# *GHG calculation methodologies*
# *The UK approach for the RTFO*


GBEP Taskforce meeting

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# *Two pieces of carbon reporting data are required in the monthly C&S reports from fuel suppliers*

| General Information | | | | | | Sustainability Information | | | | Carbon Information | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Batch number | Internal Batch number (optional) | Fuel type | Quantity of fuel (litres) | Biofuel Feedstock | Feedstock Origin | Standard | Env Level | Social Level | Land use on 30 Nov 2005 | Carbon intensity incl LUC g $CO_2e$ / MJ | Accuracy level |
| 33006 | | Biodiesel | 800,00 | | | | | | Cropland | 55 | 2 |
| 33008 | | Biodiesel | 100,00 | | | | | QS | Cropland | 45 | 2 |
| 33009 | | Biodiesel | 100,00 | | | | | | unknown | 177 | 2 |

| Carbon Information | |
|---|---|
| Carbon intensity incl LUC g $CO_2e$ / MJ | Accuracy level |
| 55 | 2 |
| 45 | 2 |
| 177 | 2 |

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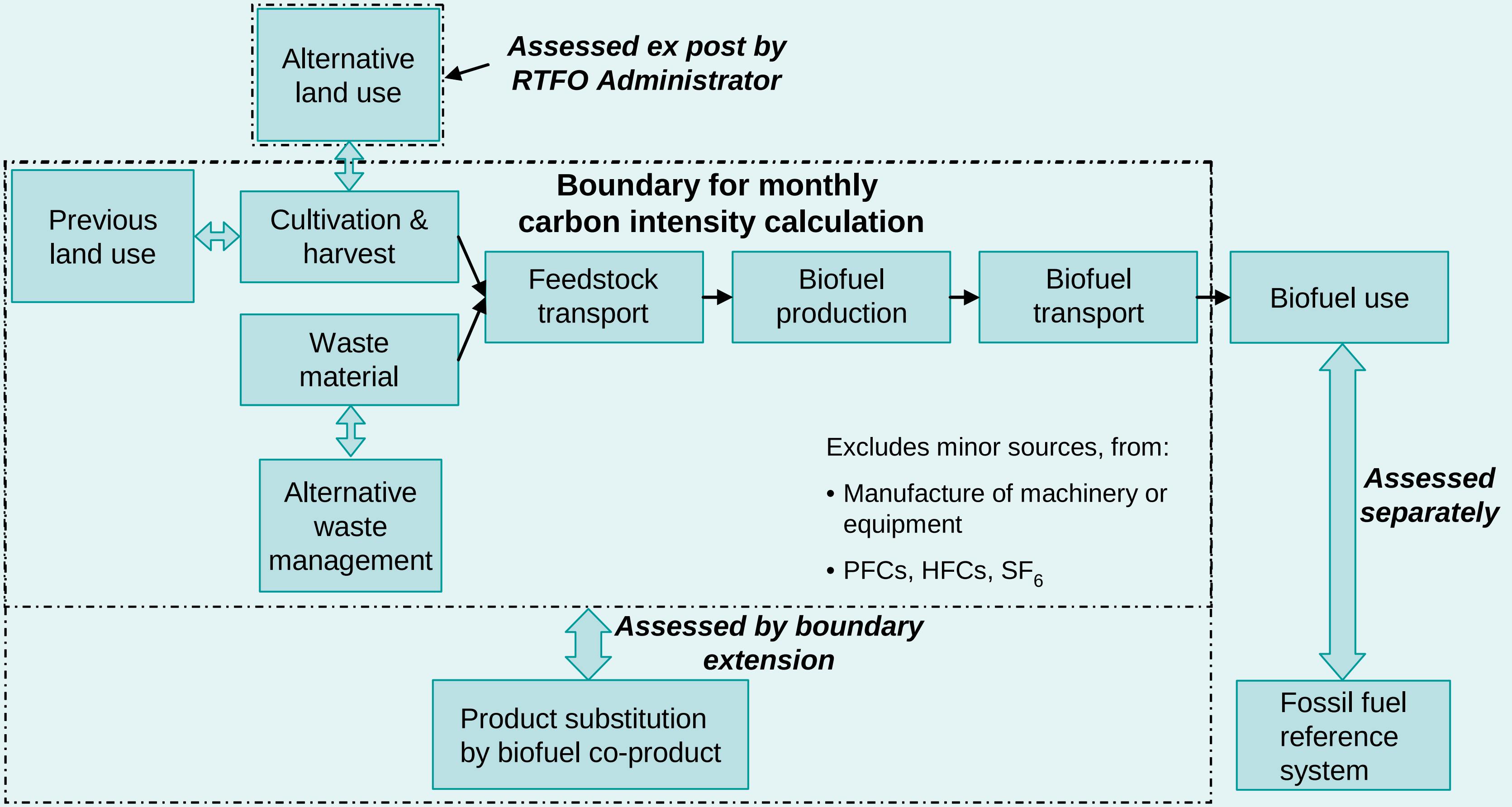
# Carbon Intensity calculation boundaries



# *Calculation method – fuel chains*

- Ethanol from:
  - sugar cane (Br, Moz, Pak, SA)
  - sugar beet (UK)
  - Molasses (Pak, SA, UK)
  - Wheat (Can, Fr, Ger, Ukr, UK)
  - Corn (Fr, USA)
  - Ethanol converted to ETBE
  - Biomethane from anaerobic digestion of MSW
- FAME biodiesel from:
  - Tallow (UK)
  - used cooking oil (UK)
  - palm oil (My, Ind)
  - Soy (Arg, Bra, USA)
  - Rapeseed (Aus, Can, Fin, Fr, Ger, Pol, Ukr, UK)
- HVO biodiesel from palm oil, soy and rapeseed

## *Calculation method – Reference Systems*

- Alternative Waste Management
  - Default values set to zero
  - Companies that can demonstrate alternative waste management may claim credits
  - Renewable Fuels Agency has to approve a new waste

- Previous land use (or Direct land-use changes) reference date 31 Nov 05
  - Only applies to changes from forest or permanent grassland
  - No account of alternative land-use for existing agricultural systems
  - Land use in November 2005
  - Applies IPCC Tier 1 factors
  - Option to use Tier II / III systems

- Alternative land use
  - Used to determine emissions that would have occurred had the land been used for an alternative
  - Not covered within boundaries
  - Can be assessed ex-post

- Indirect land-use change (same as alternative land use)
  - Calculated by Administrator
  - Not part of company reporting

- Fossil fuel reference system
  - Based on Concawe/EUcar/JRC
  - Modifications to ensure consistent boundaries

## *Co-products are dealt with in a flexible way – system expansion preferred in RTFO*

| Co-product | Fuel chains applicable to | End use | Substituted product | Treatment |
|---|---|---|---|---|
| Palm kernel olein | Palm to biodiesel | Wide range | Wide range | Market value |
| Palm kernel stearin | Palm to biodiesel | Wide range | Wide range | Market value |
| POME | Palm to biodiesel | Fertiliser | Other fertilisers | Within system boundaries |
| DDGS/WDGS | Wheat, corn to bioethanol | Animal feed | Soy meal | System expansion |
| Rape meal | Oilseed rape to biodiesel | Animal feed | Soy meal | System expansion |
| Soy meal | Soy to biodiesel | Animal feed | Feed wheat | System expansion |
| Palm stearin | Palm to biodiesel | Wide range | Wide range | Market value |
| Electricity | All | Marginal baseload elec | e.g. coal, nat gas | System expansion |
| Chemicals (glycerine) | Several | Wide range | Wide range | Market value |

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# *Default values – Data sets and N20 emissions*

- International data sets are used to set single default values (e.g. IEA for emissions factors)
  - Consistent approach but some stakeholders concerned e.g. methane emissions from pipelines not included.

- $N_2O$ emissions from soil for all crops are, by default, calculated on the basis of the amount of nitrogen fertiliser applied to the soil – using a co-efficient developed by the IPCC for the purposes of national GHG inventories:

$$N_2O \text{ emissions} = 1.325\% \times \text{N fertiliser}$$

- This approach does not take into account the nitrogen in crop residues.
- More advanced approaches to calculating $N_2O$ emissions would be allowed, provided they are consistent with IPCC guidelines on "Tier 3" approaches
- Based on comparisons with emissions measured from fields, the default approach would appear to significantly underestimate the $N_2O$ emissions arising from soya beans (e.g. by 40 – 50%). This is due to the exclusion of crop residues from the methodology.
- Soy beans treated as an exception in the methodology – crop residues included.

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## *The magnitude of the default values has important implications for the effectiveness of the policy and the cost of compliance*

- **If default values are set too low:**
  - Little incentive to report => no differentiation between chains
  - Underestimate carbon intensity (risk to industry and Govt)
  - Uncertain carbon savings from policy

- **If default values are too high:**
  - Incentive to report, but potentially high compliance costs
  - Overestimate carbon intensity => negative public perception

- **From a policy perspective, default values should be set on the conservative side**

- **From a practical point of view, the magnitude of the default values could depend on**
  - the contribution of the source to the overall carbon intensity
  - the ease of reporting actual data

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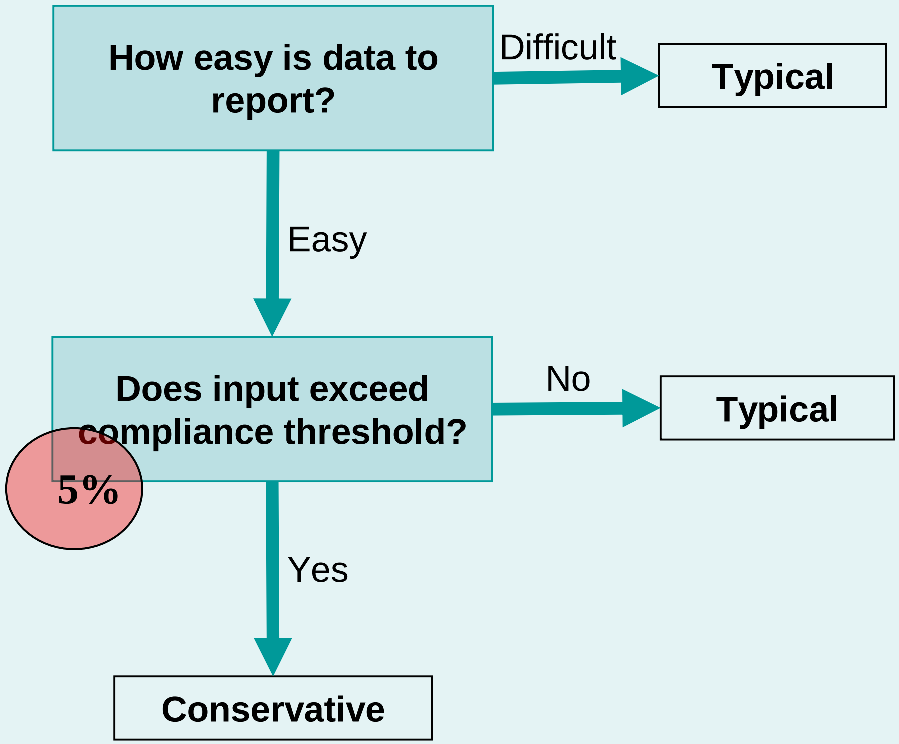
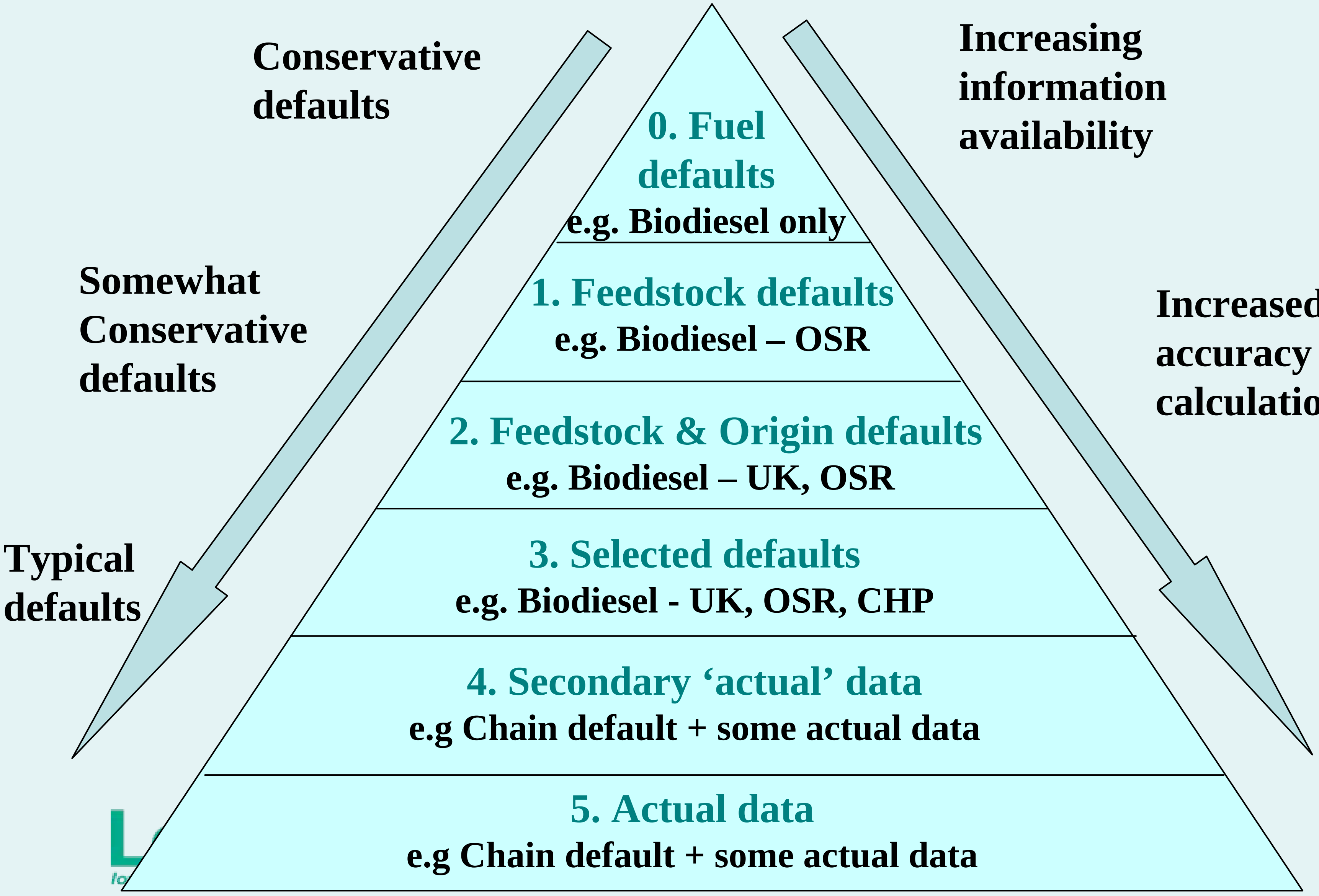
# *How do you decide on what magnitude to set single default values at?*

- Define worst possible, typical and best practice




- In practice for all chains: default values upstream of biofuel producer set at **typical** level

# The result is a practical and flexible approach that encourages the supply of more information



# *LUC emissions are estimated using the 2006 IPCC Guidelines*

**Methodology for calculating emissions from LUC is based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (www.ipcc.ch)**

**Four types of LUC to Cropland are considered and need to be reported**

- Forest land
- Grassland with agricultural use
- Grassland without agricultural use

Cropland

Scientific evidence to calculate wetlands not available

**Default values available based on:**

- Land use in 2005
- Type of biofuel cropland (annual or perennial)
- Country in which land use change has occurred

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# *Land use change assumptions*

- For calculating changes in carbon stock in biomass (above ground) it is assumed:
  - Carbon stock immediately after LU conversion is zero
  - All biomass carbon is lost when annual crops harvested – but none when perennials harvested

- For calculating changes in carbon stocks in dead organic matter
  - Amount of dead wood/litter [carbon] stock under the old land use category is equal to average of the 3 IPCC default values given for each climate zone
  - The amount of dead wood/litter carbon stock for the new land use is zero

- For changes in carbon stocks in soil it is assumed that:
  - Default is mineral soils (except Indonesia)
  - Stock change factors for management regime and carbon input before and after land use = 1. Stock factor for land use system before the change was also assumed to be 1.

# *Comparison of key methodological issues (i)*

| | UK | EC | Germany | Netherlands |
|---|---|---|---|---|
| **Fuel chains** | Biofuels | Biofuels and biomass to electricity | Biofuels (also considering biomass to electricity) | Biofuels and biomass to electricity |
| **Metric** | $gCO_2$ eq / MJ | $gCO_2$ eq / MJ | k $gCO_2$ eq / G J | $gCO_2$ eq / MJ |
| **WTW wheel system boundaries** | Full well to wheel approach with only minor emissions from machinery manufacturing & maintenance excluded | Full well to wheel approach with only minor emissions from machinery manufacturing & maintenance exclude d | Full well to wheel approach with only minor emissions fr om machinery manufacturing & maintenance excluded | Full well to wheel approach with only minor emissions from machinery manufacturing & maintenance excluded |
| **Reference residue / waste management** | Assume zero default with option to prove otherwise (e.g. credi t for avoided landfill) | Assume zero default | Assume zero default with ***no*** option to demonstrate actual numbers | Same approach as UK but biomethane may have a value |

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# *Comparison of key methodological issues (ii)*

| | UK | EC | Germany | Netherlands |
|---|---|---|---|---|
| **Annualised emission period** | 20 years | 20 years | 20 years | 20 years |
| **Indirect land-use change (incl displacement, crop rotation etc)** | Not included in WTW (ex-post facto analysis) | Not included in WTW | Not included in WTW | Not included in WTW |
| **Co-product treatment** | Substitution (system expansion) for majority<br>Market value where substitution and energy not applicable | Allocation by energy content (LHV) | Allocation by energy content (LHV) | Substitution in theory<br>In practice almost all market value |
| **Fossil reference** | JRC<br>Petrol – 84.8g$CO_{2eq}$/MJ<br>Diesel – 86.4g$CO_{2eq}$ /MJ | Average emissions reported in Fuel Quality Directive OR 83.8 g$CO_{2eq}$ /MJ | JRC<br>Petrol – 85kg$CO_{2eq}$/GJ<br>Diesel – 86.2kg$CO_{2eq}$/GJ | JRC |

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# *Key issues and conclusions*

Added value from a GBEP process:

- Agree high level principles as demonstrated in earlier slide – many similarities in Europe already e.g. boundaries, metric
- Spend time on:
- Engaging developing countries – programme of activities needed
- Co-product treatment – explore potential for agreement on substitution i.e the substituted products and the relevant credits
  - Significant implications for other national schemes – need to engage with them
- Developing harmonisation and unity on other key issues
  - Land use change (direct) – agree the key assumptions based on IPCC guidelines
  - Indirect land use change – how?
  - N20 emissions – emissions from soy – can a Tier 1 approach work?;
- Development of process to improve international data sets
  - N20 emissions – Tier 3 to be better defined
  - IEA data – emissions factors modifications

**Engage IPCC**

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# Any Questions?

**Methodology Document**
**Technical Guidance**
**..soon..**
**The carbon calculator**

**Available from The Renewable Fuels Agency**

**[www.dft.gov.uk/rfa](www.dft.gov.uk/rfa)**
**rfa.info@dft.gsi.gov.uk**
**020 7944 8555**



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# Spare slides

| | | UK[1] Range represents different Countries and conversion processes | EC[1] Range represents different conversion processes | Germany (without land use change in brackets) |
|---|---|---|---|---|
| ***Fuel*** | ***Feedstock*** | | | |
| Ethanol | Wheat | -22% to 30% | 0% to 67% | 1% (32%) |
| | Sugar cane | -36% to 71% | 74% | -120 (67%) |
| | Sugar beet | 41% | 35% | 1% (19%) |
| | Molasses | -10% to 53% | - | - |
| | Corn | -28% to 42% | 49% | 20% (43%) |
| | | | | |
| Biodiesel ME | Oilseed rape | 17% to 36% | 36% | 9% (47%) |
| | Soy | 10% to 45% | * | -274% (62%) |
| | Palm | 48% | 16% to 51% | -61% (70%) |
| | UCO & tallow | 85% | 77% | - |
| | | | | |
| Biomethane | MSW & manure | 42% | 75% to 85% | |
| | | | | |
| Biodiesel HVO | Oilseed rape | 9% to 44% | 45% | 6% (44%) |
| | Soy | 1% to 40% | * | -281% (60%) |
| | Palm | 43% | 24% to 60% | -66% (67%) |

[1] represents conservative rather than typical defaults

* the Commission agree with the UK that the approach to N20 emissions for soy should be readdressed but they propose this is done so through comitology.

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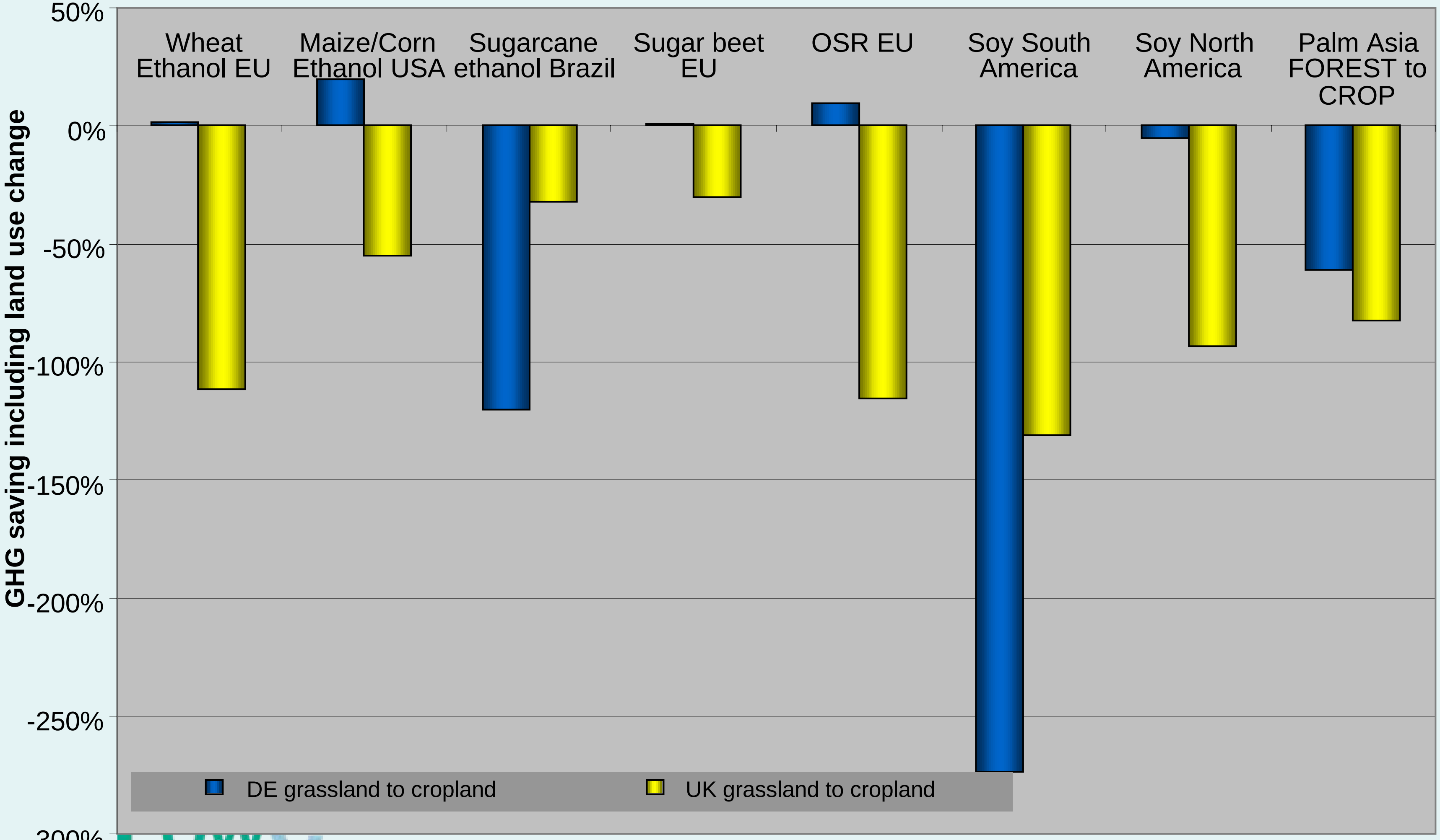
# Using different assumptions based on IPCC guidelines yields different results

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## *UK has also developed a carbon calculator software tool*

- All default values in Technical Guidance will be in tool
- The tool will be desktop-based – downloadable from www.dft.gov.uk/rfa shortly, but will automatically update when defaults change
- Will be possible to customise to enable more efficient use by different actors (e.g. oilseed crusher, commodity trader)
- Will record evidence for verification purposes
- Freely available (owned by UK Government)