

# DfT Advanced Fuels Fund – GHG emissions

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E4tech briefing pack

25 August 2022

# General overview of GHG emissions assessment

- Bidders will be filling in Appendix H - an Excel workbook, detailing the supply chain GHG emissions for their main fuel (jet, avgas or diesel).
- This briefing pack is designed to:
  - Highlight feedstock and hydrogen eligibility rules
  - Run through the GHG emissions methodology and emissions threshold.
  - Explain the GHG emissions system boundary.
  - Explain how to report your findings in the AFF application form.
  - Flag common errors and answer likely questions.
- Further questions can be submitted to [AFF@ricardo.com](mailto:AFF@ricardo.com), provided these are regarding eligibility or categorisation enquiries, “how” to conduct the assessment and where to find RTFO guidance, or if the AFF instructions provided are unclear.
- In the interests of treating each bidder equally, we are not able to review your workbooks before submission.

## Eligible/ineligible feedstocks, and requirements for hydrogen use

- Biogenic feedstocks must be double-counting wastes/residues and should have the potential to qualify as a RTFO “development fuel”. The use of segregated oils & fats, such as Used Cooking Oil or tallow, is **not** permitted.
- The only fossil wastes eligible as recycled carbon fuel (RCF) feedstocks for the AFF’s first application window are the fossil fraction of Refuse Derived Fuel (either brought in or converted to RDF onsite), and waste fossil industrial gases. Other fossil wastes such as waste lubricant oils, scrap tyres or MSW that does not undergo separation/recycling are **not** eligible.
- Any waste biogenic or RCF feedstock must also demonstrate compliance with the definition of a waste (intent to discard, no mixing to make a waste, no increased output) **and** with the waste hierarchy (feedstock could not be prevented, reused or recycled, and could only be disposed of or used for energy recovery).
- Renewable fuels of non-biological origin (RFNBOs) must meet RTFO CO<sub>2</sub> sourcing rules, as must nuclear energy derived fuels. RFNBO or nuclear energy sources do not have to meet RTFO additionality requirements for the first AFF application window.
- RTFO rules are used to determine fuel shares where there are multiple consignments. All consignments must be eligible, e.g. partial RFNBOs are only eligible if the non-RFNBO fraction is also eligible (i.e. an eligible biofuel, RCF or nuclear energy derived fuel).
- AFF funded hydrogen production, or hydrogen purchases >5% (by LHV energy content) of the total fuel output, must evidence how the UK Low Carbon Hydrogen Standard is likely to be met for this hydrogen in the first full year of fuel plant operations.
- Hydrogen production/purchases derived from fossil fuels must be ≤5% (by LHV energy content) of the total fuel output in any year.

# Choice of GHG methodology and emissions threshold depends on the consignment

Consignment type	GHG emissions methodology	Threshold for FOAK commercial plant in first full year of operation
<b>Biofuel</b>	<a href="#">RTFO compliance guidance</a>	$\leq 31 \text{ gCO}_2\text{e/MJ}_{\text{LHV}}$
<b>Renewable fuel of non-biological origin (RFNBO)</b>	<a href="#">RTFO compliance guidance</a> , including extra RFNBO guidance	$\leq 31 \text{ gCO}_2\text{e/MJ}_{\text{LHV}}$
<b>Nuclear energy</b>	RFNBO method, adding uranium ore to nuclear power/heat generation emissions	$\leq 31 \text{ gCO}_2\text{e/MJ}_{\text{LHV}}$
<b>Recycled Carbon Fuel (RCF)</b>	AFF Guidance document Appendix E (equivalent to biofuel method, including counterfactual emissions but no CCU)	See AFF Guidance document Appendix E for the threshold trajectory

- Proposed demonstration plants do not have to meet the threshold but must evidence their emissions in the first full year of operations (using Appendix H), **and** provide clear and credible evidence how a future FOAK commercial plant will meet this threshold in its first full year of operations (using a separate version of Appendix H).
- If the main fuel is a mix of different consignments (e.g. part biofuel, part RCF), **separate GHG calculations are required for each consignment** following the relevant methodologies above. Separate GHG calculations are also needed for different feedstocks, as by definition these result in separate fuel consignments (e.g. biojet from forestry residues & biojet from straw).
- All GHG calculations should be split into supply chain components (as per your system boundary and supply chain diagram).

# Further details for Recycled Carbon Fuels

- Guidance document Appendix E gives the GHG methodology to be used for RCFs in the AFF. This is aligned with the preferred positions set out in the 2022 [RCF Consultation](#), except a slightly lower jet fossil fuel comparator ( $89\text{gCO}_2\text{e}/\text{MJ}_{\text{LHV}}$ ) was used for deriving the AFF RCF emissions threshold. *NB: meeting AFF RCF rules is no guarantee final RTFO or SAF mandate rules will be met.*
- The RCF methodology broadly follows the RTFO waste biofuels methodology, except CCU credits are not allowed, and instead of zero emissions up to the point of feedstock collection, waste fossil feedstocks are given the displaced emissions from their diversion to fuels from a counterfactual use. AFF's default counterfactual is **power generation at 22% net electrical efficiency (no CHP or CCS)**, with the emissions from additional grid electricity generation in the relevant year (and country) given to the feedstock.
- RCFs from waste fossil industrial gases can evidence alternative counterfactuals, but in all cases need to demonstrate that heat generation is not displaced by RCF production (otherwise heat generation will be the counterfactual). The industry site also needs to evidence they are not claiming reduced emissions due to the new use of the waste gases (similar to RFNBO CO<sub>2</sub> sourcing rules).

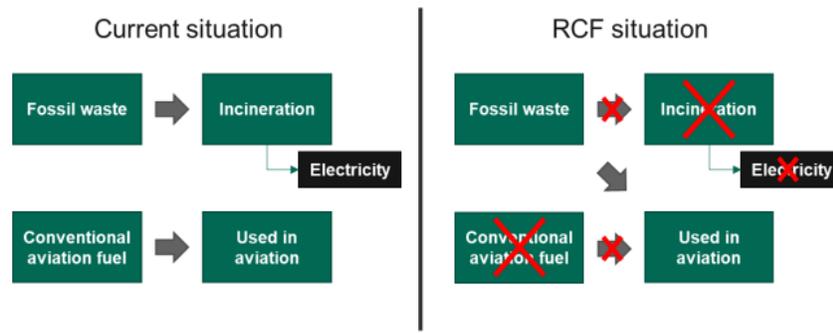
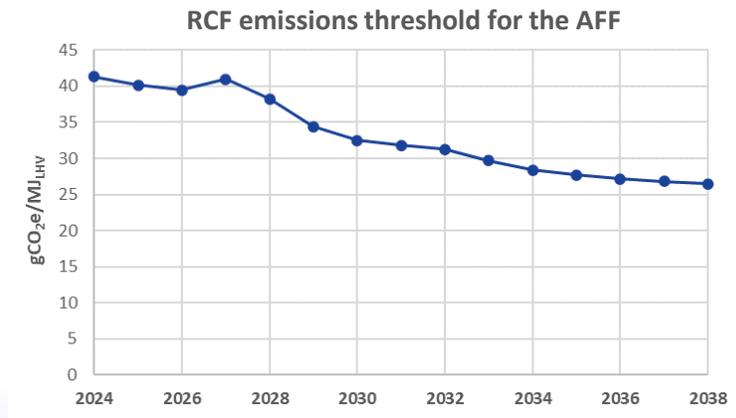


Figure 3 Simplified description of the GHG assessment methodology used to assess RCFs.



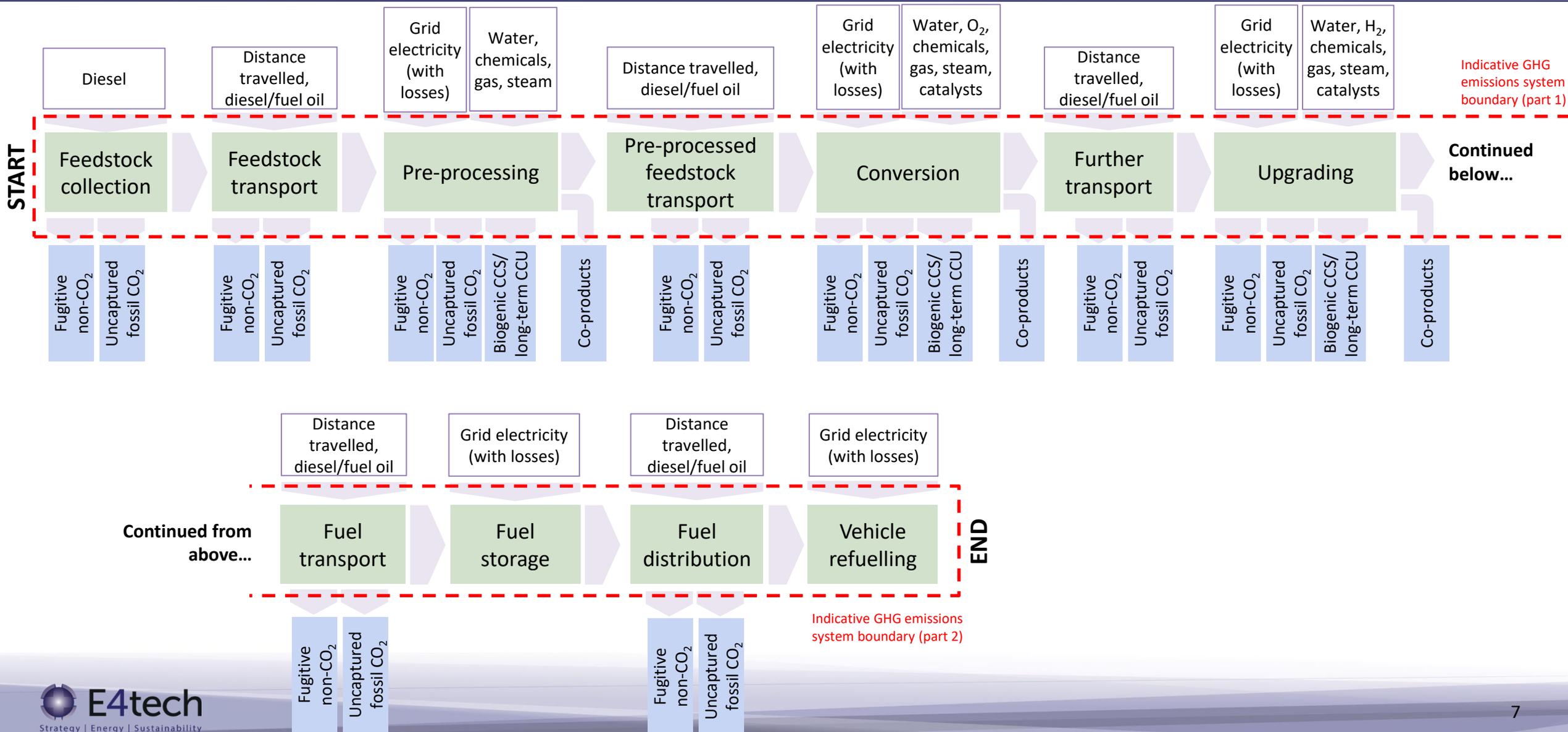
# The system boundary and scope of your supply chain also depends on the consignment

- The bidder needs to decide and provide (in diagram format) the system boundary used for the GHG emissions calculation.
- The start and end of the supply chain considered must follow the instructions below:

Consignment type	First step of supply chain	Last step of supply chain
Biofuel	Waste/residue collection	Vehicle refuelling
Renewable fuel of non-biological origin (RFNBO)	Renewable power/heat generation	Vehicle refuelling
Nuclear energy	Uranium ore extraction	Vehicle refuelling
Recycled Carbon Fuel (RCF)	Feedstock counterfactual emissions, then waste collection	Vehicle refuelling

- Various choices can be made about the breadth of the system boundary when e.g. there are supporting processes at/near the pre-processing/conversion/upgrading plants (e.g. CHP units). You should make your choices clear in your submitted diagram about what processes are within or outside of the system boundary.
- The information you provide in the Excel spreadsheet (Appendix H) should be the **flow rates and emissions intensities** of any inputs crossing your system boundary, and the **flow rates, LHV energy contents and categorisation** (product/coproduct/residue/waste) of any outputs crossing your system boundary. Appendix H is not looking at any internal loops that do not cross the system boundary.

# Example system boundary and supply chain for a generic biofuel consignment



# Reporting findings in the application form (Questions 3.4.1 & 2.2.2)

Demonstration plant, if applicable:

- consignment #1: GHG emissions in year X =  $gCO_2e/MJ_{LHV}$
- consignment #2: GHG emissions in year X =  $gCO_2e/MJ_{LHV}$
- consignment #3: GHG emissions in year X =  $gCO_2e/MJ_{LHV}$

Supply chain module	Module efficiency (MJ <sub>LHV</sub> main output / MJ <sub>LHV</sub> main input)	Cumulative backward chain efficiency (MJ module main output / MJ final fuel)	GHG emissions from module (gCO <sub>2</sub> e/MJ <sub>LHV</sub> module main output), WITHOUT allocation	GHG emissions from module (gCO <sub>2</sub> e/MJ <sub>LHV</sub> final fuel), WITHOUT allocation	Allocation of GHG emissions to main output of each module	Cumulative backward chain allocation of GHG emissions	GHG emissions from module (gCO <sub>2</sub> e/MJ <sub>LHV</sub> final fuel), WITH allocation	
Not used	NA	NA	NA	NA	NA	NA	NA	
Feedst								
Feedst								
Pre-pr								
Interm								
Conve	Not used	NA	NA	NA	NA	NA	NA	
Furthe	Not used	NA	NA	NA	NA	NA	NA	
Upgrad								
Fuel di								
Fuel di								
Refuel								
Further t	Not used	NA	NA	NA	NA	NA	NA	
Total c								
Advanc								
Upgradin	Feedstock collection	99%	3.74	1.1	4.1	100%	65%	2.7
Fuel distr	Feedstock transport	100%	3.74	1.4	5.4	100%	65%	3.5
Fuel distr	Pre-processing	79%	2.95	4.7	13.8	100%	65%	9.0
Fuel distr	Intermediate transport	100%	2.95	2.0	5.8	100%	65%	3.8
Refuellin	Conversion	46%	1.36	-9.5	-12.8	88%	65%	-8.4
Further tra	Further transport	100%	1.36	0.9	1.2	100%	75%	0.9
Advanc	Upgrading	74%	1.00	4.9	4.9	75%	75%	3.7
Fuel distrib	Fuel distribution 1	100%	1.00	2.3	2.3	100%	100%	2.3
Fuel storag	Fuel storage	100%	1.00	1.5	1.5	100%	100%	1.5
Fuel distrib	Fuel distribution 2	100%	1.00	2.3	2.3	100%	100%	2.3
Refuellin	Refuelling	100%	1.00	1.4	1.4	100%	100%	1.4
Total chain								22.7
Advanced Fuels Fund threshold		26%						31.0

FOAK commercial plant:

- consignment #1: GHG emissions in year Y =  $gCO_2e/MJ_{LHV}$
- consignment #2: GHG emissions in year Y =  $gCO_2e/MJ_{LHV}$
- consignment #3: GHG emissions in year Y =  $gCO_2e/MJ_{LHV}$

Supply chain module	Module efficiency (MJ <sub>LHV</sub> main output / MJ <sub>LHV</sub> main input)	Cumulative backward chain efficiency (MJ module main output / MJ final fuel)	GHG emissions from module (gCO <sub>2</sub> e/MJ <sub>LHV</sub> module main output), WITHOUT allocation	GHG emissions from module (gCO <sub>2</sub> e/MJ <sub>LHV</sub> final fuel), WITHOUT allocation	Allocation of GHG emissions to main output of each module	Cumulative backward chain allocation of GHG emissions	GHG emissions from module (gCO <sub>2</sub> e/MJ <sub>LHV</sub> final fuel), WITH allocation	
Not used	NA	NA	NA	NA	NA	NA	NA	
Feedst								
Feedst								
Pre-pr								
Interm								
Conve	Not used	NA	NA	NA	NA	NA	NA	
Furthe	Not used	NA	NA	NA	NA	NA	NA	
Upgrad								
Fuel di								
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Further t	Not used	NA	NA	NA	NA	NA	NA	
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Fuel distrib	Fuel distribution 2	100%	1.00	2.3	2.3	100%	100%	2.3
Refuellin	Refuelling	100%	1.00	1.4	1.4	100%	100%	1.4
Total chain								22.7
Advanced Fuels Fund threshold		26%						31.0

# Common errors from prior DfT competition GHG assessments, and recommendations

- GHG emissions were only reported for the biogenic fuel consignment, with GHG emissions for the non-biogenic consignments often missing. **Report each consignment separately.**
- Non-approved GHG methodologies were used to calculate emissions. **Use the Excel template (Appendix H), and if in doubt about which methodology to employ, i.e. which consignment type(s) apply to your fuel, ask [AFF@ricardo.com](mailto:AFF@ricardo.com)**
- Inappropriate proxy values from sources other than approved RTFO default values were used for some stages of the supply chain. **Use RTFO approved or recommended datasets given in Appendix H.**
- Several stages of the supply chain were frequently missing, e.g. no GHG emissions reported for fuel distribution, storage, refuelling. **Ensure your system boundary covers the full scope required.**
- GHG emissions calculations were not provided for a commercial sized plant, only a proposed demonstration plant. **To enable a fair comparison of the benefits of your technology, FOAK commercial plant GHG estimates are required from all applicants.**
- Final decisions, e.g. plant location, had not been made, resulting in large variations in emissions due to changes in assumptions, e.g. transport modes & distances. **Make it clear where you have had to make reasonable guesses and why they are appropriate.**
- Supporting documentation, evidence and assumptions made for the emission calculations were not provided for review, making it very hard to validate data. **Provide clear links in Appendix H to your supporting evidence provided in Appendix B.**
- Waste fossil feedstock counterfactual didn't use correct counterfactual. **In most cases for AFF, this will be EfW power generation at 22% efficiency (no CHP or CCS), using the projected UK grid intensity from AFF Guidance document Appendix E.**

## AFF likely questions

- **Part of my feedstock is ineligible for the AFF, am I still able to apply at a reduced rate for the eligible portion only?** No, all consignments produced must come from eligible feedstocks.
- **What do you mean by the first full year of operations?** If your plant completes commissioning in e.g. August 2026, then your first full year of operations would be 2027.
- **Why are we providing estimates for the first full year of operations, and not a common year of 2030 as for GFGS?** Given the scope of the AFF crosses into post-FID work (Detailed Design and Procurement of Main Equipment), and the wider ambition to have five SAF plants under construction in the UK by 2025, DfT need evidence that the plants that they will be supporting through the AFF will be able to meet the GHG threshold from their start of operations – and not just by 2030.
- **What if I'm only planning a demo plant, and I don't know when my future commercial plant might be operating?** Please make estimate aligned with your answer to the UK/RoW commercialisation roll-out question in the application form.
- **Why is the UK grid factor delayed by 3 years?** RTFO rules say to use the latest full year published official data, and Government conversions from the UK's 2020 Inventory were published in June 2022. So a plant calculating its emissions in say March 2026 would be using actual UK grid data from 2023.
- **What should I use for grid factors if part of the supply chain is abroad?** Use in-country projections for grid factors aligning with national decarbonisation legislation, NDCs or long-term goals (assuming success), if this data is available, or else the best available evidence. Use the appropriate delay for that country, based on when the latest full year of published official data was released (may be more or less than a 3 years delay as in the UK).

## AFF likely questions (continued)

- ***I don't have CO<sub>2</sub>e data using the new GWPs, will I be marked down?*** JRC produced two large datasets ([here](#), [here](#)) that use the same GWPs as the current RTFO. We recommend looking at these datasets first. If they don't provide the required data, attempt a calculation bottom-up to adjust the GWPs from other data. If not possible or the impact is minimal, use data in the old GWPs and highlight that this factor has not been possible to update.
- ***What if I only have emissions intensity data for the combined supply and use of an input material, not split out?*** The inputs table for each supply chain component in Appendix H asks you to account for only the upstream GHGs in supplying this input, with GHGs released on use recorded in the outputs table lower down. However, if you don't have data for this split, you should put the combined GHG intensity (supply + use) in the inputs table, exclude the use emissions from the outputs table, and highlight this.
- ***Do I include downstream emissions for CCS – i.e. purification, compression, distribution, injection of CO<sub>2</sub>?*** Yes. Also include the emissions for the CO<sub>2</sub> capture process itself.
- ***How permanent do CCU applications have to be to be eligible?*** Near immediate release of CO<sub>2</sub> back to atmosphere (e.g. greenhouses or fizzy drinks manufacture) will not be allowed to claim a CCU credit in the AFF, even though this may still currently be allowed under the RTFO. Long-term storage in e.g. cement would be allowed to claim a CCU credit. CCU with medium-term storage should evidence why this is sufficiently permanent to merit a credit, with inclusion of any credit or partial credit then at DfT's discretion. Ensure you include any emissions for the CO<sub>2</sub> capture process itself, purification, compression and distribution (or their equivalents if other forms of carbon are utilised).
- ***Do I have to include any land use change (direct or indirect) emissions in my GHG emissions calculations?*** No, because eligible AFF feedstocks are either biogenic waste/residues or fossil wastes, or else nuclear or renewable non-biogenic energy sources.