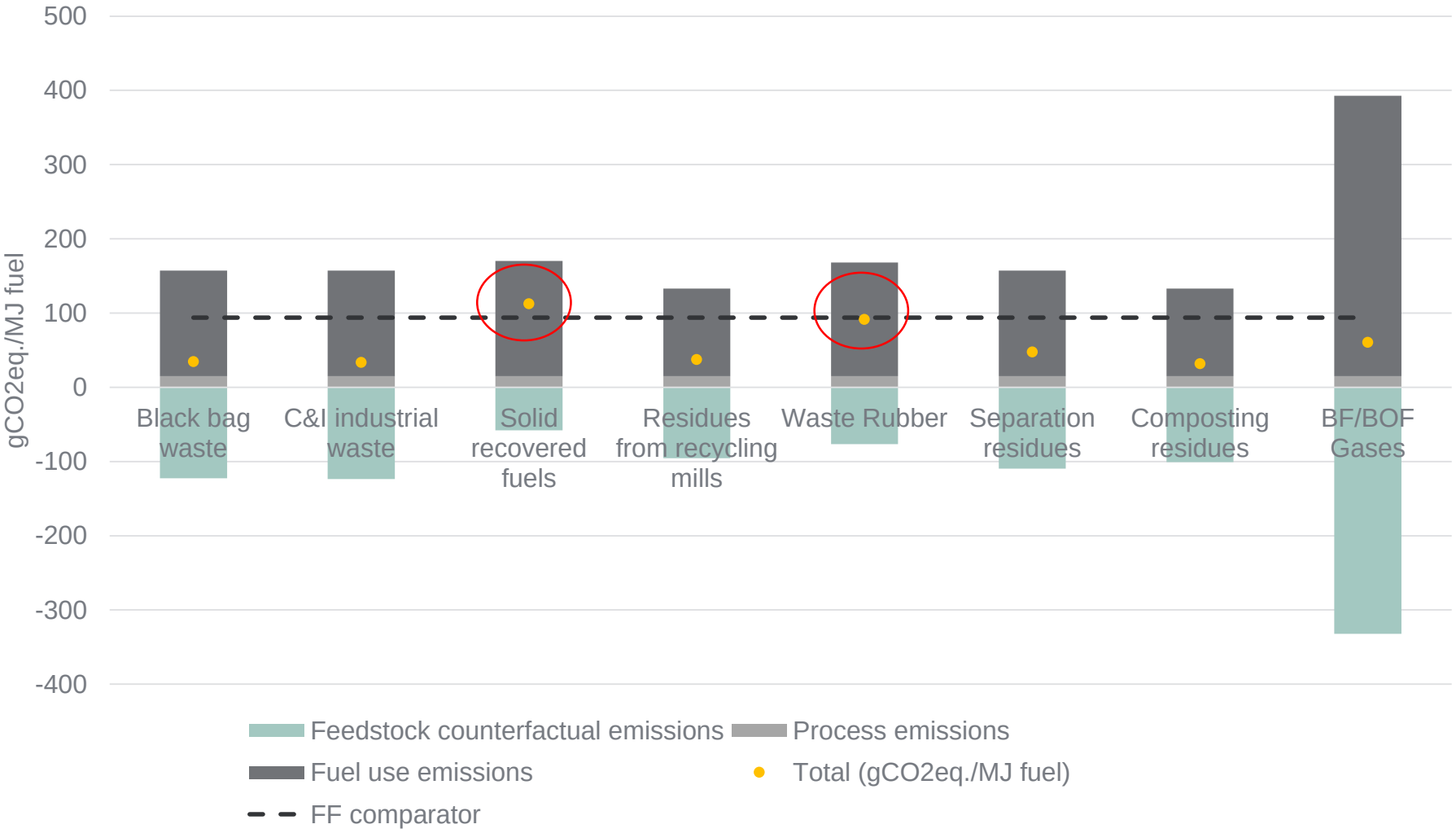
Remodelled: On a per-MJ basis



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SRF and tyres?

- **SRF**- can be produced by sorting waste- elastic
  - If demand increases= supply increases
  - Vast quantities of material coming from landfill- more than enough SRF to meet demand for heat

- Study showed a relatively large proportion of tyres used in cement kilns for heat
- Will be replaced with a mix of feedstocks, potentially including coal

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Group Discussion: The counterfactual

- Should it be a specific counterfactual or average approach like shown in the study?
  - Solid wastes
  - Gaseous wastes
- How might this change over time?

- Solid wastes: How should landfill be treated? Do you agree that EfW (power only) is a suitable alternative to landfill?

- Will there be displacement of LCFF feedstocks from heat? Could we use more LCFF for heat?

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Quick Break

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Understanding Risk

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Support

- What if we supported all LCFF at the same level?
  - Per Litre?
  - Per kg CO2 eq. mitigated?
- We have explored potential GHG emission savings but what about production costs? “Low hanging fruit?”
- **We need to understand risks of either choice and what to support and how.**

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Understanding Risk

- How to ensure that LCFFs lead to a GHG emission saving?
- Do LCFFs offer enough of a GHG saving?
- Where do these GHG emission savings occur?
- How to restrict recycled materials ending up in fuel?

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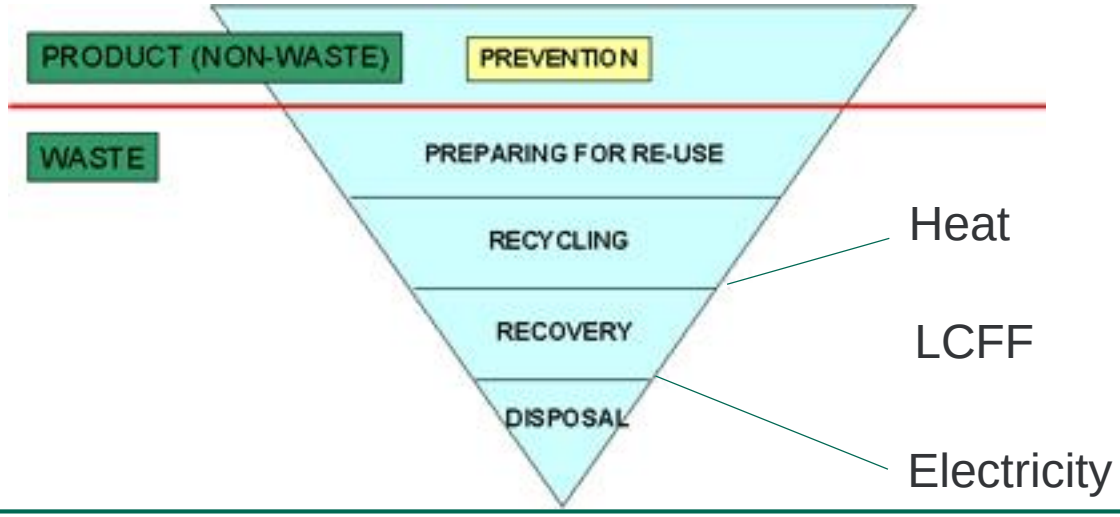
How to ensure that LCFF lead to a GHG emission saving?

- We need to ensure that LCFFs offer a more efficient outcome than counterfactual use

- The LCFF GHG methodology could include some efficiency comparison to ensure that only LCFF technologies that are greater than counterfactual can meet sustainability criteria

- Is this enough to ensure GHG emission savings?



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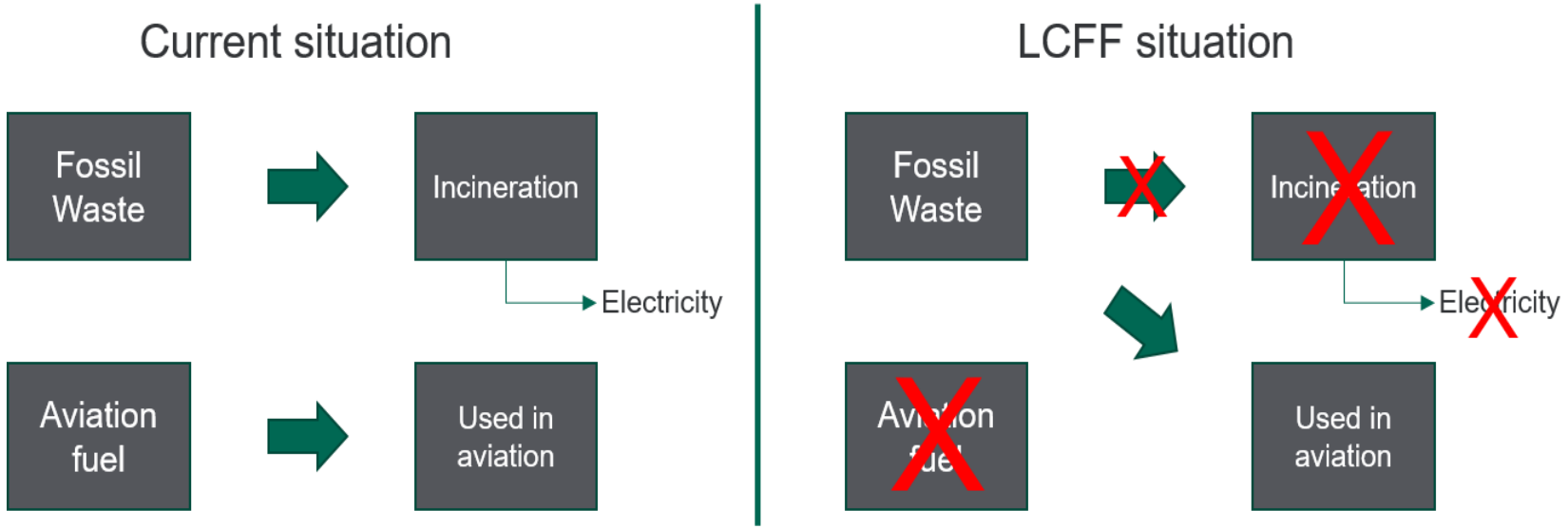
Is it enough of a GHG saving?

- GHG emissions from producing LCFF higher than disposing of waste
- But due to higher efficiency you get more “energy” out of the system



X = avoided GHG emission

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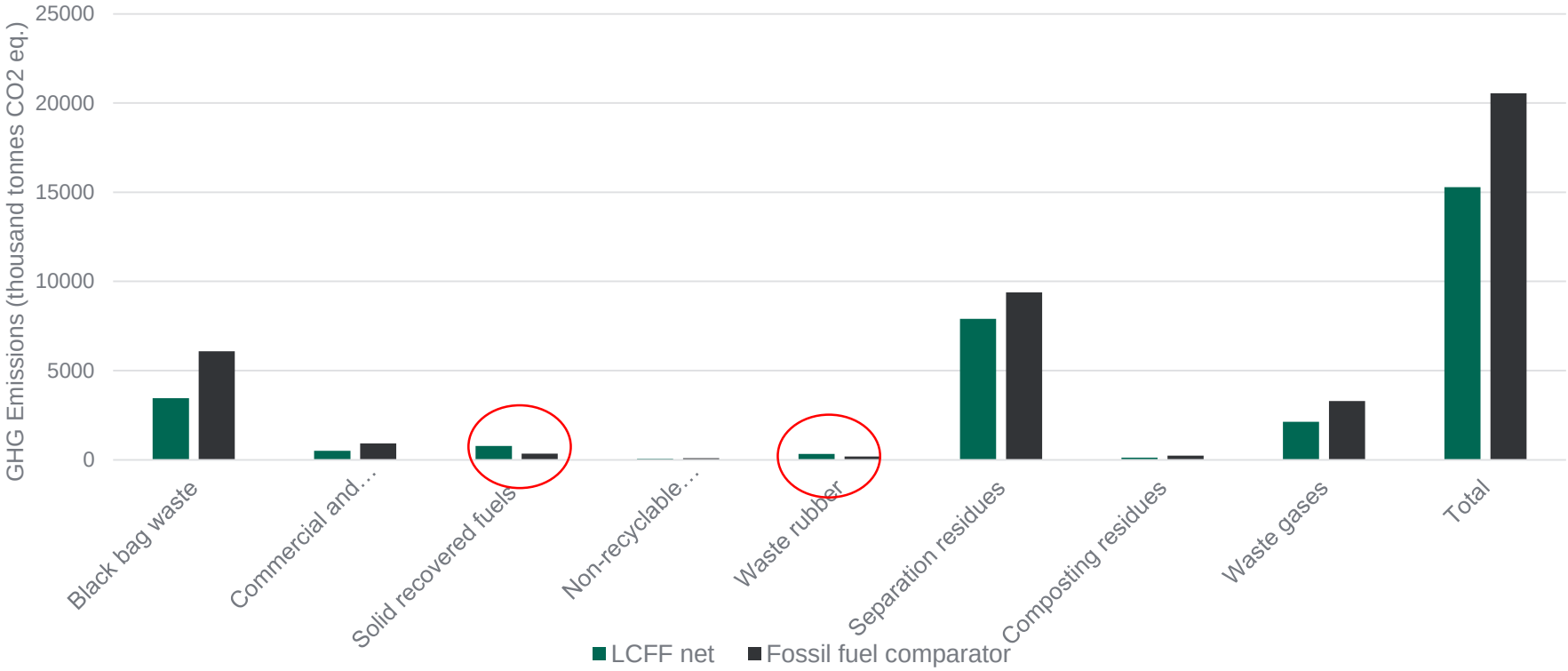
Is it enough of a GHG saving?



- Looks like GHG emission savings are possible
- Not for SRF and waste rubber (they are usually used for heat in cement kilns)
- There *could* be additional avoided methane emissions- look even better

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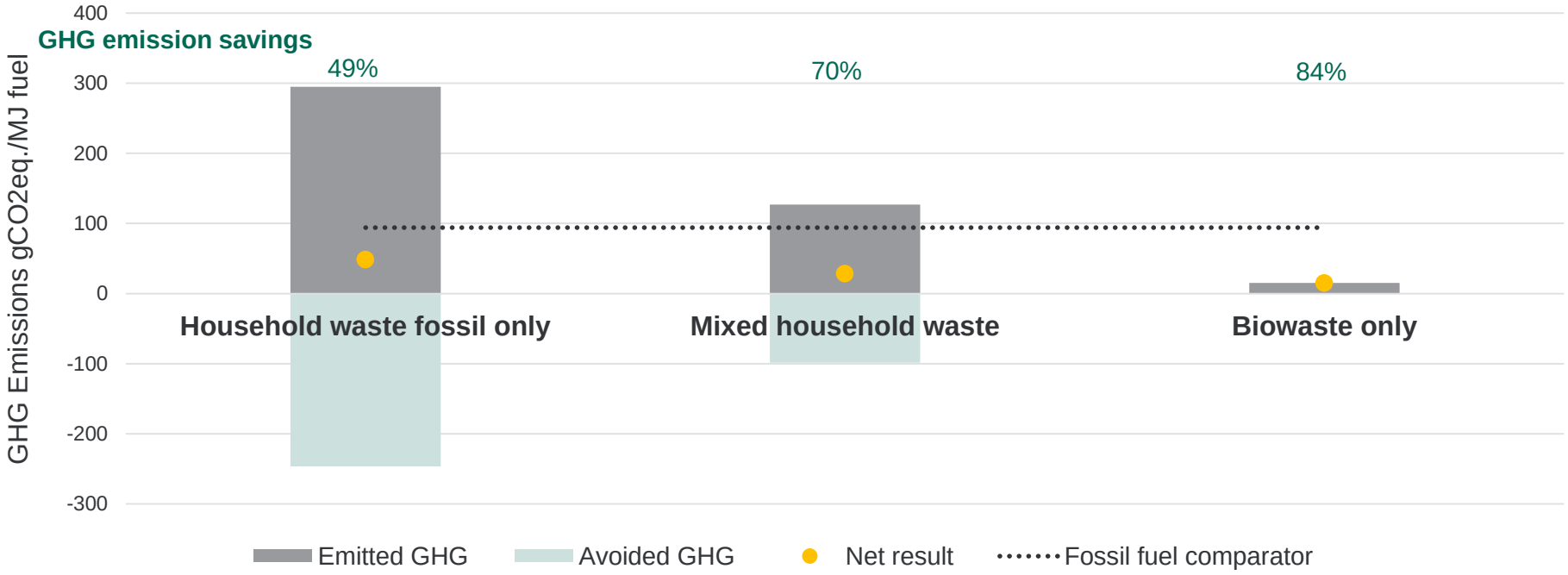
Mixed Wastes Only?



Based on estimated figures, assume 60% bio component (RTFO).

Will a mixed waste requirement help ensure GHG emission savings are delivered?

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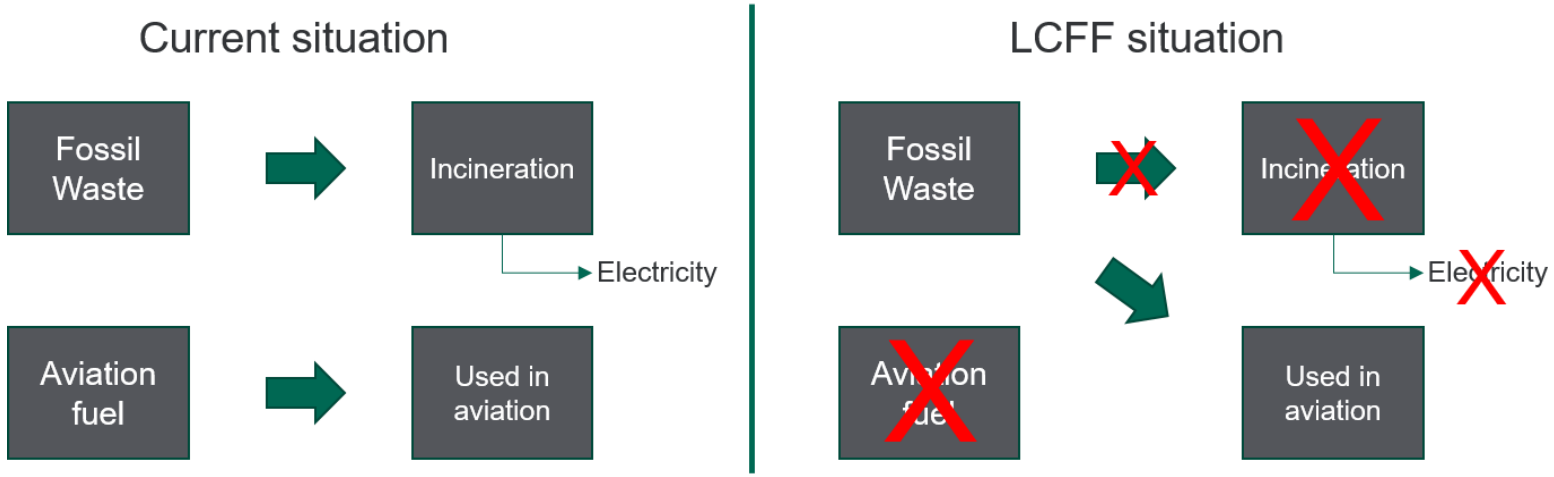
Where do the GHG savings occur?

- If we compare the ‘current’ situation with the ‘LCFF situation’ the GHG emissions are saved in the electricity or waste sectors
- (the country of origin)
- What does this mean if we import LCFFs?
- Can we have a UK-only waste policy?



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How to stop recycled materials ending up fuel?

- There are several recognised ‘recyclable’ plastics
  - GHG benefits of recycling outweigh those from LCFF
- Clear and NIR detectable plastics such as
  - Polypropylene, HDPE, LDPE, PET
- It will be expected that LCFF feedstocks have been sorted prior the fuel conversion process in order to remove the recyclable plastic material content.
- Waste sorting is not 100% efficient.

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How to stop recycled materials ending up fuel?

- Set a permissible content of recycled materials according to separation efficiency of NIR sorting?
- With NIR, a value of above 90% is considered to be very good, between 80-90% is good, between 70-80% is acceptable, whilst below 70% indicates a poor separation.
- The separation efficiency may differ across plastic categories, and whether hand sorting is also used.
- This should be based on best practice – with or without hand sorting?
- **Should we set this as an acceptable level of sorting?**

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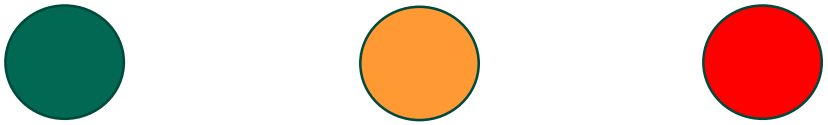
Sticker Time

- Got tables on each table
- Issue
- Option
- Risk Rating
  - Option will lead to increased GHG emissions from LCFFs
  - Option will see zero solid waste LCFF projects coming forward
  - Option will see zero gaseous waste LCFF projects coming forward



  - Or- not a concern?
  - Why?

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Next steps

Moving Britain Ahead

June 2019

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Next steps

- Refine policy for consultation as part of wider RTFO changes
- Scope
  - Consider low carbon fossil fuels
  - Transpose/maintain alignment with RED2
  - Review RFNBOs/hydrogen

- Implementation now likely to be in 2021
- Consultation in summer 2020

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Thank you!

- Thank you for coming today
- Any questions or follow up conversations contact Carly
- carly.whittaker@dft.gov.uk