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Feed-in Tariffs (FIT)

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Feed-in Tariffs: Guidance on sustainability criteria and feedstock restrictions (version 2)

Overview

This document is for anaerobic digestion (AD) generators in England, Scotland and Wales accredited on the Feed-in Tariffs scheme. It explains how to demonstrate compliance with the sustainability criteria and feedstock restrictions which came into force on 1 May 2017.

Context

On 1 April 2010 the Feed-in Tariffs (FIT) scheme was introduced, aimed at encouraging the uptake of small-scale renewable and low-carbon technologies up to a Total Installed Capacity (TIC) of 5MW in England, Wales and Scotland.

The scheme requires certain licensed electricity suppliers to pay eligible installations for the generation and export of renewable and low carbon electricity.

Installations using solar photovoltaic (PV), wind, hydro and AD technologies up to 5 MW – and fossil fuel-derived combined heat and power up to 2 kW can receive FIT payments, if all eligibility requirements are met.

The FIT scheme, introduced by the Department of Energy and Climate Change (DECC) (now known as the Department for Business, Energy and Industrial Strategy [BEIS]), is administered by the Gas and Electricity Markets Authority (the Authority), which is assisted in its day-to-day functions by the Office of Gas and Electricity Markets (Ofgem).

Associated documents

Policy and legislation

The Feed-in Tariffs Order 2012 (as amended):
http://www.legislation.gov.uk/uksi/2017/131/contents/made

Modifications to Conditions 33 and 34 of the Standard Conditions of Electricity Supply Licences:
https://epr.ofgem.gov.uk/Content/Documents/Electricity%20Supply%20Standard%20Licence%20Conditions%20Consolidated%20-%20Current%20Version.pdf

Guidance

All documents are available at www.ofgem.gov.uk

- Feed-in Tariffs: Guidance for Licensed Electricity Suppliers
- Feed-in Tariffs: Guidance for Renewable Installations

- Renewables Obligation and Feed in Tariffs: Fuel Classification Flow Diagram

Contents

Executive Summary

This document describes the sustainability requirements and feedstock restrictions placed on AD eligible installations from 1 May 2017.

The obligation to meet sustainability requirements and feedstock restrictions applies to all AD installations that made a new application for ROO-FIT preliminary accreditation or full accreditation (other than during the period of validity of any preliminary accreditation) on or after 1 May 2017.

The sustainability criteria consider the land from which the biomass is sourced as well as the life-cycle greenhouse gas emissions associated with the biomass. The legislative framework requires AD generators to report against, and meet, the sustainability criteria on a quarterly basis in order to be eligible for generation payments under the scheme. Generators of installations with a Total Installed Capacity (TIC) of 1MW and above will also be required to submit an independent annual audit report to provide further assurance on sustainability information provided in the quarterly declarations. This document has more information on the criteria and the types of information and evidence which can support a generator's reporting.

The feedstock restrictions place an annual limit on the FIT generation payments an AD installation is entitled to, according to the fuel classification of the feedstocks used to produce the biogas. Where the electricity generated from biogas not derived from feedstocks classified as wastes and/or residues exceeds 50% of the total biogas yield (by energy content), the installation is not entitled to FIT generation payments for that payment year for the proportion in excess of 50%. This document provides further information on how to identify which feedstock types will be impacted by the restrictions, the types and evidence the generator must report on, and how the FIT generation payments will be impacted.

This document only provides guidance; it is not a legal guide. It is the responsibility of the generator to ensure that they are aware of the legislative requirements of the scheme when making an application. It is not intended to provide comprehensive legal advice on how the legislative framework should be interpreted. Where necessary, generators should seek their own technical or legal support.

This document cannot anticipate every scenario which may arise. If there is a situation not addressed in this guidance or to the extent there is any inconsistency with the legislative framework, the legislative framework will take precedence over the guidance.

1. Introduction

Chapter summary

This chapter describes the sustainability requirements, feedstock restrictions and other ongoing obligations placed on anaerobic digestion generators from 1 May 2017. These were introduced through The Feed-in Tariffs (Amendment) Order 2017.

1.1 From 1 May 2017 generators of all new anaerobic digestion (AD) eligible installations will have to comply with sustainability requirements and will have their FIT generation payments limited according to feedstock type. FIT export payments will be unaffected.

1.2 These requirements apply to all AD installations that made a new application for preliminary accreditation or full accreditation on or after 1 May 2017.

1.3 Generators who made an application for preliminary accreditation or full accreditation before 1 May 2017, but fall into a tariff period that starts on or after 1 May 2017, **will not** be required to comply with the sustainability criteria and feedstock restrictions.

Sustainability criteria

1.4 To be eligible for FIT generation payments, feedstocks that meet the sustainability criteria must be used. The sustainability criteria are formed of the following:

a. The land criteria:

- The land criteria refer specifically to the production of the raw material, such as at the farm, forest or plantation.
- The aim is to discourage use of biomass that was sourced from land with a high biodiversity and carbon stock value.
- There are two types of land criteria: for woody biomass and for non-woody biomass.
- More information on the land criteria can be found in Chapter 7.

b. The greenhouse gas (GHG) emissions limit:

- This accounts for the life cycle greenhouse gas emissions of the biomass.
- Every consignment of biogas must meet the GHG threshold. The relevant maximum threshold will be 66.7gCO_2e/MJ of electricity generated, falling to 55.6gCO_2e/MJ of electricity from 1 April 2020 to 31 March 2025 and then to 50.0gCO_2e/MJ of electricity from 1 April 2025 onwards.
- More information on the GHG criteria can be found in Chapter 8.

1.5 Wastes or feedstock wholly derived from waste **will not** have to comply with the sustainability criteria as those feedstocks are deemed to have met the criteria.

These consignments must be declared as wastes in the quarterly sustainability declarations.

1.6 If a generator uses biogas from a feedstock(s) that does not meet the sustainability requirements, they will not be eligible for FIT generation payments relating to the portion of electricity generated from that unsustainable biogas. FIT export payments are not impacted by the sustainability criteria.

1.7 Biogas produced from liquid feedstocks that are classified as non-wastes (such as a residue or a product) are deemed as unsustainable, however the installation may still be eligible to receive FIT export payments.

1.8 Generators must demonstrate compliance with the sustainability criteria at their installation on a quarterly basis through reporting. A template for the sustainability declaration is available on ourwebsite.

Feedstock restrictions

1.9 The restrictions will impact the amount of FIT generation payments a generator is eligible for in each FIT payment year:

- Where the electricity generated from biogas not derived from feedstocks classified as wastes or residues exceeds 50% of the total biogas yield (by energy content), the installation will not be entitled to FIT generation payments relating to that payment year for the proportion in excess of 50%.

1.10 The payment due when biogas not derived from feedstocks classified as wastes or residues exceeds 50% can be worked out using the following equation:

Payment = A × (1.5 − B) where—

- A = the total generation payments to which the FIT generator or nominated recipient would be due if not for any reductions in that annual period and

- B = the proportion of the energy content of the biogas which is not derived from waste or residue, expressed as a decimal and rounded to 4 decimal places.

1.11 For example, if in an installation's FIT reporting year 70% of the biogas yield (by energy content) is derived from feedstocks other than wastes and/or residues, with the remaining 30% of the yield derived from wastes or residues, the installation will only be entitled to 80% of that year's FIT generation payments. This is because the portion from non-wastes and residues exceeds the 50% limit by 20%.

1.12 FIT export payments will not be affected by the feedstock restrictions.

1.13 This restriction applies on an annual basis, from the installation's Eligibility Date. Within three months of every anniversary of the Eligibility Date, generators must submit a feedstock declaration regarding their feedstock, fuel classification and biogas yields for the previous year and other supporting information we request. A template is available on our website.

1.14 This information will demonstrate what portion of the year's biogas yield is derived from wastes or residues, and therefore the portion of FIT generation payments

that the generator is entitled to. Once this is established, the FIT licensee will be instructed by us to adjust the FIT payments accordingly.

How to apply for accreditation

1.15 AD installations with a total installed capacity (TIC) up to and including 5MW are eligible to apply to the FIT scheme through the ROO-FIT route of accreditation. Please read the Guidance for Renewable Installations[1] for further information on how to apply for ROO-FIT accreditation.

1.16 From 1 May 2017, all new AD generators will need to complete and submit a Fuel Measurement and Sampling (FMS) questionnaire at the preliminary, convert-to-full (where the associated preliminary application was made on or after 1 May 2017) or full application stages so that the FMS procedures can be discussed with and reviewed by us upfront. This must be done before an installation can be accredited.

1.17 Chapter 5 provides further information on FMS procedures. A guidance note with further details on how to complete the FMS questionnaire is available on our website.[2]

Ongoing obligations

1.18 There are a number of ongoing obligations and reporting requirements relating to the sustainability criteria and restrictions on feedstock(s) which new AD generators use in their installation to produce biogas. In summary, these are:

- The biogas produced by anaerobic digestion must meet the sustainability requirements as described in Chapters 7 and 8 and generators must submit quarterly sustainability declarations to us within 28 calendar days from the end of the relevant quarterly period to reflect this information.
- The feedstocks used must take into account the feedstock restrictions as described in Chapter 10 and generators must submit annual feedstock declarations to us within 3 calendar months from the end of the relevant annual period to reflect this information.
- Quarterly generation meter readings must be submitted to their FIT licensee within 28 calendar days from the end of the relevant quarterly period.
- Records of all feedstocks used for production of biogas by the installation must be kept. We may request these records throughout the duration of an installation's accreditation on the FIT scheme.

1.19 The dates for the provision of this information (reporting period dates) will depend on the installation's Eligibility Date, and a submission timetable will be set out and sent to generators in their accreditation letter when their application for accreditation has been approved.

1.20 The reporting period dates may be amended by us where an installation is accredited on both the RHI and FIT schemes, in order to allow the declarations

[1] Available at: https://www.ofgem.gov.uk/publications-and-updates/feed-tariff-fit-guidance-renewable-installations-version-10-2
[2] Available at: https://www.ofgem.gov.uk/publications-and-updates/fit-anaerobic-digestion-fuel-measurement-and-sampling-fms-questionnaire-and-guidance-note

and audit report on each scheme to be submitted to cover the same period. This is covered further in chapter 3.

1.21 Installations with a TIC ≥1 MW will have to submit an annual independent audit report to us to demonstrate and verify compliance with the sustainability criteria and feedstock restrictions.

1.22 We may audit all AD installations, during which the generator must provide relevant evidence and information to demonstrate the sustainability criteria have been met in previous quarters and the feedstock restrictions have been complied with.

1.23 Please also note that we have a zero tolerance approach to fraud. Our Counter Fraud team undertakes activities to detect, prevent and deter fraudulent activity across the scheme.

Terminology

1.24 The document refers to the Feed-in Tariffs Order 2012 (as amended) and the Standard Conditions of Electricity Supply Licences (as modified). Collectively these are referred to as 'the legislative framework'.

1.25 "Ofgem", "us", "our" and "we" are used interchangeably when referring to the exercise of the Authority's powers and functions under the Orders. The term "the Act" refers to the Electricity Act 1989.

1.26 Unless the context otherwise requires, where the term "new AD generator" is used, it refers to a generator who made a new application for preliminary accreditation or full accreditation on or after 1 May 2017.

1.27 Where the term "biomass" is used in this document it refers to solid and liquid feedstock states. Where a distinction needs to be made the terms "solid biomass" and "liquid biomass" will be used. "Biogas" refers to the fuel used in the AD plant, and this is produced from the digestion of the solid biomass and liquid biomass feedstocks.

1.28 Where the term "fuel" is used it refers to the biogas that is produced in an AD installation from a consignment(s) of feedstock. "Fossil fuel" will be referenced separately.

1.29 Where the term "waste" is used, it refers to the definition given in the legislative framework which has "the meaning given in Article 3(1) of Directive 2008/98/EC of the European Parliament and of the Council on waste and includes excreta produced by animals". This Article provides the meaning of waste as "any substance or object that the holder discards or intends or is required to discard".

Queries

1.30 Any queries about changes to the FIT scheme and wider policy should be directed to the Department for Business, Energy and Industrial Strategy (BEIS).[3]

[3] https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy

2. Aligning Reporting Periods

Chapter summary

Installations that are accredited on both FIT and RHI schemes can have their reporting periods aligned so that they are able to submit their FIT and RHI audit reports and declarations at the same times, covering the same reporting periods. This chapter explains the process and steps to be taken to ensure that the report can be submitted for the same period for both schemes

2.1 As the FIT and RHI schemes are separate and distinct, where an installation is accredited under both schemes the generator will need to submit their reporting information (declarations and audit report) under both schemes. This ensures that each report refers to the legislation for each respective scheme.

2.2 We recognise that some of the underlying data and systems to produce the information contained in the reports will be the same for both schemes, and being able to use the same information at the same time for reporting under both schemes will reduce the work you will need to do. This requires the reporting periods to be aligned.

2.3 To ease any potential burden on the generator, we have the ability to amend reporting periods to enable us to align an installation's FIT quarterly and annual period with their RHI reporting periods.

2.4 This will enable you to appoint the same auditor to review the information for your audit reports for both the FIT and RHI schemes. The auditor should continue to produce two reports, one for each scheme.

Where an RHI installation becomes accredited on FIT

2.5 Where an installation is already accredited on the RHI scheme, we will amend the first quarterly and annual period at the point of FIT accreditation so that all subsequent periods fall in line with the RHI periods.

2.6 Where an installation's first annual reporting period is reduced to less than 3 months in order to align periods, it will not need to submit an audit report for this period.

Where a FIT installation later becomes accredited on RHI

2.7 If at the time FIT accreditation is granted the installation is not accredited under the RHI scheme, the reporting periods will be quarterly and annually from the FIT effective date. Should the installation be accredited under the RHI scheme at a later date, we can amend these periods to align with the RHI scheme.

2.8 In the instances where the reporting periods are aligned with RHI, there will likely be one period which is not a full quarter. The generator will still need to ensure that this is covered by their declarations to us.

2.9 Further, due to this alignment there will likely be a period where the annual feedstock declaration and the sustainability audit report, which would normally be for an annual period, are for a slightly longer or shorter period. Again, the generator will need to ensure that this is covered in their reporting.

2.10 Where an annual reporting period is reduced to less than 3 months in order to align periods, an installation will not need to submit an audit report for this period.

2.11 FIT licensees will also require meter readings to match the reporting periods such that the amount of generation within a period can be determined. The generator is responsible for taking these meter readings and ensuring that they have the information for where reporting periods change.

2.12 The FIT and RHI teams at Ofgem will aim to identify where an installation is accredited on both. To assist this, we ask some questions regarding any RHI interaction within the FMS questionnaire. However, the generator can also bring to our attention when accreditation has been granted under the RHI scheme by emailing fuellingandsustainability@ofgem.gov.uk. This email should include:

- The FIT installation name
- The RHI installation name and accreditation number
- The RHI accreditation date

3. Fuel classification

Chapter summary

This chapter outlines the fuel classification process, key definitions and how generators can classify their fuels based on the feedstock consignments used in their AD installation.

3.1 It is important that generators understand the classification of their fuel(s) and feedstock(s) as it can affect both the sustainability criteria and feedstock restrictions which in turn impact FIT generation payments.

3.2 The term 'fuel classification' refers to the determination of whether the fuel or feedstock is a product, co-product, wast e or a type of residue.

3.3 If the generator believes the fuel being used should be classed as a waste or a type of residue, there are different sustainability reporting requirements.

3.4 Generators will need to gather evidence to demonstrate the classification of their fuel to us if requested and, where applicable, to their independent auditor as part of their annual sustainability audit for installations 1MW and above.

3.5 It is not necessarily the final fuel that needs to be considered as a waste or type of residue. It is also possible to classify fuels used based on the material from which the final fuel was made being a waste or a type of residue. For example, the biogas is produced from the anaerobic digestion of a feedstock that is a waste.

3.6 A fuel classification flow diagram is available on our website, for use on FIT and RO.[4]

Fuel classification reporting requirements

Table 1: Fuel classification reporting requirements

Fuel Classification	Land Criteria	GHG Criteria
Waste	Reporting required – deemed sustainable	Reporting required – deemed sustainable
Wholly derived from waste	Reporting required – deemed sustainable	Reporting required – deemed sustainable
Processing residues	If not wood - exempt from land criteria	Emissions during and from the process of collection only

[4] Available at: https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-and-feed-tariffs-fuel-classification-flow-diagram

	If wood - must report against the land criteria for woody biomass	
Residues from agriculture	Reporting required	Emissions during and from the process of collection only
Residues from forestry	Reporting required	Emissions during and from the process of collection only
Residues from arboriculture	If not wood - exempt from land criteria If wood - deemed sustainable and meets the land criteria for woody biomass	Emissions during and from the process of collection only
Residues from aquaculture and fisheries	Reporting required	Emissions during and from the process of collection only
Products, co-products	Reporting required	Full life-cycle emissions

Additional exemptions

3.7 In addition to the exemptions associated with fuel classifications in Table 1;

- Wood that was removed for the purpose of creating, restoring or maintaining the ecosystem of an area (which was not a forest), is deemed sustainable under the land criteria for woody biomass. Emissions during and from the process of collection will be required to report against the GHG emissions.

Definitions

3.8 What constitutes a waste or a residue relies on interpreting the legislative framework, the Renewable Energy Directive (RED), European Commission (EC) communications, and the existing UK and EU law on waste.

3.9 The sections below aim to give guidance that is as clear and consistent as possible in this area. This information should not be treated as legal guidance. Where necessary, generators should seek their own legal or technical advice.

Definition of waste

3.10 The legislative framework defines 'waste' to have "the meaning given in Article 3(1) of Directive 2008/98/EC of the European Parliament and of the Council on waste and includes excreta produced by animals".[5] This Article provides the meaning of waste as "any substance or object that the holder discards or intends or is required to discard".

[5] Available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098

3.11 Further guidance on this definition was published in August 2012 by the Department for Environment, Food and Rural Affairs (DEFRA) titled 'Guidance on the legal definition of waste and its application'.[6]

3.12 The Environment Agency has an important role under the Waste Framework Directive (WFD), in determining whether a substance is a waste or is derived from waste. As far as possible, a consistent approach will be taken, but there may be times when a material is classified as a waste by the Environment Agency but this is not definitive for the purpose of FIT, Renewables Obligation (RO) and Non-Domestic Renewable Heat Incentive (RHI).

Definition of residues

3.13 Neither the legislative framework nor the RED defines residues. However, EC communications provide further information in this area.

3.14 The EC communication on practical implementation (2010/C 160/02)[7] defines processing residues as "a substance that is not the end product(s) that a production process directly seeks to produce. It is not a primary aim of the production process and the process has not been deliberately modified to produce it."

3.15 The Communication (2010/C 160/02) also notes that "agriculture, aquaculture, fisheries and forestry residues are residues that are directly produced by agriculture, fisheries, aquaculture and forestry; they do not include residues from related industries or processing". Although EC communications are not binding on member states, and are not transposed into the legislative framework, we generally have regard to the EC's guidance whilst remaining consistent with UK law.

3.16 This definition of residues from agriculture, aquaculture, forestry and fisheries, can be interpreted to mean that such residues are those generated in the process of harvesting the material being sought. Once the product is removed from the point of harvest and processed elsewhere, any residues generated from this are considered processing residues.

3.17 Residues from arboriculture are not defined in the legislative framework. However, in line with DECC's consultation response in August 2014[8] arboricultural residues are considered to be material from woody plants and trees planted for landscape or amenity value that are removed as part of tree surgery usually in gardens, parks or other populated settings, and utility arboriculture such as the verges of roads and railways. Residues from arboriculture should not include forestry residues.

Allocating GHG Emissions - Process of Collection

[6] Available from DEFRA's website at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69590/pb13813-waste-legal-def-guide.pdf

[7] Commission Communication on practical implementation (2010/C 160/02) - http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:160:0008:0016:EN:PDF

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/343005/Response_to_Biomass_Consultation.pdf

3.18 For calculating the GHG emissions, the RED makes it clear that for residues, the GHG calculations are only required from and during the process of collection of the waste or residue.[9]

3.19 'Process of collection' refers to the beginning of the process of collection which includes all emissions involved in collecting the waste or residue, and further processing and transport. This is not necessarily the same as the point of collection, which is often considered to be the point where the material is collected by another party, as any emissions arising after the residue was created but before it is collected should also be taken into account. For example, there may be emissions associated with machinery used to gather the residue into storage containers ready for collection.

3.20 For example, residues from agriculture may be collected from different fields, which is considered to be the starting point of this residue. The collection of these residues, transportation (and any associated processing) will need to be calculated and allocated to the final fuel.

Considering fuel classification

3.21 Appendix 2 sets out an indicative list of common classifications for materials. It is not intended to be an exhaustive list and therefore if a material is not on the list, it does not mean the substance is not a waste or a type of residue.

3.22 We may periodically review and update this list, if sufficient evidence emerges to indicate that a substance should be treated differently. Where further information comes to light we will liaise with other relevant parties such as the Renewable Transport Fuels Obligation (RTFO) administrator, RHI and RO with the potential to reassess if we deem necessary.

3.23 Furthermore, while we endeavour to be as consistent as possible with other government departments, there may be occasions where our role and responsibilities under the legislative framework lead us to a different approach on the same material.

3.24 It is necessary on FIT, RHI and RO for us to take a view on whether a substance is a type of residue or a waste. Please note that this is relevant only to the sustainability criteria and feedstock restrictions of the applicable scheme, and is not for other external purposes. Our view will have no influence on the Environment Agency when it is making decisions on substances. This applies both to the common classification tables at Appendix 2, and to any subsequent views we reach on wastes and residues.

Approach for generators

3.25 When considering the classification of a fuel, we recommend that generators first refer to the common classification tables at Appendix 2 of this document. If the fuel is listed in the common classification tables, and fit the table description, the generator will need to gather evidence to support the identified classification. This evidence needs to be presented to the auditor as

[9] Annex V, Part C, Paragraph 18: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

part of the annual sustainability audit report where applicable, or to us on request.

3.26 If the generator considers their biomass to be a waste or type of residue that is not covered in the common classification lists, as either the material is not listed or the way the material was produced does not correspond with the common classification, they should provide their proposed classification as part of their FMS upon full ROO-FIT application, and include evidence and reasoning for this classification, for review by us.

3.27 Any discussions in respect of fuel classification should occur during the accreditation process, following the submission of the full application which includes the FMS questionnaire for the fuel(s). This will need to happen as part of the accreditation decision or during any subsequent FMS update.

Process for fuel classification discussions

3.28 The full FMS questionnaire will contain questions referencing fuel classification. Where the generator considers the fuel to be a waste or a type of residue which is not covered in the common classification tables, we will ask the generator to provide evidence of the fuel classification. Generators can also request our view on the fuel classification when they consider the fuel classification indicated by these tables is not appropriate for a particular material.

3.29 To facilitate this, we have developed a number of questions to ensure the generator presents relevant information to support any further discussion. These questions will be made available to the generator during the FMS approval process, where necessary.

3.30 We will consider the information provided by the generator. During this process, we may seek further information from other parties. The generator should be aware that the information they provide to us may be shared.[10]

3.31 If the information is unclear or incomplete, we will ask the generator for further information in order to provide our view on fuel classification.

3.32 Any view from us on fuel classification is not 'a decision' or 'official approval' and does not remove the requirement for evidence of fuel classification to be assessed at audit. For installations with a TIC of 1MW and above, we expect the generator's independent auditor to consider all the relevant evidence and, where necessary, seek further information, as part of the annual sustainability audit. We will not consider it sufficient for the auditor to rely solely on the correspondence between us and the generator as part of the fuel classification review.

3.33 Where the audit disagrees with the classification, or further information comes to light from other sources, we will review the case. Should the additional evidence result in the classification being inappropriate we will need to consider the impact this has on the way the generator has reported and, where relevant, any associated FIT payments.

Demonstrating Compliance

[10] https://www.ofgem.gov.uk/privacy-notice

3.34 Where the generator is seeking to make use of an exemption associated with fuel classification, whether for a material specified in the common classifications list or otherwise, they must have evidence to demonstrate this.

3.35 Where a voluntary scheme is not being used, or does not cover fuel classification, useful documentation may include:

- Permits and certificates (such as waste transfer notes or end-of-waste certificates) issued by the Environment Agency.
- Process flow diagrams which set out how the material is created.
- Information regarding the uses of the material and its value in the market place.

3.36 This evidence will be verified by the annual sustainability audit report if applicable, or during an Ofgem audit. This means that a generator must demonstrate to the auditor's satisfaction that the biomass used is as per the common classifications list or those specified in the FMS procedures agreed by us.

4. Consignment and mass balance

Chapter summary

Generators must report per consignment of biomass in relation to the sustainability criteria. This chapter provides information on how to determine a consignment and what steps the generator should take if consignments are mixed.

4.1 The legislative framework requires generators to report per consignment of biomass.

4.2 To report accurately against the sustainability criteria for each consignment of biomass, and for the information to be verifiable, the sustainability information must be traceable through the supply chain. This concept of traceability from raw material to end product is known as the 'chain of custody'.

4.3 For ease of reporting, the most straightforward chain of custody system is 'physical segregation'. This is where the consignment of biomass is not mixed with any other consignment and therefore the biomass, and its associated sustainability characteristics, can be easily traced through the supply chain from start to end.

4.4 Where consignments are mixed, we recommend that generators use a mass balance system in order to report against the sustainability requirements. This accounts for their biomass fuel on an input equals output basis but does not require physical separation of different consignments.

4.5 To identify whether a mass balance chain of custody system is required, the generator must first determine the number of consignments they are using and whether these are being mixed at the installation or elsewhere in the supply chain. We recognise that the generator may not necessarily be aware of every detail of the supply chain. However, they should ensure that they are seeking the relevant information from their supplier to understand whether they are receiving biomass that is a single consignment or a mix of consignments.

Determining a consignment

4.6 The legislative framework does not define 'consignment'. However, we interpret this as needing to be based on the main characteristics that could influence whether a fuel is considered as sustainable. This interpretation is in line with the policy intent and has the same meaning as that used for sustainability reporting of biomass electricity under the RO[11] and RHI schemes.

[11] As stated in the Government Response to 'Providing Certainty, improving performance' July 2012 consultation: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/128679/Gov_response_to_non_domestic_July_2012_consultation_-_26_02_2013.pdf

4.7 The term 'consignment' in relation to biogas is interpreted to mean the quantity of biogas attributable to the consignment of feedstock from which that biogas was made.

4.8 We refer to these as the 'sustainability characteristics' of the fuel. For practical reasons, we consider the following sustainability characteristics should be taken into account:

- Feedstock type[12],
- Country of origin[13],
- Classification of the fuel (waste, processing residue, product etc.),
- Compliance with land criteria,
- Compliance with GHG criteria.

4.9 This list is not a definitive legal guide.

4.10 The GHG characteristic will be determined as having been applied by considering the portion of the material with the largest emissions and whether this meets the relevant GHG emission threshold. If it does not, even if all other characteristics are the same, it cannot be considered the same consignment.

4.11 There is no 'timeframe' considered to be applicable to a consignment. It is for the generator to determine what consignments of biomass should be reported to us each quarter based on what is considered to have been used over the quarter.

4.12 Provided materials have identical sustainability characteristics (as listed above), these can be considered as a single consignment for the purposes of data collection and reporting under FIT. The same approach is taken on the RO and RHI schemes.

4.13 Where your feedstock has a binder added to it we will need to consider whether this is a separate consignment. If the binder is greater than 2% of the feedstock then this will be considered to be a separate consignment and you will need to report against the sustainability criteria for it. If it is 2% or less then you can assume that it has the same sustainability characteristics as the rest of the feedstock.

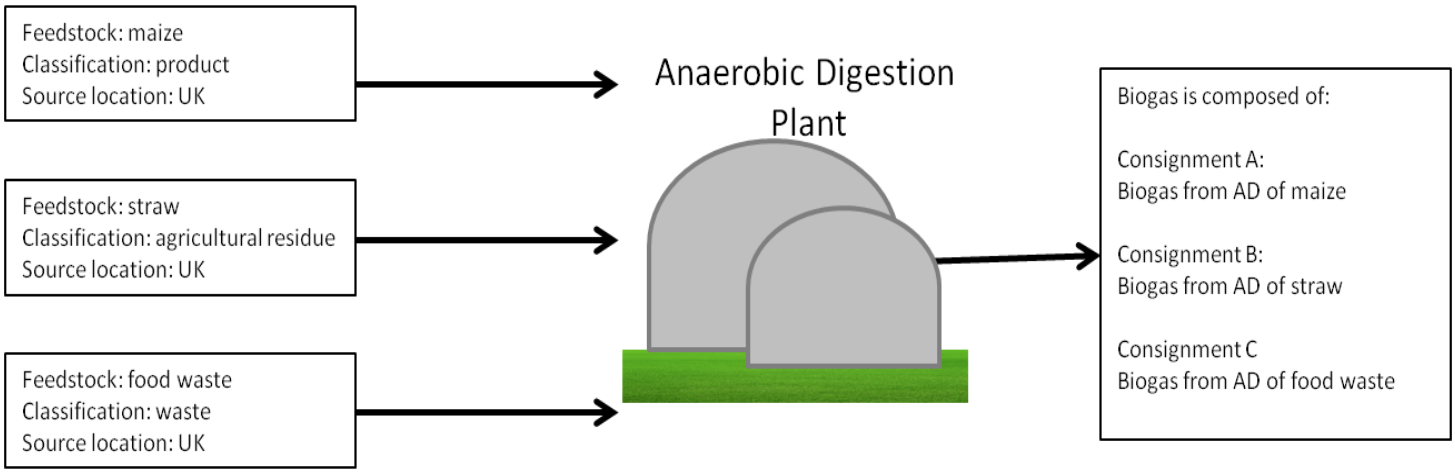
4.14 Where there are a number of source locations in the same country of origin (for example maize silage sourced from numerous locations in the UK) and the sustainability characteristics are the same, the overall carbon intensity for aggregated consignment is given by calculating a weighted average (by quantity) of all the carbon intensities.

4.15 To assist generators, Figure 1 provides an example of determining consignments.

[12] This is to ensure that different types of biomass are not grouped together, eg wood cannot be considered the same as sunflower pellets

[13] UK can be considered as a single country of origin

Figure 1: Example of determining a consignment for biogas from AD



4.16 The example shown in Figure 1 is of a UK-based AD eligible installation. In this example, all feedstock inputs are from the same country of origin, none are certified by a voluntary scheme and each would satisfy the land and GHG[14] criteria. The main determining factors here as to the number of consignments within the biogas is based on the fact that the feedstocks and their fuel classifications differ.

4.17 Once the number of consignments has been determined the generator will need to establish whether the consignments are mixed at the installation or elsewhere in the supply chain. A mass balance system will need to be used to trace the biomass and its associated sustainability characteristics.

4.18 Where the generator and parties in the supply chain are making use of a relevant voluntary scheme, as per the guidance in chapter 6, they should follow the voluntary scheme rules for the purpose of tracking sustainability information associated with each consignment of biomass.

4.19 In the event that a mass balance system is required, and the generator and parties in the supply chain are not making use of a voluntary scheme recognised in this respect, this chapter provides further guidance on the types of mass balance and good practice for setting up a system.

Overview of mass balance

4.20 A mass balance system is a system in which sets of sustainability characteristics remain assigned to consignments. The sum of all consignments withdrawn from the mixture is described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture. A party in the chain of custody cannot sell more output with certain biomass data than its sourced input with the same biomass data.

4.21 Mass balance systems should be used where a mixing of consignments takes place, either at the generator's site or down the supply chain. This is to ensure that the biomass and its associated sustainability data are verifiable. The onus is on the generator to implement the appropriate process and procedures.

[14] the biogas from each feedstock would meet the GHG criteria separately

4.22 Although consignments with different sustainability information can be physically mixed, sustainability information cannot be mixed between different consignments of biomass. For example, if a generator has two types of biomass in a single storage container, 'short rotation forestry from Canada' and 'thinnings from Germany', the information could not be swapped between the consignments. A generator could therefore not assign the outgoing consignment as 'short rotation forestry from Germany'.

Types of mass balance systems

4.23 There are typically two ways of reporting claims through mass balance systems.

- When using **proportional mass balance**, any quantity of fuel removed from a mixture containing different consignments must be assigned the sustainability characteristics in the same proportions as the original mixture. For example, if a solid biomass mixture is 400 tonnes of 'A' and 600 tonnes of 'B' when you extract an amount of biomass from the mixture you apply these proportions to the extracted amount (for example, 40 per cent is 'A' and 60 per cent is 'B'). See Figure 2.

- When using **non-proportional mass balance**, any quantity of fuel removed from a mixture containing different consignments does not require the sustainability characteristics to be assigned based on the proportions of the mixture. Instead it allows the sustainability characteristics to be assigned freely, as long as what is being assigned is not in greater amount than in the original mixture. For example, if a solid biomass mixture is 400 tonnes of 'A' and 600 tonnes of 'B' when you extract a volume of biomass you are free to set out whether it composes all of 'A', 'B' or a combination of the both. However, you should not declare that you have more volume of either 'A' or 'B' than the mixture in the first instance. See Figure 3.

4.24 Generally, we are content for the generator to determine which mass balancing system to use within their supply chain. However, we note the following constraint that the generator, and parties within their supply chain, should follow:

- When making use of the non-proportionate method, we recommend that data assigned to a quantity of biomass should be done on a 'first in first out' (FIFO) basis – the consignment that was first added to the mix should be the first to be reported being used. This reduces the risk that there is an amount of unsustainable biomass within the mix which is never assigned to an extracted quantity of biomass. If a party does not follow a FIFO approach the independent auditor may wish to consider this risk as part of the annual verification process.

4.25 There may be other examples of where the use of one particular method should be followed, such as the use of the proportionate method where there are technical reasons for a quantity to be a specific blend.

4.26 In general, the feedstock reported by parties should be representative of the feedstock mixture and parties should have a consistent and transparent reporting process.

Figure 2: Example of proportional mass balance

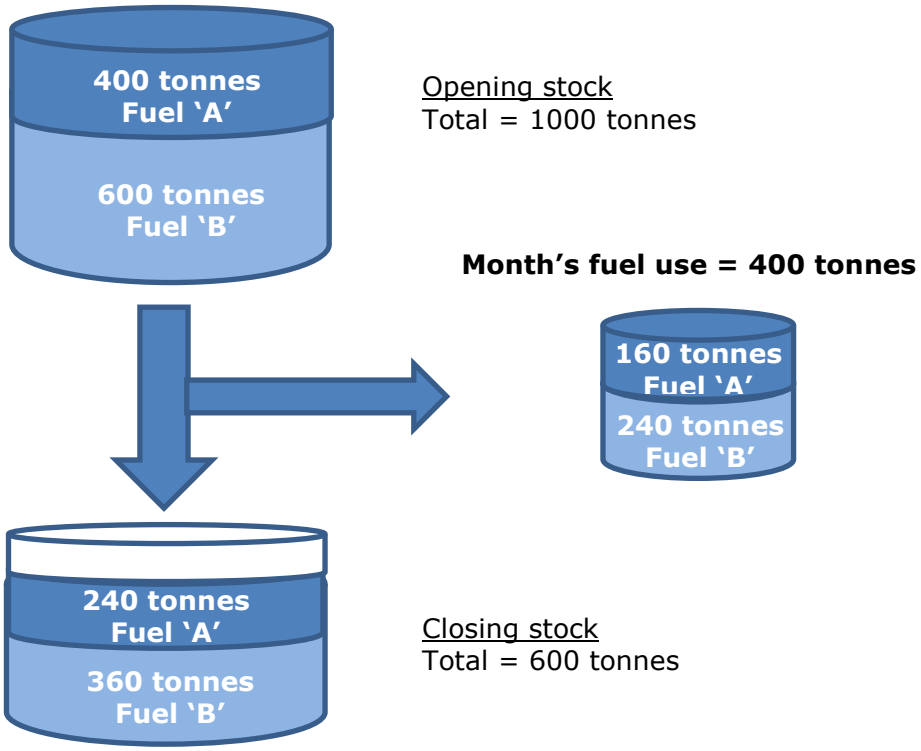
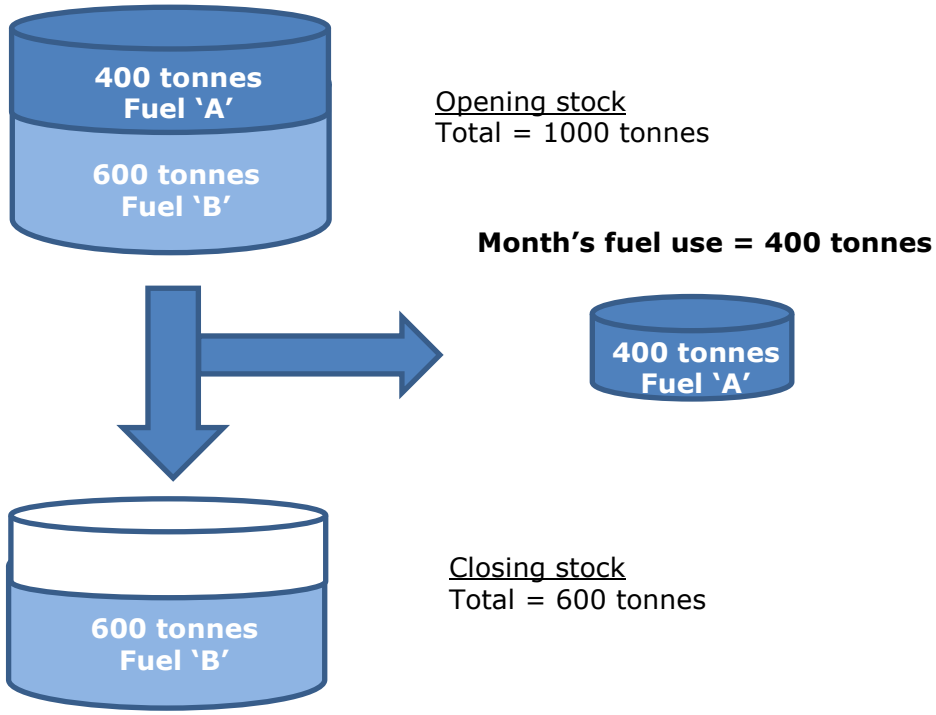


Figure 3: Example of non-proportional mass balance



The operation of a mass balance system

4.27 Each party in the supply chain, which is at any point the legal owner of the product, will need to put in place the administration necessary to maintain the mass balance chain of custody.

Level at which the mass balance should take place

4.28 The mass balance should be operated at the level of a 'site' that a company owns/operates. For the purposes of mass balance sustainability requirements, a 'site' is defined by the EC as 'a geographical location with precise boundaries within which products can be mixed'.[15] A site can include multiple silos or tanks, as long as they are at the same physical site.

4.29 Should a party wish to manage the data at a more detailed level of granularity then this is also acceptable. For example, a company could operate mass balance at the level of individual storage containers within a site. The mass balance however is not recommended to be operated over multiple physical sites that a company owns.

Timeframe within which the mass balance should be conducted

4.30 It is recommended that parties in the supply chain undertake a periodic review of site-level sustainability data at least on a monthly basis.

4.31 It is acknowledged that, due to the way the supply chain currently operates, it may be challenging for some parties in the supply chain to conduct a monthly mass balance review, particularly at the agricultural end of the supply chain. Therefore the maximum period over which the mass balance has to be achieved, can be longer than one month but must not exceed one year.[16]

4.32 Parties using a certified voluntary scheme must use the mass balance timeframe of that scheme.

Passing information through the supply chain

4.33 The use of a mass balance chain of custody system promotes information regarding a particular consignment of biomass to be passed down the supply chain. Whilst the physical evidence does not need to move through the supply chain with the biomass it is recommended that there is sufficient information with the generator for them to have confidence in reporting to us against the sustainability criteria on a quarterly basis. Any information or evidence should be kept and made available if required for verification purposes.

4.34 It is good practice if generators inform parties earlier in the supply chain of what is required to demonstrate compliance with the sustainability criteria. This will ensure that relevant information moves along the supply chain.

4.35 Records of commercial transactions should enable parties in the supply chain, including auditors, to trace back through the supply chain to verify any sustainability data claims made. A company that sells biomass should specify certain information on the invoice or documentation they share with the buyer.

[15] Definition available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:160:0001:0007:EN:PDF
[16] Generators should note that lengthy balancing timeframes may add a layer of complexity and thus hinder the ability of verifiers to confirm whether the sustainability criteria have been met

4.36 Generators may wish to seek additional information from their biomass supplier to be confident that the biomass they are buying meets the sustainability criteria.

Demonstrating compliance and record keeping

4.37 Where a generator is not mixing consignments they do not need to use a mass balance approach. They must, however, be able to demonstrate to an auditor's satisfaction that the biomass is traceable through the supply chain.

4.38 Where consignments are being mixed, a generator should demonstrate they have a suitable mass balance in place to allow for traceability of the biomass and its associated sustainability characteristics.

4.39 Where the generator is making use of a voluntary scheme to demonstrate compliance with mass balance, they should ensure they have the appropriate certification documentation to demonstrate this to their auditor.

4.40 Where a generator is using a mass balance chain of custody which is not covered by a voluntary scheme, they should collect information to demonstrate they have a suitable mass balance approach in place.

4.41 This will require not just the generator, but also parties within the supply chain to maintain suitable evidence. Clear, detailed and transparent records are vital to support sustainability reporting under the FIT scheme and to facilitate the annual sustainability audit process where relevant.

4.42 Each party in the supply chain should keep records that concur with the information on the invoices, to enable sustainability data claims to be traced back through the supply chain. This will be required for audits. Table 2 sets out the recommended records to maintain and example formats for these records are found in Appendix 5.

Table 2: Recommended records and associated information for mass balance

Record type	Information to record
Input and output records of biomass data and sustainability information Input records refer to the biomass and sustainability related information for products purchased from a supplier. Output records refer to the biomass and sustainability related information for products sold to a buyer.	• An invoice reference(s) • Description of the physical product to which the biomass data refer • Volume of physical input/output to which the biomass data refer • Supplying/receiving company • Transaction date • Any biomass and sustainability information.
Conversion factor records These records refer to the conversion factor of inputs to outputs and	• To which input product it refers • To which output product it refers

associated actual input data. Each party in the supply chain can maintain records of its own conversion factors. A party may have more than one conversion factor. If no records are kept for the conversion factor a standard input value must be used.	• The units in which the conversion factor is expressed • The value of the actual conversion factor • When the specific conversion factor was valid • The calculation and supporting documentation that determines the conversion factor.
Periodic inventory of biomass data These records provide an insight into the balance of biomass and sustainability information. Besides helping companies to manage their input-output balance, these records also assist in the verification of a party's mass balance records. Periodic inventories are recommended to be conducted on a monthly basis.	• Inventory of biomass and sustainability information at the beginning of the respective period. It must be clearly specified whether this is expressed in input-equivalents (before conversion factor) or output-equivalents (after conversion factor). • Volumes of inputs with identical biomass and sustainability information in the respective period. These volumes must coincide with the input records described above. • Volume of outputs with identical biomass and sustainability information in the respective period. These volumes must coincide with the output records described above. • Conversion factor(s) used in the respective period. • Inventory of biomass and sustainability information at the end of the respective period (including the carbon intensity of the stock). It must be clearly specified whether this is expressed in input-equivalents (before conversion factor) or output-equivalents (after conversion factor). • Purchase and sales invoices should be retained.

5. FMS procedures

Chapter summary

This chapter provides guidance to generators on Fuel Measurement and Sampling (FMS) procedures. An outline of data submission and supporting information requirements are also included.

5.1 An FMS procedure is the general term that we use to describe the agreement with generators of suitable procedures for the measurement and sampling of their fuels. These are required in order to determine:

- the quantity of fuel used in a quarter,
- consignment classification of the fuel used in a quarter for the purposes of sustainability,
- consignment classification of the fuel used in a year for the purposes of feedstock restrictions,
- the management of mixed consignments, and
- the energy content of the fuel used in a quarter.

5.2 FMS procedures are required to ensure that:

- Generators have established appropriate procedures to report against their sustainability requirements.
- The amount of eligible electricity is determined according to the energy content of each of the fuels used in a particular quarter to generate electricity. It is because of this calculation that applicants need to propose and agree an FMS regime with us, describing how they will determine the values required for the calculation of FIT generation payments.
- FIT generation payments are only issued for electricity generated which complies with the sustainability criteria and feedstock restrictions.

When to submit FMS procedures

5.3 AD applicants must submit or amend an FMS questionnaire in the following circumstances:

- When applying for ROO-FIT preliminary accreditation on or after 1 May 2017 a preliminary FMS questionnaire must be completed,
- when applying for full ROO-FIT accreditation on or after 1 May 2017 (where preliminary accreditation has not already been applied for prior to 1 May 2017) a full FMS questionnaire must be completed,

- an amended FMS questionnaire is needed where a new fuel or consignment is used, or where any change has been made onsite that affects the previously discussed procedures, at an accredited installation that is required to comply with the sustainability criteria and feedstock restrictions, or

- an amended FMS questionnaire is needed when changes to the FIT legislative framework mean that the current agreed procedures are no longer adequate.

5.4 Please note that generators applying for accreditation of new AD installations on or after 1 May 2017 are no longer required to submit a FIT AD Feedstock Declaration form during the ROO-FIT application process, as the FMS questionnaire replaces this document.

5.5 When applying, the agreement of FMS procedures is conducted as part of the preliminary accreditation (where applicable) and full accreditation application review process. FMS procedures must be agreed before accreditation can be granted.

Applications for preliminary accreditation

5.6 A preliminary FMS questionnaire must be submitted to our Renewable Electricity Fuelling and Sustainability team, to FuellingandSustainability@ofgem.gov.uk.

5.7 This must be emailed when the application for preliminary accreditation is made via the Renewables and CHP Register.

5.8 The preliminary FMS questionnaire is a less intensive FMS process that ensures that the generator is not using sewage as a feedstock in their digester. The FMS procedures are proposed and agreed during the full accreditation application process.

Applications for full accreditation

5.9 The full FMS questionnaire must be uploaded in response to question 'QJ700' on the ROO-FIT application made via the Renewables and CHP Register.

5.10 A copy must also be submitted to our Renewable Electricity Fuelling & Sustainability team, to FuellingandSustainability@ofgem.gov.uk.

Amended FMS information

5.11 If there are any changes to your feedstocks or FMS procedures you will need to submit an amended FMS questionnaire to fuellingandsustainability@ofgem.gov.uk. You should also ensure you agree these changes with us before making them at your installation.

Format of FMS procedures – 'FMS Questionnaire'

5.12 The proposed FMS procedures must be provided on the Microsoft Word template available on our website.[17]

5.13 Depending on your specific circumstances different sections of the FMS questionnaire will need to be completed. More information on this and a note on instructions for completing FMS procedures are available on our website[18].

Agreement of FMS: case-by–case approach

5.14 We recognise that no single installation is identical to another and that different installations will use combinations and quantities of fuels from different sources. We will therefore agree FMS procedures on a case-by-case basis, according to the specific setup and conditions at each installation.

5.15 However before agreeing FMS procedures, we must be satisfied that the approach you are proposing is capable of adequately demonstrating ongoing compliance with the fuel requirements as set out in the legislative framework.

5.16 The onus for the production of suitable FMS procedures lies with the generator. However, we can look at any source of information that may be used to determine that the sustainability requirements and feedstock criteria are met (whether or not this information has been provided by the generator).

Quarterly FMS measurement: carry-over of fuel-stocks

5.17 Measuring the volume of biogas used to generate electricity in a quarterly period is required as part of calculating FIT generation payments. As biogas is formed from feedstocks it is important to account for any carryover of the feedstock from the previous quarter. This means that the weight of any feedstocks carried over from the previous quarter must be measured in the quarter of use.

5.18 A restrictive approach to accounting accurately for the weight of feedstock(s) used within a quarter could mean that measurements had to be taken at the stroke of midnight on the last day of each quarter. Since this is not practical we will accept measurements taken +/- 3 days of the end of the quarterly period in line with the approach taken on the RO and RHI schemes.

5.19 We encourage generators to take weight measurements of stock carried over from one quarterly period to the next at the same time each quarterly period so that the qualifying percentage (proportion of electricity used that came from eligible sources) can be measured accurately.

5.20 When assessing measurement and sampling information for stock carried over from one quarterly period to the next, we will take a pragmatic approach. For example, where an installation uses unsustainable fuels and submits relevant information on stock levels, we may be able to accept estimates of stock levels (as opposed to requiring sheds to be emptied and stock taken back over weighbridges) in circumstances where we are satisfied that the proposed estimation techniques offer an acceptable level of accuracy and reliability.

[17] Available at: https://www.ofgem.gov.uk/publications-and-updates/fit-anaerobic-digestion-fuel-measurement-and-sampling-fms-questionnaire-and-guidance-note
[18] Available at: https://www.ofgem.gov.uk/publications-and-updates/fit-anaerobic-digestion-fuel-measurement-and-sampling-fms-questionnaire-and-guidance-note

Reporting by consignment

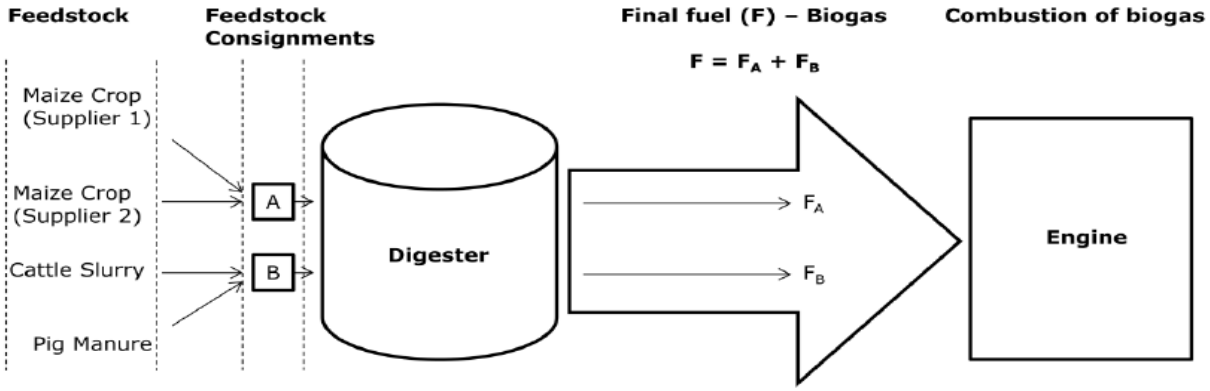
5.21 As part of the FMS process, we require generators to consider whether they are using multiple consignments, and whether there is any mixing of these consignments at the installation site or in the supply chain. For further information on mixing of consignments and mass balance systems, see Chapter 4.

5.22 Sustainability characteristics are passed from the feedstock to the final fuel (biogas). Therefore, a consignment of biogas is derived from a feedstock consignment. A feedstock consignment consists of any feedstocks that have identical sustainability characteristics.

5.23 In Figure 4 below, the final fuel (biogas) for combustion is apportioned according to Consignment A and Consignment B. The example shows how an applicant can group feedstock with identical sustainability characteristics together to form Feedstock Consignment A (Maize crop from two different suppliers). Feedstock Consignment B represents the feedstocks (pig manure and cattle slurry) which are considered to be sustainable.

5.24

Figure 4: Example of how to apportion biogas derived from multiple feedstock consignments.



5.25 The resulting final fuel (F), in this case biogas, can then be apportioned according to the consignments of Consignment A and Consignment B.

5.26 Generators can use our Biogas Apportioning Tool[19] to apportion their resultant biogas, which requires the user to input the mass (dry or wet) of each feedstock used. Together with built in default literature data on biogas yield and moisture content, the tool calculates the percentage contribution due to each feedstock. This tool can be used by FIT and RHI generators.

5.27 Generators are welcome to propose an alternative method to apportion their biogas, and will need to demonstrate its suitability.

[19] Available at https://www.ofgem.gov.uk/publications-and-updates/non-domestic-rhi-and-fit-biogas-and-biomethane-apportioning-tool

Measuring and sampling fuels

Weight measurements

The following tables provide examples of how you may wish to weigh your feedstock:

Table 3: Example of weight measurement using a weighbridge and stock calculation

Question	**Weight measurement using a weighbridge**	**Weight measurement using a weighbridge and stock calculation**
When is the weight measurement taken?	At installation on delivery	At installation on delivery and stock calculation at quarter end.
How is the weight measurement taken?	By totalising weighbridge deliveries	By totalising weighbridge deliveries and performing a stock calculation at the end of each quarter.
How often is the weight measurement taken?	Every delivery	Every delivery and at a stock calculation at the end of each quarter.
How is fuel carried over from one quarter to the next accounted for?	Stocks run down at quarter end	By a stock calculation at quarter end. This can be done typically by transit over a weighbridge, survey of the stockpile, or level measurement of a bin.
Are any industry standards met?	The British Standard BS EN 30012-1 for weighbridge calibration. This presents in detail methods of calibration for static weighing devices and for determining periodic confirmation intervals. This is reviewed with further details in the following code of practice: Code of Practice for the Calibration of Industrial Process Weighing Systems, Institute of Measurement and Control, October 2003.	
How is accuracy ensured?	Weighbridges will normally achieve an accuracy of +/- 0.5% of the load. Generators with public weighing equipment have responsibilities to ensure that they can perform their	Accuracy can be maximised by operating the stocking area so as to reduce the remaining quantity to a very low level at the period end. This could be achieved by separating

	duties competently and honestly. No one may operate public weighing equipment unless they hold a certificate from a Chief Trading Standards Officer. If the weighbridge is not at a public weighing facility, good practice would be that the weighbridge is operated as if it were, and that the appropriate certificate is obtained. Regular calibration is an integral part of the quality assurance of all weight measurements.	each period's stock. Weighbridges will normally achieve an accuracy of +/- 0.5% of the load. Generators with public weighing equipment have responsibilities to ensure that they can perform their duties competently and honestly. No one may operate public weighing equipment unless they hold a certificate from a Chief Trading Standards Officer.

6. Demonstrating compliance and voluntary schemes

Chapter summary

This chapter sets out how voluntary schemes can be used to demonstrate compliance and the different types of recognised voluntary schemes.

Demonstrating compliance with the criteria

6.1 When the generator is reporting that they meet the criteria, or are using exemptions, they must retain the relevant evidence which demonstrates their compliance. [20]

6.2 Generators can show that they comply with the sustainability criteria, by collecting information and/or using voluntary schemes as evidence. Any information or evidence should be kept by the relevant party and made available if needed for verification, even if it is held by the supply chain. This does not need to be in paper copy – electronic format is acceptable.

6.3 Other people in the supply chain may have some of the evidence (for example, evidence for meeting land criteria). The generator should have enough information to be confident about reporting sustainability information to us. For this, the generator may be relying on contractual agreements.

6.4 If you want to read more about the type of information and data which may be considered relevant evidence to demonstrate compliance refer to the applicable sections of this document.

6.5 Aside from the option to collect evidence, it is also possible to use voluntary schemes to demonstrate compliance.

Recognised voluntary schemes

6.6 Voluntary schemes are certification schemes used to assure us that a fuel meets part or all of the sustainability criteria. These schemes often provide further information and additional guidance on demonstrating compliance with the relevant criteria.

6.7 Voluntary schemes typically have a specific scope for which they are recognised. The generator of an eligible installation may use more than one voluntary scheme or a combination of voluntary schemes and collect other information.

6.8 If all or part of the supply chain is covered by a voluntary scheme, the operator can use this as evidence for demonstrating compliance with the relevant aspects of the FIT sustainability criteria. If there is a break in the voluntary scheme certification in the supply chain, the certification cannot be used as

[20] Compliance must be with the criteria set out in the legislative framework. Compliance with another member state's requirements may not provide sufficient evidence to demonstrate compliance with the legislative framework.

automatic compliance and instead the generator's independent auditor would need to view this as part of the evidence.

6.9 To be registered with a voluntary scheme, the relevant party will typically be audited by an independent third party to ensure compliance with the scheme rules, before they can obtain certification by that voluntary scheme. Further audits will normally be needed to maintain certification, according to the requirements of that scheme.

6.10 The generator may make use of voluntary schemes approved by the EC or recognised by the UK government to demonstrate compliance with the FIT sustainability criteria (see Appendix 1). As parties will have been audited by the scheme, a generator's independent auditor may be able to rely on the audit conclusion/assessment result when providing assurance within the FIT sustainability audit report.

6.11 Any voluntary schemes which are neither EC-approved nor recognised by the UK government may still be used to demonstrate compliance with aspects of the FIT sustainability criteria, but these will be considered alongside other evidence as part of the annual independent sustainability audit or Ofgem audit. The independent auditor will need to review the voluntary scheme to consider which aspect(s) of the FIT sustainability criteria the scheme rules correspond with.

Using EC-approved voluntary schemes

6.12 The EC formally assesses voluntary schemes[21] for biofuels to judge whether the schemes demonstrate compliance with the RED sustainability requirements, including the GHG and land criteria, the mass balance and auditing requirements. These schemes may be approved for a specific feedstock or geographical location as well as a specific scope only, eg the land criteria, and/or the GHG criteria and/or the methodology to calculate actual values, and/or the mass balance.

6.13 The EC has approved a number of voluntary schemes, and member states are required to accept these as demonstrating compliance with the criteria. Any decision by the EC takes precedence over any assessment made by the UK government, or other member states. We will recognise any voluntary scheme recognised by the EC from the date the EC decision takes effect, subject to parties in the supply chain being audited against the version of the voluntary scheme the EC decision refers to.[22]

6.14 The EC might decide to not approve a scheme for the same scope previously recognised in an assessment for the UK government. We will usually continue to recognise the scheme for the outlined scope assessed by the UK for the remainder of the obligation year. After that, the decision from the EC will be followed. In some cases, compliance with the voluntary scheme may still be useful to provide supporting evidence towards compliance with the FIT sustainability criteria.

[21] It is the responsibility of voluntary schemes to apply to the EC for recognition against the RED

[22] EC decisions take effect 20 days after publication in the *Official Journal of the European Union*

6.15 EC decisions on voluntary schemes will be published on the EC's transparency platform.[23] This also includes a useful table noting the schemes and their scope.

Using UK-recognised voluntary schemes

6.16 In 2012 we benchmarked a number of voluntary schemes against the RO's protected land criteria for non-woody biomass under the ROO 2009 (as it then was) for use on the RO scheme. In 2015 our RO team also undertook an exercise to benchmark these schemes against the ROO 2015 sustainable source land criteria for woody biomass for the purpose of the RO scheme. The results of this exercise are also being used on FIT and RHI. Please see Annex 2 of the RO: Sustainability Criteria[24] guidance.

[23] http://ec.europa.eu/energy/renewables/transparency_platform/transparency_platform_en.htm

[24] Available at: https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-sustainability-criteria

7. Sustainability – land criteria

Chapter summary

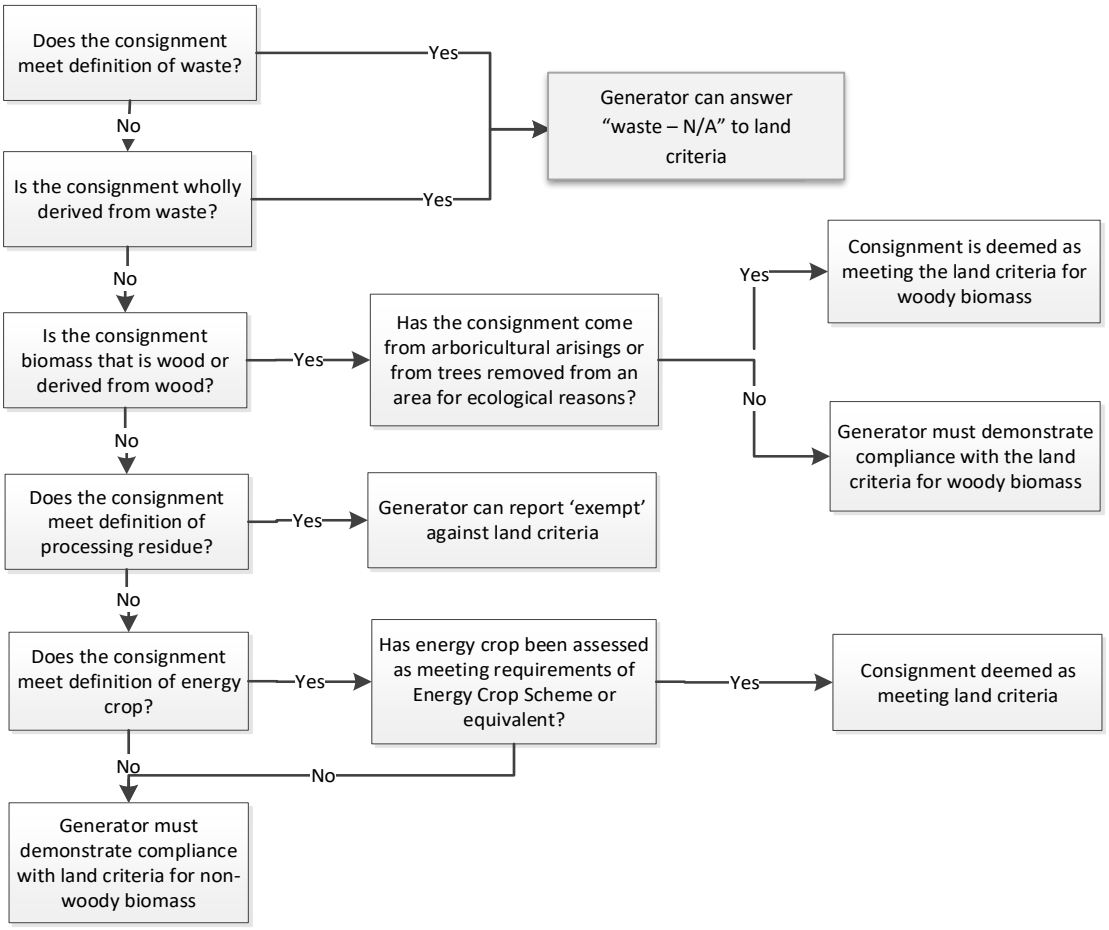
This chapter provides information on the land criteria that generatorsI must report against and how to demonstrate compliance.

7.1 Generators must report against the land criteria, which aims to protect land with a high biodiversity value and high carbon stock values.

7.2 The land criteria refer specifically to the production of the raw material, ie at the farm, forest or plantation. They do not apply to any other steps further down the supply chain.

7.3 There are two types of land criteria: the land criteria for woody biomass and the land criteria for non-woody biomass. The type of feedstock used will affect which type of land criteria to report against. However, please note that all liquid feedstocks are deemed to be unsustainable for AD installations.

Figure 5: Overview of land criteria requirements (for non-liquid consignments)



Exemptions to the land criteria

7.4 A fuel that is not wood or derived from wood and is classified as a waste or a residue meets the land criteria (for more information on fuel classification please see Chapter 3). When submitting their quarterly declaration, the generator should specify the classification of fuel. The generator will need to collect information to justify the applied fuel classification during independent audits. This information may also be requested by us.

7.5 Aside from the fuel being waste or wholly derived from waste there are no exemptions to the land criteria for woody biomass, based on fuel classification, for wood. However, arboricultural arisings and trees removed from an area for ecological reasons are deemed to be sustainable, and therefore meet the land criteria for woody biomass.

7.6 For fuels that are not considered exempt, the generator must demonstrate compliance with the relevant criteria (either the wood or non-wood land criteria). Figure 5 is a diagram to identify the suitable criteria for reporting.

Land criteria for woody biomass

7.7 If the biomass used to generate electricity was wood or derived from wood the generator is required to report against the land criteria for woody biomass.

7.8 The Woodfuel Advice Note[25] has been published by BEIS to provide accessible advice and guidance on the requirements and how to demonstrate compliance against them. It is recommended that generators refer to this document to become more familiar with the requirements.

7.9 There is a '70:30 threshold' which applies in demonstrating that woodfuel meets the land criteria:

- In line with the EUTR 100% of woodfuel used must meet the legality requirements; and either
  - at least 70% of each consignment must meet the sustainability requirements outlined in the Woodfuel Advice Note; or
  - at least 70% of all the woodfuel used in a quarterly period must meet the sustainability requirements outlined in the legislative framework
- the fuel used is certified by an environmental quality assurance scheme[26] that has been benchmarked by the RO (see Chapter 6), which ensures that at least 70% of the biomass certified by the scheme meets the sustainability requirements outlined in the Woodfuel Advice Note.

Demonstrating compliance

7.10 Evidence to demonstrate compliance with the land criteria for woody biomass should include evidence that traces the biomass from the source to the end user. There are two routes to demonstrate compliance outlined in the Woodfuel Advice Note, which reflect what we would expect to be used:

[25] Available at: https://www.gov.uk/government/publications/woodfuel-guidance-version-2
[26] "environmental quality assurance scheme" means a voluntary scheme which establishes environmental or social standards in relation to the production of biomass or matter from which a biomass is derived

- Category A evidence: Through the use of Forest Stewardship Council (FSC) certificate scheme or the Programme for the Endorsement of Forest Certification (PEFC) certification scheme.

- Category B evidence: Through the collection of bespoke evidence that demonstrates compliance with the criteria. The 'risk-based regional approach' can be used with this method.

7.11 Both routes of demonstrating compliance are described in more detail in the Woodfuel Advice Note.

7.12 It is recognised that it may be challenging to meet the criteria via the use of Category B evidence and therefore to support this, our RO team have benchmarked these schemes against the ROO 2015 legislation. The results of this exercise are also being adopted on RHI.

7.13 There are two scenarios in which woodfuel can be 'deemed sustainable' against the woodfuel land criteria:

- The woodfuel was residue from arboriculture. In line with BEIS' consultation response in August 2014[27], arboricultural residues are considered to be material from woody plants and trees planted for landscape or amenity value that are removed as part of tree surgery usually in gardens, parks or other populated settings, and utility arboriculture such as the verges of roads and railways.

- The woodfuel was removed for the purpose of restoring or maintaining the ecosystem of an area which was not a forest.

7.14 'Deemed sustainable' woodfuel can count towards the 70% sustainable proportion in mass balance calculations.

7.15 Further advice on how to comply with these requirements has been published by BEIS. This includes the Woodfuel Advice Note, guidance on the consignment and mass balance approach, and guidance on the checklist approach to the risk-based regional approach to demonstrating compliance.[28]

7.16 A number of different documents have been produced to explain the woodfuel land criteria, and we recommend that generators refer to these. We have not replicated the detail in this guidance document.

Land criteria for non-woody biomass

7.17 For biomass that is not wood or derived from wood, or exempt on the basis of fuel classification, the generator must demonstrate compliance with the land criteria.

7.18 This sets out that biomass cannot be obtained from a protected source. This means that the requirements are not met if the biomass was obtained from any of the following:

[27] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/343005/Response_to_Biomass_Consultation.pdf

[28] Available at: https://www.gov.uk/government/publications/woodfuel-guidance-version-2

- land which at any time during or after January 2008 was primary forest,
- land which at any time during or after January 2008 was land designated for nature protection purposes (unless production of that biomaterial did not interfere with purposes for which this land was designated),
- highly biodiverse grassland, unless the harvesting is necessary to preserve the grassland status,
- land which at any time during January 2008 was peatland (unless the cultivation and harvesting of biomaterial did not involve the drainage of previously undrained soil),
- a former continuously forested area, or
- a former wetland area.

7.19 If a land-use change is permitted under the criteria (eg non-highly biodiverse grasslands to cropland), then a carbon stock calculation resulting from the land-use change will need to be performed. The associated GHG emissions will need to be calculated and added to the supply chain emissions. The relevant GHG threshold will still need to be met for the fuel to be compliant with the GHG criteria.

Residues

7.20 Biomass which is not wood-based but can be classified as a processing residue will be considered to have met the land criteria.

7.21 In such cases the generator will need to be able to demonstrate that their fuel has been correctly classified as a residue, and the type of residue.

Energy Crops

7.22 An energy crop will be considered to meet the land criteria where financial assistance has been paid under the Energy Crops Scheme for that energy crop, or under an equivalent financial assistance scheme.

7.23 The Energy Crop Scheme is managed by Natural England and offers grants to farmers in England for establishing miscanthus and short rotation coppice for their own energy use or to supply power stations. The scheme closed to new applications on 31 August 2013.

7.24 If a generator is making use of an energy crop which is supported under a scheme which is thought to be equivalent to the Energy Crops Scheme, they will need to set out the case clearly making a comparison to the requirements of the scheme against the Energy Crops Scheme for consideration.

Demonstrating compliance

7.25 To demonstrate compliance with the land criteria, the generator can use relevant voluntary schemes and/or collect evidence to support the land use from where the biomass was sourced. We benchmarked a number of voluntary schemes against the land criteria in 2012. If the generator is using any of these schemes, they should refer to Chapter 6 and Appendix 1 for more information.

7.26 If the generator seeks to collect evidence to demonstrate compliance with the criteria, they should do this by collecting information on the land use of the farm/plantation in January 2008 (and after this date, where applicable).

7.27 The following types of evidence could be useful in demonstrating compliance; aerial photographs, satellite images, maps, land register entries/databases, and site surveys.

7.28 The evidence can be direct or indirect with regard to the format of the information supplied. For example, you could demonstrate compliance with the criterion about primary forest with evidence such as:

- An aerial photograph of the land, showing that it is planted with short rotation forestry (direct);
- A map of all the primary forests in the region, showing the land to fall outside of them (indirect).

Other useful resources

7.29 It may be useful for generators to draw on other sources of guidance to help them determine the land use and gather evidence of this to demonstrate compliance with the land criteria.

7.30 The EC has produced a guidance document to help identify the status of the land in January 2008 for demonstrating compliance with land criteria. This was produced for use with bioliquids and biofuels to demonstrate compliance with the RED land criteria, but is also useful for solid biomass and biogas where the same criteria are relevant. It is available on the Transparency Platform.[29]

7.31 For UK-sourced biomass, DEFRA is a useful source of information about land use. They have a list of evidence sources in the UK that might be useful for generators to demonstrate compliance with the land criteria. This list has been designed specifically for biofuels under the RTFO and is not exhaustive. Generators may need to draw on several sources as the work done by DEFRA was not done specifically to show compliance with the FIT sustainability criteria.[30]

7.32 The European Committee for Standardization[31] (CEN) has published sustainability standards for bioliquids and biofuels, including one titled 'biodiversity and environmental aspects related to nature protection purposes' (published August 2012). This provides guidance on evidence that the production of raw material has not interfered with nature protection purposes for the land criteria. This may also be useful in relation to biomass and biogas.

7.33 The Forestry Commission, Forestry Commission Scotland, Natural Resources Wales and other countryside agencies may be able to help generators, as they have useful resources and guidance on providing evidence.

[29] Inventory of data sources and methodologies to help identify land status. Available at http://ec.europa.eu/energy/renewables/biofuels/sustainability_criteria_en.htm
[30] Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/2625/rtfo-supporting-claims-compliance.pdf
[31] CEN Sustainability criteria for biomass: http://www.cen.eu/cen/Sectors/Sectors/UtilitiesAndEnergy/Fuels/Pages/Sustainability.aspx

Land categories

7.34 To establish whether the land that the biomass comes from meets the criteria, the generator must consider what type of land it is, ie the land category.

7.35 To help, Table 4 shows some common land categories and indicates which land categories may comply with the land criteria.

7.36 The categories 'cropland', 'grassland' and 'forestland' specifically refer to the land cover. The categories 'peatland' and 'wetland' refer to other characteristics of the land, such as soil properties, that are not mutually exclusive with cropland, grassland or forest. For example, a forest may be located on peatland, and grassland may be located on a wetland. 'Peatland', 'wetland' and their variations should always be considered as taking precedence over the land types 'cropland', 'grassland' and 'forestland' and their variations. For example, if a plantation is located on peatland this should always be considered as peatland, irrespective of whether it had forest or grassland on it.

Table 4: Categories of land and whether they comply with the land criteria

Land category	**Description**	**Land Criteria**
Cropland - non-protected	The Cropland is not in a nature protected area. This category includes cropped land, (including rice fields and set-aside[32]), and agro-forestry systems where the vegetation structure falls below the thresholds used for the forest land categories.[33]	Complies.
Cropland – protected	Same as above, but the Cropland is in a nature protection area.	Complies if evidence is provided that shows the production of the fuel did not interfere with the nature protection purposes of the land. The appropriate evidence will depend on the specific nature protection purposes; however, this might be expected to include evidence of actions taken to avoid damage to or actively maintain the nature protection purposes. Evidence could also be provided through reporting a voluntary scheme that meets the RED biodiversity criteria.
Primary forest	This is namely forest and other wooded land of native species, where there is no clearly visible indication of human activity	Complies only if the solid biomass was obtained previous to January 2008.

[32] 'Set-aside' is a term related to the EU's Common Agricultural Policy (CAP). It refers to land taken out of production to reduce the risk of food surpluses, while increasing the opportunity for environmental benefit. From 2007 set-aside land has been abolished under the CAP.
[33] EC Communication 2010/C 160/02 considers that perennial crop plantations, including oil palm plantations, are classified as cropland.

	and the ecological processes are not significantly disturbed.	If the solid biomass was obtained during or after 2008, this does not comply.
Continuously forested area (forest >30%)	Continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30%, or trees able to reach those thresholds in situ.[34].	Complies only if the status of the land has not changed. Evidence of the nature and extent of the forest will need to be provided for the time the raw material was harvested.
Highly biodiverse grassland	This can be either: Highly biodiverse grassland that is natural, namely grassland that would remain grassland in the absence of human intervention and which maintains the natural species composition and ecological characteristics and processes; or Highly biodiverse grassland that is non-natural, namely grassland that would cease to be grassland in the absence of human intervention and which is species-rich and not degraded, unless evidence is provided that the harvesting of the raw material is necessary to preserve its grassland status.	This does not comply unless the harvesting is necessary to preserve the grassland status.
Wetland	Namely land that is covered with or saturated by water permanently or for a significant part of the year.	Complies only if the status of the land has not changed. Evidence of the nature of the land will need to be provided for the time the raw material was harvested. Complies only if the status of the land has not changed. Evidence of the nature and extent of the wetland will need to be provided for January 2008 and the date when the raw material was harvested.
Peatland	Land consisting largely of peat.	Complies only if the land was *not* peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material did not involve drainage of previously undrained soil.
Settlement	All developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories. Examples of settlements include land along streets, in residential (rural and urban) and commercial lawns, in public and private gardens, in golf courses and athletic fields, and in parks, provided such land is functionally or administratively associated with particular cities, villages or other	Complies.

[34] Article 17, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

	settlement types and is not accounted for in another land use category.[35]	

7.37 In some cases, the actual land cover may not be the same as the land category designated in a country's land registry. Generators who find themselves in this situation should consider the actual land cover rather than that stated in the registry. For example, it is feasible that the land is or was designated for future agricultural purposes in a land registry, but the actual land cover (if you visit the site) is forestland. In this example, the land should be considered as forestland.

7.38 Cropland specifically refers to land that is under the control of a farm or plantation. It is possible that the land at a single farm is not exclusively cropland, but also includes other land uses (for example, forestland). If the land cover does include forestland, the generator will have to demonstrate that there has been no conversion of that forestland after January 2008. However, if the land used to produce the feedstock is cropland, 'cropland' should be reported.

7.39 The land category 'cropland - non-protected' can be reported only if the land in question fully meets the land criteria. Similarly, the land category 'cropland - protected' can be reported only if the generator has evidence that the production of the raw material, from which their biomass is sourced, did not interfere with the nature protection purposes of the land.

Energy Crops

7.40 An energy crop will be considered to meet the land criteria where financial assistance has been paid under the Energy Crops Scheme for that energy crop, or under an equivalent financial assistance scheme.

7.41 Generators must be able to demonstrate that their fuel meets the definition of energy crop in order to demonstrate that the land criteria have been met in accordance with the previous paragraph.

7.42 In addition to this, suitable evidence will also need to be available to demonstrate that the energy crop has been assessed as meeting the requirements of the Energy Crop Scheme, or equivalent, and to show that financial assistance has been paid. As with any of the evidential requirements, the generator may need to provide a suite of evidence rather than relying on a single document for audit purposes. Here are examples of what this evidence may be:

- a copy of the offer letter signed by the energy crop grower,
- confirmation of the payment of the grant, and/or
- additional confirmation that the requirements set for the grower have not been breached, requiring the repayment of the grant.

[35] Definition from IPCC Guidelines for National Greenhouse Gas Inventories, volume 4, 2006

8. Sustainability – greenhouse gas criteria

Chapter summary

Generators must report against the greenhouse gas (GHG) criteria to demonstrate their installation has met the sustainability criteria. This chapter outlines the GHG thresholds and describes the methodologies to calculate the GHG emissions for each consignment of feedstock.

8.1 The legislative framework shows that the generator must report on the GHG criteria against each consignment of biomass and also specifies the methodology for calculations and the thresholds that must be met.

8.2 The relevant maximum GHG thresholds can be seen in table 5.

8.3 Reporting of GHG emission values must be per consignment of feedstock used for each quarterly period, given in grams of CO_2 per MJ of electricity (gCO_2e/MJ electricity).

8.4 Every consignment of feedstock must meet the GHG threshold to be eligible to receive full FIT generation payments. FIT export payments will not be affected. However, please note that all liquid feedstocks are deemed to be unsustainable for AD installations.

Table 5: GHG emission thresholds for AD installations

	From 1 May 2017 to 31 March 2020	**From 1 April 2020 to 31 March 2025**	**From 1 April 2025 onwards**
GHG emission threshold	66.7gCO_{2eq}/MJ electricity	55.6 gCO_{2eq}/MJ electricity	50.0gCO_{2eq}/MJ electricity

8.5 Throughout this chapter we refer to GHG emissions of biomass as 'carbon intensity'. This is measured in terms of the lifecycle GHG emissions associated with the biomass as carbon dioxide equivalent (CO_{2eq}). It therefore includes GHG other than carbon dioxide (eg methane and nitrous oxides).

Performing GHG calculations

8.6 Where a generator is required to calculate the carbon intensity of their fuel, they have the following methods available to them:

- Default value method
- Actual value method

8.7 Where a generator has a choice between the default value method and actual value method it will be up to them to determine their preferred approach. Please note the following:

- The actual value method can be time consuming and may require a large amount of verification. However, employing this method may allow the generator to understand more about their supply chain and where carbon savings can be made.

- The default value method provides a much less burdensome route than the actual value method to demonstrate that the GHG criteria have been met. This method can only be used for installations with a capacity of less than 1MW. Default carbon intensities are conservative; this means they are expected to be higher than the emissions calculated using the actual value method. Only certain fuels are covered.

8.8 If more than one fuel is being used, and the generator is able to choose between the actual value method and the default value method, they are permitted to use both methods. For example, they may use the default value method for biogas from wheat and straw and the actual value method for biogas from maize.

Default value method

8.9 The default value method involves using a default carbon intensity of the fuel(s) being used for the purpose of reporting GHG emissions to us.

8.10 The fuels which have default values associated with them are set out in the legislative framework. For ease of reference, the default values are replicated in Appendix 3.

8.11 Please note that installations using these fuels which have a TIC ≥1MW will not be eligible to use the default value method. They must therefore use the actual value method.

8.12 The default carbon intensities may also only be reported if emissions from land use change are not greater than zero (see Appendix 3 for how to calculate these). For fuel chains in which land use has changed, the default value can only be used if combined with the emissions from the land use change.

8.13 The generator must be able to demonstrate that the fuel specified for which they are utilising the default carbon intensity value, does correspond to the actual fuel they are using.

8.14 The default values for GHG emissions savings for the various biomass feedstocks only provide the carbon intensity of the fuel itself, and not the electricity generated, which needs to be reported to us. Therefore, before reporting to us, the generator must perform a single calculation using the default value and the actual conversion efficiency of the eligible installation. This calculation is set in paragraphs 8.24-8.25.

Actual value method

8.15 The actual value method involves assessing the carbon intensity for each stage within the fuel lifecycle. The methodology for this GHG calculation is set out in the legislative framework. It refers to Part C of Annex 5 of the Renewable Energy Directive[36] (RED) and includes some specific modifications to the methodology specified in the RED to tailor its applicability to FIT.

[36] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN

8.16 The methodology specifies which GHG emissions must be accounted for when determining the carbon intensity of the biomass. In calculating emissions, the actual value method does not specify that all values must be actual data associated to their specific circumstances. A generator can make use of actual data which are relevant to their specific supply chain alongside standard input data from relevant sources such as academic literature.[37]

8.17 For example, actual data could be the transportation distance from the point of feedstock collection to the installation, whereas standard input data may be a literature value of the carbon intensity for the type of fertiliser used.

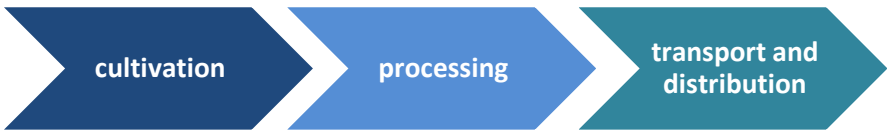
8.18 If you are using the carbon calculator[38], there is reference to 'default fuel chains' and 'default values'. These are not related to the values provided in the legislative framework for the 'default value method.' The 'default values' provided in the calculator are typical or indicative values that should be adapted for your fuel chain where needed. There are no restrictions on which generators can make use of these values – but it must always be considered whether they require adapting for the generator's particular fuel chain(s). You can find a user guide for the carbon calculator in a subsidiary document on the carbon calculator page on our website, which provides information on how to use these default values and default fuel chains.

8.19 According to the methodology, the total carbon intensity of biomass is the sum of the following, minus any emission savings[39]:

- emissions from the extraction or cultivation of raw materials,
- annualised emissions from carbon stock changes caused by land-use change (if applicable),
- emissions from processing, and
- emissions from transport and distribution.

8.20 These can be broadly categorised into three main stages as shown in figure 6.

Figure 6: Summary of key steps in GHG calculations



8.21 In an actual supply chain, there may be more than one transport or processing step. Figure 7 provides an example of a typical fuel chain.

Figure 7: Example of a crop to electricity generation fuel chain through the production of biogas: sugar beet (KEY: Dark blue: Cultivation and harvesting, Teal: Transport and distribution, Blue: Processing, Orange: electricity generation.)

[37] There is some standard input data pre-built into the Carbon Calculator that generators can make use of if appropriate for their fuel
[38] https://www.ofgem.gov.uk/publications-and-updates/uk-solid-and-gaseous-biomass-carbon-calculator
[39] Emission savings may be related to soil carbon accumulation via improved agricultural management, carbon capture and storage/replacement and excess electricity from co-generation, in line with the RED methodology.

8.22 Where, due to a material's fuel classification, the emissions must be calculated 'from the process of collection' the methodology for calculation is the same except there will be no emissions associated with cultivation.

8.23 Where material is added to solid biomass to act as a binding agent or to reduce the emissions of dust, carbon dioxide, methane or nitrous oxide from the use of the biomass, the material will be considered as having zero GHG emissions, as long as it does not exceed 2% of the biomass in terms of weight.

GHG emissions and efficiency calculations

8.24 For AD installation producing electricity only, the GHG emissions value to report to us must be calculated using the following formula:

$$\frac{E}{\eta_{el}}$$

8.25 For AD installations producing both heat and power, the GHG emissions value to report to us must be calculated using the following formula:

$$\frac{E}{\eta_{el}}\left(\frac{\eta_{el}}{\eta_{el}+C_h\times\eta_h}\right)$$

Where:

E = the GHG emissions expressed in grammes of $CO_{2(eq)}$ per MJ of electricity produced from the production of the biomass or biogas

η_{el} = the efficiency of the plant in the generation of electricity, which is equal to A/F, where:

A = the total electricity generated by the installation from all fuels used in that installation (MJ)

F = the energy content (net calorific value) of all those fuels (MJ) used to generate electricity

η_h = the efficiency of the installation in the generation of heat, which is equal to H/F, where:

H = the total heat produced by the installation in the form of liquid or steam in the relevant quarter from all fuels used in that installation

C_h = 0.3546 where the temperature of the heat produced by the installation in the form of liquid or steam is <150°C; or = (T – 273)/T, where T is the temperature in Kelvin of the heat produced by the installation in the form of liquid or steam.

Allocation factors, input data and emission factors

8.26 When working through the actual value method, you will likely make use of allocation factors for co-products, input data and emission factors. The following sections provide further information on these terms and how to use them.

Allocation factors

8.27 In some cases, when a feedstock is produced, other useful products are made at the same time. These are termed 'co-products'.

8.28 In these cases it is important that all of the emissions at the point at which the co-products are produced are split between the different co-products. This proportioning of emissions is referred to by the term 'allocation factor' which is determined by performing a calculation.

8.29 In most cases, the upstream emissions should be allocated between the different co-products based on the energy content (determined by net calorific value in the case of co-products other than electricity) of each co-product.

8.30 To calculate the emission factor follow these steps:

Step 1: Calculate or look up the net calorific values of all products exported from the conversion plants (both the main exported product and all the co-products) – each of these values should be expressed in MJ/kg of product. NOTE: calorific values of common co-products are part of the list of standard emission factors.

Step 2: Calculate the total energy contained in each product exported from the eligible installation (the main product and the co-products) by multiplying the amount of product (expressed in kg of product) by its net calorific value. This gives the energy content of each exported product.

Step 3: Sum of all values in Step 2 to give the total energy content of products exported from the eligible installation (expressed in MJ).

Step 4: For a particular product, divide the energy content of that product (Step 2) by the total energy content of products exported from the eligible installation (Step 3). This gives the proportion of emissions which should be allocated to that product. This can also be done for each of the co-products.

8.31 If one of the co-products during the production of the biomass is useful heat, then the emissions should be allocated between the different products by taking into account the energy content of all the co-products and the temperature of the useful heat based on this formula:

Allocating emissions when useful heat is co-produced

$$A_i = \frac{E}{\eta_i}\left(\frac{C_i\eta_i}{C_i\eta_i + C_h\eta_h}\right)$$

Where:

A_i = allocated GHG emissions at allocation point to co-product, *i*

E = total GHG emissions up to allocation point

η_i = the fraction of co-product, measured in energy content, defined as the annual amount of co-product produced divided by the annual energy input

η_h = the fraction of heat produced together with other co-products, defined as the annual useful heat output divided by the annual energy input

C_i = fraction of exergy in the energy carrier (other than heat), equal to 1

C_h = Carnot efficiency (fraction of exergy in the useful heat)

The Carnot efficiency, C_h, is calculated as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

Where:

T_h = temperature of the useful heat, measured in Kelvin at point of delivery

T_0 = temperature of surroundings, set at 273 Kelvin.

For T_h < 150°C, C_h is set to 0.3546.

8.32 If the co-product is excess electricity from co-generation during the production of biomass or biogas, the emission saving shall be taken to be zero.

Input data

8.33 When using the actual value method, generators are advised to focus on parameters which have an impact on the overall results, ie inputs that change the carbon intensity by more than 1% when included. Factors that you should consider include:

- nitrogen fertiliser application rate,
- crop yield,
- fuel consumption for cultivation,
- transport distances and mode of transport,
- process mass efficiency[40],
- fuel type and demand,
- electricity demand, and
- co-product yield and energy content.[41]

8.34 Aside from the restrictions noted in paragraph 8.34, it is possible to use standard input data in place of actual data. When using standard input data the generator should be sure that values correspond to the type of biomass fuel being used at the eligible installation in terms of feedstock type, form, region of origin and if relevant, the drying technique.

[40] tonnes of product per tonne of input

[41] The energy content of co-products should be based on their lower heating value (LHV) (or net calorific value). By convention, the LHV is considered to be the heat released during the combustion of a fuel, with starting temperature at 20°C and end-state temperature at 125°C for all products. For the purposes of the carbon intensity calculations laid out in this guidance, LHV can either be found in scientific literature or measured in calorimeters.

8.35 A range of input data was agreed by BEIS (previously DECC at the time the decision was made) to be used in the carbon calculator. Appendix 3 sets out a number of these inputs. Where actual input data is being used, these are not required.

8.36 There are some forms of input data which are heavily interdependent. Table 6 below sets out these compulsory dependencies which generators must follow where they are using actual data for one of the inputs. For example, the yield of many crops is influenced heavily by the amount of nitrogen which has been applied, and as such, if actual data is provided for yield, actual data is also required for nitrogen input.

Table 6: Compulsory links between interdependent parameters

Input one	**Input two**
Crop production	
Crop yield[42]	Nitrogen fertiliser application rate
Nitrogen fertiliser application rate	Soil N_2O emissions[43]
Conversion	
Efficiency	Any co-product yield
Electricity or heat exported	Fuel use

Emissions factors

8.37 Emissions factors are used to calculate the GHG emissions associated with the production of an input material. For example, the emissions factor for nitrogen fertiliser provided in the carbon calculator for March 2015 is 4.57 kg of CO_{2eq} per kg of nitrogen applied ($kgCO_{2eq}/kgN$), based on the emissions from producing and transporting the fertiliser. This factor is used in combination with the application rate of the fertiliser (in kg N/ha) and the yield of the crop (in t/ha) to give the contribution of the use of the nitrogen fertiliser to the overall carbon intensity of the production of the crop (in $kgCO_{2eq}/t_{crop}$).

8.38 If actual data is unavailable, a value should be referenced from scientific literature. A copy of this literature or its detailed reference should be provided to the auditor as a part of the annual verification process if applicable, or to us if requested. The value used must fulfil the following requirements:

[42] This compulsory link does not apply to sugar beet.
[43] Note that actual input data does not need to be collected for soil N_2O emissions; the IPCC Tier 1 methodology can be used as described in Step 4 of the table 5 in paragraph 6.42, which calculates N_2O emissions based N fertiliser input. If either of the Carbon Calculators is used, N_2O emissions are automatically calculated from the nitrogen fertiliser applied, using the same IPCC Tier 1 methodology.

- the standard emission factor should be obtained from an independent and recognised author or organisation[44],
- it should also be based on the most up-to-date reference available, and
- it should be applicable for what it is being used for.

8.39 When accounting for the consumption of electricity that is not co-produced within the biomass production installation, but which is imported from the grid, the emission factor for the electricity consumed should be equal to the average emission intensity of the production and distribution of electricity in the "region" where the biomass is produced. The emissions intensity of production and distribution in different regions should be taken from an authoritative source, for example the latest version of the International Energy Agency CO_2 emissions from fuel combustion database[45]. A region may be a sub-national region, a country or a supra-national region. If electricity is co-produced, follow the steps as outlined in paragraph 8.33.

8.40 If the electricity is provided to the fuel production process from a power plant that is not connected to the electricity grid, generators may use a carbon intensity value for the production of electricity in that specific power plant. In this instance the party should still keep evidence of the source of this value.

The step-by-step method

8.41 The following steps explain how to calculate the carbon intensity of the biomass using the actual value method. Once the carbon intensity of the biomass has been calculated (Steps 1 to 10) it must then be converted into the appropriate units for reporting to us as shown in Step 11:

Table 7: Step by step approach for actual value method

Step 1 – Define the supply chain
Define the steps which occur during the production of the biogas. Each part of the process during which emissions are emitted is called a module, and therefore each supply chain is composed of a series of modules.
Step 2 – Identify the output of each module
Identify the main product which is exported from each module (for example wood chips, biogas). All emissions within a module should be calculated per unit of this product (ie in kg $CO_{2eq}/t_{product}$ or $kgCO_{2eq}/MJ_{product}$ if the product is a gas[46]).
Step 3 – Identify the inputs of each module

[44] In the first instance, it is recommended to look to the EU Transparency Platform as the EC may decide to upload acceptable input data there.
[45] Other sources may also be used.
[46] MJ is used as the unit of product of gaseous biomass rather than m^3 because energy content can change with pressure – this matches the UK Biomass and Biogas Carbon Calculator

Within each module, identify all inputs (material and energy) which will have an impact of more than 1% on the final carbon intensity of the biomass.

Each input must then be measured and expressed per unit of the exported product (ie in MJ or t input/t product).[47]

Step 4 – Identify appropriate emission factors

For each input, find an appropriate emission factor. The emission factor is a factor used to calculate the GHG emissions that occurred during the manufacture and distribution of an input (in kg CO_{2eq}/t input or kg CO_{2eq}/MJ input). Paragraph 8.38 provides further information on emission factors.

Step 5 – Multiple inputs by emission factors

Within each module, multiply the inputs by their appropriate emission factors and sum the results. The summed total represents the total GHG emissions per unit of output for this module (the material that is transferred to the next module in the biomass chain). Any certified reductions of GHG emissions from flaring at oil production sites anywhere in the world should be deducted from the overall emissions from the production of the biomass.[48]

Step 6 – Accounting for co-products in conversion modules

Within each conversion module, identify if there are co-products. Co-products are products created (which are not wastes or residues) alongside the main product and to which some of the emissions generated should be allocated. If the co-product is a waste, the emission associated with disposing of that waste should be included in the calculation of the overall carbon intensity of the biomass used. Differing allocation factors are applied if the co-product is excess electricity. See paragraph 8.26 onwards for more information of allocation factors and the differing calculations.

Step 7 – Identifying efficiency of modules

For all modules, the efficiency (in unit output/unit input) of the module has been collected, as this is needed to establish the contribution that upstream emissions make to the final carbon intensity of the biomass. Typical efficiencies are:

- For a conversion module – generally lower than 1.
- For transport and distribution modules – can be 1 if no losses occur during the transport.

For a module converting biomass into biogas (eg an anaerobic digestion installation), the unit of the efficiency should be in MJ output/t input, and the value will usually be much bigger than 1.

[47] The use of nutrient recycling through the reuse of digestate can provide an advantage in terms of GHG emissions for crops used for anaerobic digestion. Although the first cultivation year is likely to be based on inorganic fertiliser application in order to produce digestate from AD, for the purposes of GHG calculations, the average annual inorganic fertiliser and digestate input over the life of the crop can be used.

[48] European Commission, Annex V, Part C, paragraph 6, European Directive 2009/28/EC on the promotion of the use of energy from renewable sources, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF [accessed 17 August 2011].

Specifically for the cultivation module, make sure that the crop yield (in $t_{product}$/ha/yr) has been collected. Please note that N_2O emissions, from soil, which occur when nitrogen in the soil is converted to N_2O through naturally occurring processes, should also be included in the cultivation module.[49]

Step 8 – Calculating carbon intensity of each module

For each module, the contribution of that module to the total carbon intensity now needs to be calculated (in gCO_{2eq}/MJ). This is done by taking:

- the total GHG emissions per unit of exported product for this module (as calculated in step 5)

- any emission savings for that module (as calculated in step 6)

- any allocation factor of the module or any downstream modules (as calculated in step 6)

- the efficiency of any downstream modules (as determined in step 7)

For each module performing this calculation:

$$\frac{(total\ GHG\ emissions\ of\ exported\ product - emission\ savings\ for\ module) \times (allocation\ factor\ of\ module\ or\ any\ downstream\ modules)}{efficiency\ of\ any\ downstream\ modules}$$

Step 9 – Calculating carbon intensity of supply chain

The biomass carbon intensity can now be calculated by adding up the contribution of each module as calculated in step 8. This carbon intensity is expressed in $kgCO_{2eq}$/MJ.

Step 10 – Converting carbon intensity into relevant units

The carbon intensity has to be converted to gCO_{2eq}/MJ biomass. For a biogas chain, this is done by multiplying the result of Step 9 by 1000 to convert the $kgCO_{2eq}$/MJ biogas to gCO_{2eq}/MJ biogas.

The energy content (ie lower heating value) of typical biomass types can be found in the standard emission factors list (see Appendix 3).

Step 11 – Final calculation for value to report to us

The legislative framework requires the carbon intensity to be reported in specific units in order to demonstrate whether the GHG threshold has been met.

For solid biomass or biogas, the value is reported in gCO_{2eq}/MJ electricity. This requires the operator to take into account the efficiency of the eligible installation.

[49] Biogeochemical models are the most sophisticated method for estimating these emissions from soils but are complex to use and require large amounts of data which are unlikely to be available. Instead, the RED recommends use of the IPCC methodology for estimating both direct and indirect N_2O emissions when performing actual calculations. The use of Tier 1 of this methodology is recommended here because it simply correlates N_2O emissions with nitrogen fertiliser application rates. See 2006 IPCC guidelines for National Greenhouse Gas Inventories, volume 4, chapter 11 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_volume4/V4_11_Ch11_N2O&CO2.pdf)

For a non-CHP station, the following steps, using the value determined from step 10, are necessary to calculate the emissions from the use of the biomass to be reported to us:

$$GHG\ emission\ = \frac{emissions\ from\ production\ of\ biogas}{electrical\ efficiency\ of\ power\ plant}$$

The electrical efficiency of the power plant is determined by dividing the total amount of electricity generation by the eligible installation during the month (in MJ) by the energy content (based on lower heating value) of all the fuels used in generating that electricity during the month (in MJ)[50].

For a CHP station, the following steps, using the value determined from step 10, are necessary to calculate the emissions from the use of the biomass to be reported to us:

$$GHG\ emission = \frac{emissions\ from\ production\ of\ biogas}{electrical\ efficiency\ of\ power\ plant}\left(\frac{electrical\ efficiency\ of\ power\ plant}{electrical\ efficiency\ of\ power\ plant + C_h \times thermal\ efficiency\ of\ power\ plant}\right)$$

The electrical efficiency of the power plant is determined in the same way as for non-CHP stations above. The thermal efficiency of the power plant is determined by dividing the energy content (based on lower heating value) of all the heat supplied from the eligible installation to any premises[51] during the month[52] (in MJ) by the energy content (based on lower heating value) of all the fuels used in generating that electricity during the month (in MJ).

For 'C_h', if the temperature of the useful heat at delivery point is less than 423 Kelvin (K) the C_h is 0.3546. If it is greater than or equal to 423 K then subtract 273 from the temperature, and divide the answer by the temperature.

Land use change emission calculation

8.42 As set out in chapter 7, where there is a land use change, the emissions associated with this must be included within the GHG lifecycle emissions calculation. As the calculations will be required only in certain instances, they have been included in Appendix 4.

8.43 All calculations for land use change at present refer to *direct* land use changes. There are currently no requirements on generators to report or include in their carbon intensity calculations, emissions from *indirect* land use change or from changes in land management practices if the land use classification does not change.

8.44 The land use change may not necessarily be resulting in a loss of carbon to the atmosphere. It is possible that emission savings can be created from the soil carbon accumulation via improved agricultural practices and be accounted for within the GHG calculation. This calculation is available for use in all supply chains, regardless of the fuel state.

Degraded land bonus

[50] Where appropriate the operator can use the annual average efficiency of their power plant.
[51] If several useful heat sources are produced, then the denominator in this calculation is: the electrical efficiency added to the sum of all the useful heat streams' thermal efficiencies multiplied by their respective carnot efficiencies. Refer back to section 5.47 on allocation factors for more details.
[52] Where appropriate, it is acceptable to divide the annual heat figure from the previous year by 12 to get a monthly figure.

8.45 A bonus[53] of 29 gCO_{2eq}/MJ shall be attributed if evidence is provided that the land on which the feedstock was grown was not in use for agriculture or any other activity in January 2008 and falls into one of the following categories:

- severely degraded land including such land that was formerly in agricultural use, or
- heavily contaminated land.

Where:

- 'severely degraded land' means land that, for a significant period of time, has either been significantly salinated or presented significantly low organic matter content and has been severely eroded.
- 'heavily contaminated land' means land that is unfit for the cultivation of food and feed due to soil contamination.

8.46 The bonus will apply for up to ten years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (a) are ensured and that soil contamination for land falling under (b) is reduced.

Useful tools

8.47 It is up to the generator to determine which tool they will use to calculate their GHG emissions as part of the actual value method.

Carbon Calculator

8.48 Available to download from our website[54] is the UK Biomass and Biogas Carbon Calculator (for solid biomass and biogas fuel chains) which can be used by FIT generators.

8.49 This is owned by BEIS and was developed in accordance with the methodology as set out in the legislative framework. It is designed to facilitate the implementation of the life cycle calculation methodology for reporting the carbon intensity of fuels, under FIT, the RHI and the RO.

8.50 The calculator automatically works out the total emissions of the module being edited, and the contribution of that module to the overall fuel chain. It also identifies the key inputs required for any particular module, depending on what type of module it is (for example cultivation, transport and distribution). Furthermore, accepted default emission factors are included in the calculator.

8.51 There is a user manual published alongside the calculator which explains how to use it.

Other tools

8.52 Other IT-based tools are available which a generator can seek to use when calculating the GHG emissions for their fuel chain. Alternatively, generators could create their own tool. If a generator wishes to use a tool other than the UK Biomass and Biogas Carbon Calculator, the onus is on them to ensure and

[53] As set out in the RED - Annex V, Part C, Para 8.
[54] Available at https://www.ofgem.gov.uk/publications-and-updates/uk-solid-and-gaseous-biomass-carbon-calculator

demonstrate that it meets the methodology as set out in the legislative framework and that any inbuilt standard input data is appropriate.

Sources of information

8.53 In January 2013, CEN published a standard (EN 16214-4) titled 'Methods of the greenhouse gas emission balance using a life cycle analysis'[55] which generators may find provides useful guidance in calculating emissions. Whilst the document has been published specifically for biofuels and bioliquids, it will likely contain information useful for solid biomass and biogas fuel chains also.

8.54 There is further information published on the EC transparency platform[56] which generators may find useful for calculating GHG emissions, particularly land use change emissions, including:

- EC decision of 10 June 2010 on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC.
- The climate region and soil type data layers.
- An annotated example of land use change emission calculations.

Common queries

8.55 The legislative framework does not necessarily provide practical direction to support generators (and parties within the supply chain) in calculating the carbon intensity of their fuel. Below are recommendations in relation to some common queries received by us. We have set these out in guidance to support a consistent approach.

8.56 This is recommended guidance only. The suitability of the approach taken by the generator in calculating the carbon intensity of the fuel will be subject to independent verification as part of the annual sustainability audit or during an audit run by us.

- In accounting for transport emissions the generator will likely consider the emissions associated for the single journey from 'A' to 'B', on the basis that the transport vehicle (for example lorry, ship) will be returning to 'A' or onto another destination with further separate cargo. In the event that the transport vehicle is returning empty, and therefore the journey has been solely for the transport of the biomass then it would be appropriate for the generator to factor in the emissions for the return journey. The values within the Carbon Calculator for energy intensity of transport are set up to account for an empty return journey.
- In accounting for transport emissions, the generator may wish to consider whether the biomass is the full cargo or whether this is only an aspect of what is being transported. In the event that the lorry, ship (or other transport mode) is carrying other cargo, the generator should seek to apportion the emissions accordingly.

[55] Available at http://www.cen.eu/cen/Sectors/Sectors/UtilitiesAndEnergy/Fuels/Pages/Sustainability.aspx
[56] http://ec.europa.eu/energy/renewables/transparency_platform/transparency_platform_en.htm

- A default value for methane losses is provided in the Carbon Calculator for biogas and biomethane fuel chains. This is a conservative value, so it is not necessary to apply the additional 'conservative factor' of 40% utilised for other standard input values in the drying and processing modules. Generators who do not wish to use the default value for methane losses must be able to provide evidence and support for any alternative value they propose to use, to demonstrate that it is appropriate for their installation.

9. Sustainability - reporting

Chapter summary

This chapter explains how to comply with the sustainability criteria reporting requirements.

9.1 From 1 May 2017, new AD generators must submit the following to us:

- A quarterly declaration as to whether the consignment(s) of feedstocks used and therefore biogas produced were waste and if not, a declaration as to whether the consignments of biogas met the GHG which will need to be accompanied by a GHG emissions figure for that consignment. It also must state whether the biogas was made from solid biomass which met the land criteria.

- An annual independent audit report for installations with a TIC of 1MW and above.

9.2 We may reduce the length of a quarterly and/or annual reporting period in order to simplify the reporting process – for example by aligning FIT reporting periods with RHI reporting periods.

9.3 It is only necessary to report on the fuels used during that quarter. Different consignments of fuel may be used over different quarters.

9.4 Generators should also submit this information if they have not generated any electricity for the period in question.

Meter readings

9.5 New AD generators are required to take generation meter readings on a quarterly basis that will align with the sustainability and feedstock reporting requirements.

9.6 Unless otherwise specified, generation meter readings must be taken in line with the quarterly meter reading timetable which will start from the installation's Eligibility Date.

9.7 The quarterly meter reading submission timetable will be outlined in the accreditation letter which is sent to generators when their application for accreditation has been approved.

9.8 As best practice, we recommend generators take their generation meter readings within a window of +/- 3 days from the start and end dates of each quarterly period.

9.9 These meter readings must then be submitted to the FIT licensee within 28 calendar days from the end of each quarterly period.

9.10 For example, if an AD installation's Eligibility Date is 4 January 2018, the first quarterly reporting period will start on 4 January 2018 and end on 3 April 2018. Meter readings should be taken on these dates, and the deadline for submitting the meter reading to the FIT licensee will be 1 May 2018.

9.11 Where a generator submits generation meter readings that were not taken on the start and end of each quarterly period, the amount of electricity generated in that quarterly period shall be determined by pro-rating the amount of electricity generated by reference to the available meter readings. This will be calculated by the FIT licensee.

Quarterly sustainability declarations

Overview

9.12 Generators must submit a sustainability declaration each quarter against every consignment, which reports whether the consignment(s) of fuel met the GHG and land criteria, accompanied by a GHG emissions figure for that consignment(s). This must also state whether the biogas was made from solid biomass that met the land criteria.

9.13 Any consignments classified as 'waste' do not need to meet the GHG and land criteria as waste is deemed to be sustainable. However, generators must declare on a quarterly basis whether the fuel or feedstock is classified as a waste.

9.14 The template for this declaration is available from our website.

9.15 Generators must submit their sustainability declaration to us within 28 days following the end of the relevant quarter. The relevant quarter is every 3 months from the Eligibility Date of the installation.

9.16 For example, if an installation's Eligibility Date is on 6 February, the first quarter that must be reported on will cover 6 February to 5 May. The declaration must then be submitted by 2 June.

9.17 Where the sustainability declaration is not provided by the relevant deadline or is provided but is incomplete or unsatisfactory, FIT generation payments may be impacted. Please see Chapter 12 for further detail.

How to submit the declaration

9.18 Sustainability declarations must be submitted to our Renewable Electricity Fuelling & Sustainability team, to FuellingandSustainability@ofgem.gov.uk.

9.19 The email must clearly mark the name of the installation that the sustainability declaration corresponds to.

9.20 All fields of the declaration must be completed, and every consignment of fuel used must be reported against.

Annual sustainability audit report (TIC of 1MW and above)

Overview

9.21 Generators with a TIC of 1MW and above (including those using waste), must also provide an annual independent audit report.

9.22 The audit report must be submitted within 3 months following the anniversary of the Eligibility Date.

9.23 For example, if an installation had an Eligibility Date falling on 30 April, the audit report must be submitted by 30 July each year covering the 30 April – 29 April period following each anniversary of the Eligibility Date.

9.24 It is the responsibility of the generator to provide an annual sustainability audit report. This report must meet the requirements specified by the legislative framework and be submitted to us within three months of each anniversary of the installation's Eligibility Date.

9.25 The purpose of the audit report is to provide independent assurance on the quarterly sustainability declarations and information provided by generators, to ensure there is evidence and information to support the stated fuel classification and sustainability of the fuel(s).

9.26 If the findings of the audit report show that one or more consignments used in the previous year did not have adequate supporting information, any of the non-compliance actions available may be taken, which includes reducing, recouping or withholding FIT payments.

9.27 Please note that if your installation has a TIC less than 1MW, you are not required to submit an annual sustainability audit report. You may still be audited by us. The audit may require you to provide the relevant evidence and information to demonstrate the sustainability criteria have been met in previous quarters/years.

Audit report requirements

9.28 AD installations with a TIC of 1MW and above are required to submit an annual sustainability audit report demonstrating compliance with the sustainability requirements and feedstock restrictions (covered in chapter 11) and have their sustainability data independently verified.

9.29 The legislative framework sets out the requirements on how the audit report is to be prepared, including that it must:

- be prepared by a person who is not the generator or a connected person,
- be prepared in accordance with the ISAE 3000 (Revised): Assurance engagements other than audits or reviews of historical financial information dated 9 December 2013 or an equivalent standard, and
- state whether anything has come to the attention of the person preparing the report to indicate that the sustainability information is not accurate; and
- considers, in relation to each consignment:
  - whether the systems used to produce the sustainability information are likely to produce information which is reasonably accurate and reliable,
  - the suitability of the frequency and methodology of any sampling carried out for the purpose of obtaining or checking the data on which the generator relied in preparing the sustainability information,

- whether there are controls in place to protect the sustainability information against material misstatements due to fraud or error, and

- the robustness of the data on which the generator relied in preparing the sustainability information.

9.30 The report must consider and report on each consignment of biomass used during the 12 month period preceding the relevant anniversary of the Eligibility Date, and must be supplied regardless of the conclusion reached by the independent auditor. Organising the verification is the responsibility of the generator. The report must be submitted within 3 months of the end of the reporting period.

9.31 We recognise that generators will likely have the same auditor undertake both the sustainability and feedstock restriction audit. We are content for these to be submitted as single report as long as the information for each respective area is clear and distinct in the report. More information on the feedstock restriction requirements are covered in Chapter 10 and reporting, including the audit report, is included within Chapter 11.

How to submit the audit report

9.32 The audit report must be submitted to our Renewable Electricity Fuelling and Sustainability team, to FuellingandSustainability@ofgem.gov.uk.

9.33 The email must clearly mark the name of the installation that the audit report has been produced for.

9.34 Where the annual sustainability audit report is not provided by the relevant deadline or is provided but is incomplete or unsatisfactory FIT generation payments may be impacted. Please see Chapter 12 for further detail on consequences of non-compliance.

9.35 For further information on the audit report requirements, please see our Feed-in Tariffs: Guidance on sustainability audit reports.

10. Feedstock restrictions

Chapter summary

This chapter explains the restrictions on FIT generation payments based on feedstock type.

10.1 Chapter 1 provides an overview of the feedstock restrictions.

10.2 Within three months of every anniversary of the installation's Eligibility Date, generators must submit a declaration containing information on their feedstock, fuel classification and biogas yields for the previous year and other supporting information we request.

10.3 This information will tell us what portion of the previous year's energy content[57] of the biogas used to generate electricity is derived from wastes and/or residues, and therefore the portion of FIT generation payments that a generator is entitled to.

10.4 Where more than 50% of the energy content of the biogas used to generate electricity in a year is not derived from waste or residue, the following calculation would be applied to calculate the generator's generation payments to take into account the feedstock restrictions:

$$A \times (1.5 - B)$$

Where:

A = the total generation payments to which the FIT generator or nominated recipient would be entitled to or has received before any adjustment in the relevant reporting year,

B = the proportion of the energy content of the biogas which is not derived from waste or residue in the relevant reporting year, expressed as a decimal and rounded to 4 decimal places.

10.5 Table 8 provides examples of when this calculation will be applied based on varying percentages of biogas yield derived from feedstocks other than wastes and/or residues.

Table 8: Application of the feedstock restrictions calculation

Percentage of biogas yield derived from feedstocks other than wastes and/or residues (%)	**Does the feedstock restriction calculation need to be applied?**	**Percentage of generation payments you are entitled to (%)**
30	No	100

[57] Energy content is defined as "the energy contained within a substance (whether measured by a calorimeter or determined in some other way) expressed in terms of the substance's gross calorific value within the meaning of BS 7420:1991 (Guide for the determination of calorific values of solid, liquid and gaseous fuels (including definitions))

50	No	100
70	Yes	80
100	Yes	50

10.6 Please note that the generator should continue to receive their quarterly FIT payments in full (subject to compliance with the sustainability requirements).

10.7 However, after the submission of the feedstock declaration, an annual reconciliation of payments based on compliance with the feedstock restrictions will be carried out by the FIT licensee, in accordance with instructions by us. If the feedstock restrictions apply, we will instruct the generator's FIT licensee to recoup, reduce or withhold FIT generation payments.

10.8 Generators should also submit this information if they have not generated any electricity for the period in question.

11. Feedstock restrictions – reporting

Chapter summary

This chapter explains the reporting requirements to demonstrate the apportionment of feedstock and associated limitations on FIT generation payments.

Meter readings

11.1 Please see Chapter 9 for details on meter reading requirements.

Annual feedstock declaration

Overview

11.2 Generators are required to submit an annual feedstock declaration to us within 3 months following each anniversary of the installation's Eligibility Date – unless otherwise notified by us.

11.3 For example, if an installation has an Eligibility Date falling on 21 April, the feedstock declaration covering the period 21 April to 20 April must be submitted by 21 July of the following year, and each year after that.

11.4 We may reduce the length of a quarterly and/or annual reporting period in order to simplify the reporting process – for example by aligning FIT reporting periods with RHI reporting periods, as detailed in Chapter 3 of this document.

11.5 We have published a feedstock template on our website[58].

11.6 In order to complete the declaration, generators must identify the total amount of electricity generated in each relevant annual reporting period, the feedstock type(s) used to do so and the apportionment by feedstock type of the total biogas produced (based on the energy content of each consignment).

11.7 Generators can make use of our Biogas Apportioning Tool[59] to calculate the above. This tool can be used by FIT and RHI generators. When using this tool, the biogas will be split in accordance with volume contribution of methane (%) relating to each feedstock type. This will equate to the apportionment by energy content. These percentages can then be applied to the total amount of electricity generation for the reporting year.

11.8 Generators can propose an alternative method to apportion their biogas, and will need to demonstrate its suitability.

11.9 Where the feedstock declaration is not provided by the relevant deadline or is provided but is incomplete or unsatisfactory, FIT generation payments may be impacted. Please see Chapter 12 for further details.

[58] Available at: https://www.ofgem.gov.uk/publications-and-updates/feed-tariffs-annual-feedstock-declaration-template
[59] Available at: https://www.ofgem.gov.uk/publications-and-updates/non-domestic-rhi-and-fit-biogas-and-biomethane-apportioning-tool

How to submit the declarations

11.10 Feedstock declarations must be sent to our Renewable Electricity Fuelling and Sustainability team, to FuellingandSustainability@ofgem.gov.uk. You should also keep any accompanying evidence (eg copy of Biogas Apportioning Tool) because we request it to verify your declaration.

11.11 The email must clearly mark the name of the installation that the feedstock declaration corresponds to.

11.12 All fields of the declaration must be completed for every consignment.

11.13 It is the responsibility of the generator to ensure that the declaration is submitted within 3 months of the end of the relevant reporting year.

Annual audit report (TIC of 1MW and above)

Overview

11.14 Installations with a TIC of 1MW and above are required to include verification of the feedstock declaration submitted each year within their annual independent audit report.

11.15 The audit report must be submitted within 3 months following each anniversary of the Eligibility Date. We recommend that the feedstock declaration and audit report are sent to us at the same time.

11.16 For example, if an installation had an Eligibility Date falling on 30 April, the audit report must be submitted by 30 July following each anniversary of the eligibility date covering the 30 April – 29 April year.

11.17 The purpose of the audit report is to provide independent assurance provided on the annual feedstock declarations and information provided by generators, to ensure there is evidence and information to support claims for the apportionment of biogas and eligibility for FIT generation payments. If the findings of the audit report show that one or more consignments used in the previous year did not have adequate supporting information, any of the non-compliance actions available may be taken. This includes reducing, recouping or withholding FIT payments.

11.18 Where the audit report is not provided by the relevant deadline or is provided but is incomplete or unsatisfactory, FIT generation payments may be impacted. Please see Chapter 12 for further detail.

11.19 Please note that if your installation has a TIC less than 1MW, and consequently you are not required to submit an annual independent audit report. You may still be audited by us. The audit may require you to provide relevant evidence and information to demonstrate compliance with the feedstock restrictions in previous quarters/years.

Audit report requirements

11.20 A brief explanation of what the report needs to contain can be found in section 8.27 of this guidance. For further information on the audit report requirements, please refer to our Feed-in Tariffs: Guidance on sustainability audit reports

How to submit the report

11.21 The audit report must be submitted to our Renewable Electricity Fuelling and Sustainability team, to FuellingandSustainability@ofgem.gov.uk.

11.22 The email must clearly mark the name of the installation that the audit report has been produced for.

11.23 Where the audit report is not provided by the relevant deadline or is provided but is incomplete or unsatisfactory, FIT generation payments may be impacted. Please see Chapter 12 for further detail on consequences of non-compliance.

11.24 For further information on the audit report requirements, please see our Feed-in Tariffs: Guidance on sustainability audit reports

11.25 We recognise that generators will likely have the same auditor undertake both the sustainability and feedstock restriction audit. We are content for these to be submitted as single report as long as the information for each respective area is clear and distinct in the report. More information on the sustainability audit report requirements is provided within Chapter 9.

12. Consequences of non-compliance

Chapter summary

FIT payments may be impacted where a generator does not comply with the sustainability criteria, feedstock restrictions and associated reporting requirements.

12.1 An AD generator will not be entitled to full FIT generation payments unless it complies with the sustainability criteria and feedstock restrictions. Generators must also comply with the reporting requirements.

12.2 Failure to comply with these requirements may result in us instructing the FIT licensee to withhold, reduce or recoup FIT generation payments.

12.3 This chapter provides examples of impacts to FIT payments in scenarios where a generator does not comply with the sustainability criteria, feedstock restrictions and/or reporting requirements. This list is not exhaustive and we have the authority to exercise discretionary powers in appropriate cases to withhold, recoup or reduce FIT payments.

12.4 Where we have good reason to believe that the FIT generator may not be entitled to FIT payments due to non-compliance, we will contact the generator to inform them of the reasons and to provide the opportunity for the generator to make a representation or objection. The time frame for this will be assessed on a case-by-case basis. We will then take these into account when deciding whether the generator's FIT payments should be withheld, recouped or reduced.

Where sustainability criteria are not met

12.5 Generators who use consignments of fuel during any quarter that do not meet the sustainability criteria will not be eligible for any FIT generation payments for the electricity generated from the non-compliant consignment(s).

12.6 If the sustainability declaration demonstrates that the sustainability criteria has not been met, we will confirm this with the generator and will instruct the FIT licensee to adjust payments to the amount equal to the value of any generation payments made against the ineligible electricity generation.

12.7 Where the sustainability declarations provided by the generator cannot be verified either through the independent audit report or our audit, and we have good reason to believe that the generator has not met the sustainability criteria, the FIT licensee will be instructed to adjust FIT generation payments accordingly.

Where use of non-wastes and residues exceeds 50%

12.8 Where the electricity generated from biogas not derived from wastes or residues exceeds 50% of the total biogas yield, the installation is not entitled to FIT generation payments relating to that payment year for the proportion in excess of 50%.

12.9 If, for example, an installation generated 60% of the biogas from non-wastes and residues and therefore exceeds the 50% limit by 10%, the generator will only be eligible for payments on 90% of the total electricity generated. This will be assessed at the end of each reporting year and any necessary adjustments to FIT payments will be made at that time.

12.10 At the end of each reporting year, the generator will provide us with the proportion of electricity generated from biogas which is not derived from wastes and residues. If this shows that the generator is entitled to the full amount of FIT payments that have been made throughout the reporting year, then no further action is required – the FIT Licensee will continue to make payments.

12.11 If the declaration shows that the generator is not entitled to a portion of their FIT generation payments, we will notify the FIT licensee. The FIT licensee will then adjust the FIT generation payments accordingly.

12.12 Where the feedstock declarations provided by the generator cannot be verified either through the independent audit report or our auditing processes, and we have good reason to believe that the generator is not entitled to a portion of their FIT generation payments, the FIT licensee will be instructed to adjust FIT generation payments accordingly.

Where the declarations are submitted late

12.13 If the sustainability declaration and/or feedstock declaration is not provided within the specified deadlines, we will instruct the FIT Licensee to withhold FIT generation payments until the information is provided. If information is subsequently provided demonstrating that the sustainability criteria and/or feedstock restrictions were met, the FIT licensee will be instructed to release any withheld payments (subject to adjustments made based on the feedstock type and/or sustainability of the biogas).

Where annual audit report is submitted late

12.14 For installations with a TIC of 1MW and above, each year an independent annual audit report must also be submitted to us within three months of each anniversary of the installation's Eligibility Date. This audit report verifies the sustainability declaration and the feedstock restriction declaration.

12.15 If the generator fails to submit the audit report within the deadline, payments will be withheld until the report is provided.

12.16 Payments will be released once the audit report is submitted, provided that it is deemed to meet the audit report requirements explained in Chapter 9.

Where meter readings are submitted late

12.17 If a generator fails to submit their generation meter readings to their FIT licensee within 28 days following the end of the quarterly reporting period, the FIT licensee will contact us. We will instruct the FIT licensee to withhold FIT payments until notified otherwise.

12.18 Once the meter reading has been provided, the FIT licensee will inform us and will be instructed to release any withheld payments (subject to compliance with the sustainability criteria, feedstock restrictions and reporting requirements).

Where reporting information is incorrect, incomplete or unclear

12.19 If we are not satisfied with the information contained in each declaration or audit report, we will contact the generator to query the information. We may instruct the FIT Licensee to withhold payments until the issue is resolved. Once the issue has been resolved, FIT payments will be released, and any necessary adjustments will be made.

12.20 If the issue has been resolved and does not require any adjustments to FIT generation payments, payments will be released.

13. Appendices

Appendix 1– UK recognised voluntary schemes

1.1 As set out in Chapter 6, in 2012 we benchmarked a number of voluntary schemes against the RO's protected land criteria for non-woody biomass (ROO 2009 (as amended)) for use on the RO scheme. An overview of the results of the exercise is available in table 9 below.

1.2 In 2015 our RO team also undertook an exercise to benchmark these schemes against the ROO 2015 sustainable source land criteria for woody biomass for the purpose of the RO scheme. Please see Appendix 2 of the Renewables Obligation: Sustainability Criteria guidance[60].

1.3 Table 9: Selected voluntary schemes benched against the non woody biomass land criteria

Scheme Name	**Benchmarked Version**	**Land Criteria**						**Audit Criteria**
		Conservation of primary forest and other wooded land	Conservation of protected areas	Conservation of wetlands	Conservation of continuously forested areas	Conservation of "10% to 30%" forested areas	Conservation of peatlands	
American Tree Farm System (ATFS)	2010-2015 Standard	No reference date	No reference date	No reference date, No specific reference to conversion of wetlands	No reference date	No reference date	Not covered	Yes
Canadian Standards Association	CAN/CSAZ	No reference date, Conversion permitted if	No reference	No reference date, Criteria focus on water quality	No reference date	No reference date	Not covered	Yes

[60] Available at: https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-sustainability-criteria

(CSA)	809-08	"ecologically appropriate"	date	and quantity				
Green Gold Label	GGLv20100.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Natural England Energy Crop Scheme	2009	No reference date, No specific reference to primary forest (relies on protected areas)	No reference date	No reference date, No specific reference to wetlands (relies on protected areas)	Not covered	Not covered	Not covered	3rd party verification required Annual surveillance audits required
Programme for the Endorsement of Forest Certification (PEFC)	PEFCST1003:2010	Reference date of 31 Dec 2010, Conversion permitted under "justified circumstances"	No reference date	No reference date	No reference date	No reference date	Not covered	Yes
Sustainable Forestry Incentive (SFI)	20100-2014Standard	No reference date	No reference date	No reference date	No reference date	No reference date	Not covered	Yes
UK Woodland	Seco	Yes	No refe	No reference date, No specific	No reference	No reference	Not covered	Yes

Assurance Scheme (UKWAS)[61]	nd Edition, Nov 2008		reference date for non-wooded areas	reference to wetlands (relies on protected areas)	date	date		

[61] UKWAS 2nd edition (2008) was the version benchmarked. We understand UKWAS 3rd edition has been publicly available since 1 December 2011.

Appendix 2– Common fuel classifications

2.1 These tables provide guidance on when substances should be considered products, residues or wastes only for the purposes of the sustainability criteria under the FIT.

2.2 It is not possible to lay down definitive or absolute rules for when particular materials will be considered waste, residues or products. A judgement has to be made taking into account the circumstances of each case, and applying the legislative framework, case law principles and other relevant indicators.

2.3 This is an indicative and not an exhaustive list. There may be further wastes or residues that are not on the list that still qualify as wastes or residues. We may periodically review and update this list on our website, if sufficient evidence emerges to indicate that a substance should be treated differently.

2.4 For more information on fuel classification, including definitions and reporting requirements please see chapter 3.

Table 10: Products

Material	**Description**
Virgin oils, including but not limited to: Palm, soy, rape, sunflower	Including, but not limited to, oils derived from palm, soy, rape and sunflower. The treatment of these materials and of the meal produced as part of the same process in the RED GHG calculations makes clear that these are to be treated as products.
High oleic acid rape seed oil	A product if grown as a fuel, or if grown as a product and diverted to use as a fuel. If used as fuel after being used for cooking then it will be a waste (as used cooking oil).
Short rotation coppice (SRC)	Short rotation coppice is grown specifically for use as a fuel and, as such, it is a product.
Short rotation forestry (SRF)	Short rotation forestry grown specifically for use as a fuel is a product.
Virgin wood	Virgin wood is timber from whole trees and the woody parts of trees including branches and bark derived from forestry works, woodland management, tree surgery and other similar operations. It does not include clippings or trimmings that consist primarily of foliage (though these may be forestry residues). Further information on virgin wood can be found in a statement from the Environment Agency: http://www.environment-agency.gov.uk/static/documents/Research/PS_005_Regulation_of_wood_v3.0.pdf

Miscanthus	This is commonly grown as a fuel crop and in these circumstances will be a product. If it is put to another use first, eg as animal bedding, before being used as fuel then it will be a waste.
Palm oil olein	The refined liquid fraction of palm oil is a product. If used for cooking before being used as fuel then it will be a waste (as used cooking oil).
Palm kernel oil	Palm kernel oil is a product. If used for cooking before being used as fuel then it will be a waste (as used cooking oil).
Material	Description
Acid ester	Esters are produced intentionally and are therefore a product.
Molasses	This material arises from the processing of sugar cane and sugar beet into sugar. It arises on the basis of a technical decision, and is considered a product.
Glycerol from virgin oils	The treatment of glycerol from virgin oils in the RED GHG calculations makes clear that it is to be treated as a product.
Crude tall oil	Crude tall oil arises from the process of pulping coniferous wood. The pulping process involves cooking woodchip in a chemical mixture and this gives rise to a soapy material which is separated from the pulp and liquor. It is then acidified and heated to convert it into crude tall oil. Crude tall oil is a product of the pulping process.
Brown liquor	This material arises during the pulping of wood. As for tall oil, it is considered a product.
Meal from virgin oil production	These materials' treatment in the RED GHG calculations makes clear that they are to be treated as products.
Sugar beet sludge	This is the pulp left over following sugar extraction. Its treatment in the RED GHG calculations makes clear that it is to be treated as a product.
Corn or wheat dried distillers grain (DDGS)	This material's treatment in the RED GHG calculations makes clear that it is to be treated as a product.
Palm Stearin	Palm stearin is produced alongside palm olein from the fractionation of crude palm oil. After the fractionation process, the mixture is filtered to separate stearin (solid form) and olein (liquid).

Palm fatty acid distillate	The treatment of PFAD in the RED GHG calculations indicates that it is to be treated as a product.
Tallow – Animal By-Product Category 3	Tallow, also called rendered animal fat, is the hard fat obtained from the whole or part of any dead animal through the process of rendering. It is then used as feedstock for the production of biodiesel or bioliquid as fuels. Annex V, Part D of the RED makes clear that animal oil produced from animal by-product classified as category 3 should be treated as product. A revised Animal By-Products Regulation 1069/2009 takes effect on 4 March 2011. Although the revised regulation does not appear to change this definition, no decisions have yet been made by a court or other panel on the basis of the new regulation. There is the possibility that once a decision is made, the status of tallow could change. The following documents underpin the Environment Agency's regulation of the process of producing biodiesel from rendered animal fat: http://www.environment-agency.gov.uk/static/documents/Business/MWRP_RPS_030_v2_biodiesel_22-12-10.pdf and http://www.environment-agency.gov.uk/static/documents/Business/Biodiesel_QP_NIEA_GEHO0311BTPC-E-E.pdf Note that the approach we have taken for category 3 tallow is that the generator does not have to make a response to the land criteria as the feedstock is neither cultivated nor obtained from land, as such the land criteria is considered not-applicable. The generator should therefore select 'exempt' in monthly reporting. GHG emissions should be considered from the starting point of the material when it is generated at the abattoir/rendering plant.

Table 11: Residues from agriculture, aquaculture, forestry and fisheries

Material	**Description**
Forestry residues	Forestry residues are identified explicitly by the RED as residues. Following statements from the EC[62] and the Environment Agency[63], we consider forestry residues to be derived from "virgin wood" and to include all raw materials collected directly from the forest, whether or not as a result of thinning or logging activities. This may include (but is not limited to) materials such as tree tops, branches, brash, clippings, trimmings, leaves, bark, shavings, woodchips and saw dust from felling. Forestry residues do not include any residues from related industries, or residues associated with processing the virgin wood/raw material (for example sawdust from saw mills). These may be classed as processing residues (see below).
Arboricultural residues	Residues from arboriculture are not defined by the Orders or existing EC communications but can be considered to be biomaterial such as that which is removed as part of tree surgery, management of municipal parks and verges of

[62] European Commission, *Report from the Commission to the Council and the European Parliament on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling,* http://ec.europa.eu/energy/renewables/transparency_platform/doc/2010_report/com_2010_0011_3_report.pdf [accessed 14 December 2011].
[63] Statement from the Environment Agency http://www.environment-agency.gov.uk/static/documents/Research/PS_005_Regulation_of_wood_v3.0.pdf

	roads and railways. Residues from arboriculture should not include forestry residues.
Straw	Straw is specifically named as an agricultural crop residue in the RED. Depending on whether the material was created during harvesting or processing will determine whether it must meet the land criteria or is exempt. Straw is deemed to have zero GHG emissions prior to the process of collection.
Bagasse	Bagasse results from crushing sugarcane or sorghum. Bagasse is specifically named as an agricultural residue in the RED. Depending on whether the material was created during harvesting or processing will determine whether it must meet the land criteria or is exempt. Bagasse is deemed to have zero GHG emissions prior to the process of collection.
Nut shells	Nut shells are specifically named as an agricultural residue in the RED. Depending on whether the material was created during harvesting or processing will determine whether it must meet the land criteria or is exempt. Nutshells are deemed to have zero GHG emissions prior to the process of collection.
Husks	Husks are specifically named as agricultural residues in the RED. Depending on whether the material was created during harvesting or processing will determine whether it must meet the land criteria or is exempt. Husks are deemed to have zero GHG emissions up to the point of collection.
Cobs	Cobs are specifically named as agricultural residues in the RED. Depending on whether the material was created during harvesting or processing will determine whether it must meet the land criteria or is exempt. Cobs are deemed to have zero GHG emissions up to the point of collection.
Tall oil pitch	Tall oil pitch is the remaining fraction of the fractional distillation process of crude tall oil. Tall oil pitch cannot be further refined. No matter which technical decisions are made in the fractional distillation, this fraction will remain. Tall oil pitch is therefore a residue of this process.

Table 12: Processing Residues

Material	**Description**
Vinasse	Vinasse results from the processing of sugar cane or sugar beet. The treatment of vinasse in the RED GHG calculations makes clear that it is to be treated as a residue.

Crude glycerol from processing of waste oils	Crude glycerol (from processing of waste oils) is specifically named as a residue from processing in the RED. The RED treats of glycerol from processing of virgin oils as a product – see above.
Palm processing residues: empty palm bunches, fibre and shell from palm oil production, palm oil mill effluent (POME)	These materials' treatment in the RED GHG calculations makes clear that they are to be treated as residues.
Saw dust from saw mills	This is a processing residue. Note that any deliberate change to the production process to increase the volume of sawdust resulting from processing would make the resulting material a product rather than a residue

Table 13: Wastes

Material	**Description**
Waste wood	Any waste wood, including "non-virgin" wood, will be considered a waste. Following statements from the Environment Agency, waste wood may include non-virgin timber off-cuts, shavings, chippings and sawdust from the processing of non-virgin timbers (whether clean or treated). The phrase "non-virgin" wood refers to materials such as post-consumer waste and construction and demolition waste.
Used cooking oil (UCO)	Commonly called "UCO" or "WCO" (waste cooking oil), this is purified oils and fats of plant and animal origin. These have been used by restaurants, catering facilities and kitchens to cook food for human consumption. They are wastes as they are no longer fit for that purpose and are subsequently used as either feedstock for the production of biodiesel as fuel for automotive vehicles and heating or as a direct fuel. The Environment Agency has further information on the process of producing biodiesel from UCO[64].
Brown grease (ex USA)	Brown grease is the grease that is removed from wastewater sent down a restaurant's sink drain. This is a waste.
Manure	As defined in the legislative framework.

[64] Further information can be found: https://www.gov.uk/government/organisations/environment-agency

Material	Description
Tallow – Animal By-Product Category 1	Tallow, also called rendered animal fat, is the hard fat obtained from the whole or part of any dead animal through the process of rendering. It is then used as feedstock for the production of biodiesel or bioliquid as fuels. Annex V, Part D of the RED makes clear that animal oil produced from animal by-product classified as category 1 should be treated as waste. A revised Animal By-Products Regulation 1069/2009 takes effect on 4 March 2011. Although the revised regulation does not appear to change this definition, no decisions have yet been made by a court or other panel on the basis of the new regulation. There is the possibility that once a decision is made, the status of tallow could change. The following documents underpin the Environment Agency's regulation of the process of producing biodiesel from rendered animal fat: http://www.environment-agency.gov.uk/static/documents/Business/MWRP_RPS_030_v2_biodiesel_22-12-10.pdf and http://www.environment-agency.gov.uk/static/documents/Business/Biodiesel_QP_NIEA_GEHO0311BTPC-E-E.pdf
Municipal Solid Waste	This is a waste.
Construction and demolition wastes	For the purposes of generation, this category will be mainly waste wood.
Meat/bone meal	This is a waste.
Food waste	Whether from manufacturers, retailers or consumers, this will be a waste.
Waste pressings from production of vegetable oils	When a vegetable material such as olives is pressed to produce vegetable oil, the pressed material consisting of pips, skins, flesh etc. remains. This may be used as a fuel. The purpose of the process is to produce oil; the pressings are therefore wastes.
Olive pomace	As above.
Soapstocks	From oil de-acidification; again an output from vegetable oil refining that will be waste.
Distillation residues	Distillation residues are what are left over following the distillation of products such as biodiesel, oil or petrochemicals, so will be wastes.
Food crops affected by fungi during storage	These are wastes.

Food crops that have been chemically contaminated	These are wastes.

2.5 Following the introduction of the land criteria for woody biomass we undertook some work to provide guidance on how certain types of wood should be classified.

2.6 As with the common classification tables, it is not possible to lay down definitive or absolute rules for when particular wood types will be considered waste, residues or products. A judgement has to be made taking into account the circumstances of each case, and applying the legislative framework, case law principles and other relevant indicators. This is not a definitive list and there may be some wood types not covered.

Table 14: Wood definitions and classifications

Material	**Description**	**Classification**
Bark	Tough outer surface of tree trunks and other woody plants	Forest residue or arboricultural residue (depending on where the residue is generated)
Clippings/trimmings	Primarily leaves and the stems on which the leaves grow	Forest residue or arboricultural residue (depending on where the residue is generated)
Construction and demolition waste wood (sometimes called recycled wood)	Woody material from construction or demolition sites that is no longer used in its primary function.	Waste

Material	Description	Classification
Diseased wood	Wood that has been felled due to damage from insect nests or blight which damages the tree and/or may spread disease to other trees/organisms and is of little value other than for energy	Forestry residue (unless from arboriculture)
End of life timber	Standing trees from plantations for non-timber products (suhc as coconut, rubber, palm trees) which have reached the end of their useful life	Agricultural residue
Fire damaged wood	Wood that has been damaged by fire and therefore has no other market than for energy.	Forestry residue (unless from arboriculture)
Leaves	Leaf matter arising directly from the forest as a result of harvesting or management activities	Forestry residue or arboricultural residue (depending on where the residue is generated)
Long rotation coppice	Plantation felled after a growing period of 15+ years and then replanted	Product
Non-sawmill lumber	Woody material that has been felled but does not meet the specifications for lumber for the sawmill due to its size or shape	Co-product
Post-consumer waste wood (Sometimes called recycled wood, eg pallets, packaging)	Woody material in a product that has been considered past its useful life by the consumer	Waste
Saw dust from felling	Saw dust produced during felling of trees	Forestry residue or arboricultural residue (depending on where the residue is generated)
Sawmill residue	Saw dust produced during the processing of wood at the sawmill	Processing residue However, some parties may say co-product if the value from this stream is material to ongoing profitability

Material	Description	Classification
Sawmill residue	Woody material produced during the processing of wood at the sawmill, may include small offcuts or also bark that has been stripped from the wood	Processing residue
Shavings	Wood shavings produced in the mill during timber processing	Processing residue
Short rotation coppice	Varieties of poplar and willow grown in wood plantations and managed through coppicing. Harvesting takes place every 2-5 years.	Product
Short rotation forestry	Tree plantations with short harvest rotations typically every 8-15 years. This can include agro-forestry (where trees are grown around or among crops or pastureland to optimise use of the land)	Product
Slab wood	An outsize piece cut from a log when squaring it for lumber. This takes place in the forest.	Forestry residue
Storm salvage wood	Wood from trees that have been uprooted or damaged during hurricanes or storms and is of little value other than for energy	Forestry residue or arboricultural residue (depending on where the residue is generated)
Stumps	The basal portion of a tree remaining after the rest has been removed	Forestry residue
Thinnings	Wood from a silvicultural operation where the main objective is to reduce the density of trees in a stand, improve the quality and growth of the remaining trees and produce a saleable product.	Co-product in the situation where alternative markets are available and the value of the thinnings is material to forest profitability. In other circumstances, forestry residue
Virgin Forestry	An area forested with virgin trees (ie non plantation) from which felled trees have been extracted.	Product

Material	Description	Classification
Woodchips from tops and branches	Typically comprised of chipped tops and limbs of trees that have been left behind following the harvesting of stem wood. This category should not include wood chips from stem wood or thinnings. May sometimes be called brash, which is the collective term for foliage, branches and tops of the tree.	Forestry residue
Wood residues from arboriculture	Biomaterial that is removed as part of tree surgery, management of municipal parks and verges of roads and railways. Also called arboricultural arisings	Arboricultural residue

Appendix 3 – Default values and standard input data

3.1 Table 15 sets out the default values of carbon intensities for solid biomass and biogas for use in the default value method as defined in the legislative framework.

3.2 Please note that the default value method cannot be used for installations with a TIC of 1MW and above.

3.3 Table 16 provides typical values that can be used by generators when calculating their GHG emissions as part of the actual value method. These values have been determined by BEIS and are pre-built into the Carbon Calculator.

Table 15: Solid biomass and biogas default carbon intensities

Biomass production pathway	**Default carbon intensity (CI) [gCO2eq/MJ feedstock]**
Bagasse briquettes where the process to produce the bagasse briquettes was fuelled by wood	17
Bagasse bales	20
Palm kernel	27
Rice husk briquettes	28
Biogas produced from wheat, where the whole plant was used to produce the biogas	21
Wheat straw	2
Biogas produced from straw	21
Biogas produced from organic maize, where the whole plant was used to produce the biogas	19

Table 16: Typical values provided in the Carbon Calculator

Factor	Value
Global warming potentials	
CO_2	1 gCO_2eq / g
CH_4	23 gCO_2eq / g
N_2O	296 gCO_2eq / g
Agricultural inputs GHG emission coefficients	
N-fertiliser (kg N)	4567.8 gCO_2eq/kg
P_2O5-fertiliser (kg P_2O5)	1176.0 gCO_2eq/kg
K_2O-fertiliser (kg K_2O)	635.6 gCO_2eq/kg
CaO-fertiliser (kg CaO)	89.6 gCO_2eq/kg
Pesticides	13894.6 gCO_2eq/kg
Seeds- rapeseed	794.0 gCO_2eq/kg
Seeds- soy bean	0.0 gCO_2eq/kg
Seeds- sugarbeet	3820.5 gCO_2eq/kg
Seeds- sugarcane	4.9 gCO_2eq/kg
Seeds- sunflower	794 gCO_2eq/kg
Seeds- wheat	289.9 gCO_2eq/kg
Short rotation coppice cuttings	0.0 [kg CO_2eq / cutting]
Short rotation coppice setts	0.0 [kg CO_2eq / sett]

Emissions due to transport of filter mud cake	0.0 [kg CO_2eq / kg filter mud cake]
Emissions due to transport of vinasse	0.0 [kg CO_2eq / kg vinasse]
Manganese	0.8 [kg CO_2eq / kg Mn]
Rhizomes	0.3 [kg CO_2eq / kg rhizome]
Forage maize seeds	0.3 [kg CO_2eq / kg seeds]
Urea silage additive	9.8 [kg CO_2eq / kg additive]
Propionic acid silage additive	1.3 [kg CO_2eq / L additive]
Digestate	0.0 [kg CO_2eq / kg digestate]
Farm yard manure	0.0 [kg CO_2eq / kg FYM]
Fuels GHG emission coefficients	
Natural gas (4000 km, Russian NG quality)	66.20 gCO_2eq/MJ
Natural gas (4000 km, EU Mix quality)	67.59 gCO_2eq/MJ
Diesel	87.64 gCO_2eq/MJ
HFO	84.98 gCO_2eq/MJ
HFO for maritime transport	87.20 gCO_2eq/MJ
Methanol	99.57 gCO_2eq/MJ
Hard coal	111.28 gCO_2eq/MJ
Lignite	116.98 gCO_2eq/MJ

Wheat straw	1.80 gCO_2eq/MJ
Electricity GHG emission coefficients	
Electricity EU mix MV	127.65 gCO_2eq/MJ
Electricity EU mix LV	129.19 gCO_2eq/MJ
North America	145 gCO_2eq/MJ
Latin America	55 gCO_2eq/MJ
Russia	237 gCO_2eq/MJ
Conversion inputs GHG emission coefficients	
n-Hexane	80.53 gCO_2eq/MJ
Hydrogen (for HVO)	94.35 gCO_2eq/MJ
Phosphoric acid (H_3PO_4)	3040.6 gCO_2eq/kg
Factor	**Value**
Fuller's earth	199.8 gCO_2eq/kg
Hydrochloric acid (HCl)	1375.4 gCO_2eq/kg
Sodium carbonate (Na_2CO_3)	1267.6 gCO_2eq/kg
Sodium hydroxide (NaOH)	764.4 gCO_2eq/kg
Potassium hydroxide (KOH)	626.1 gCO_2eq/kg
Pure CaO for processes	1099.9 gCO_2eq/kg
Sulphuric acid (H_2SO_4)	268.8 gCO_2eq/kg
Ammonia	2554.7 gCO_2eq/kg

Cycle-hexane	723.0 gCO_2eq/kg
Lubricants	947.0 gCO_2eq/kg
Emissions from steam production (per MJ steam or heat)	
CH_4 and N_2O emissions from NG boiler	0.39 gCO_2eq/MJ
CH_4 and N_2O emissions from NG CHP	0.00 gCO_2eq/MJ
CH_4 and N_2O emissions from Lignite CHP	3.79 gCO_2eq/MJ
CH_4 and N_2O emissions from Straw CHP	0.00 gCO_2eq/MJ
CH_4 and N_2O emissions from NG gas engine	1.23 gCO_2eq/MJ
Electricity production (reference for credit calculation)	
Electricity (NG CCGT)	124.42 gCO_2eq/MJ
Electricity (Lignite ST)	287.67 gCO_2eq/MJ
Electricity (Straw ST)	5.71 gCO_2eq/MJ
Density	
Diesel	832 kg/m^3
Gasoline	745 kg/m^3
HFO	970 kg/m^3
HFO for maritime transport	970 kg/m^3
Ethanol	794 kg/m^3
Methanol	793 kg/m^3

FAME	890 kg/m^3
Syn diesel (BtL)	780 kg/m^3
HVO	780 kg/m^3
Lower Heating Values	
Manure	10 MJ/kg
Methane	50 MJ/kg
Diesel	43.1 MJ/kg
Gasoline	43.2 MJ/kg
HFO	40.5 MJ/kg
HFO for maritime transport	40.5 MJ/kg
Ethanol	26.81 MJ/kg
Methanol	19.9 MJ/kg
FAME	37.2 MJ/kg
Syn diesel (BtL)	44.0 MJ/kg
HVO	44.0 MJ/kg
PVO	36.0 MJ/kg
Hard coal	26.5 MJ/kg
Lignite	9.2 MJ/kg
Corn	18.5 MJ/kg
FFB	24.0 MJ/kg

Rapeseed	26.4 MJ/kg
Soybeans	23.5 MJ/kg
Sugar beet	16.3 MJ/kg
Sugar cane	19.6 MJ/kg
Sunflower seed	26.4 MJ/kg
Wheat	17.0 MJ/kg
Waste vegetable / animal oil	37.1 MJ/kg
Factor	**Value**
Bio Oil (by-product FAME from waste oil)	21.8 MJ/kg
Crude vegetable oil	36.0 MJ/kg
DDGS (10 wt% moisture)	16.0 MJ/kg
Glycerol	16.0 MJ/kg
Palm kernel meal	17.0 MJ/kg
Palm oil	37.0 MJ/kg
Rapeseed meal	18.7 MJ/kg
Soybean oil	36.6 MJ/kg
Soy bean meal	-
Sugar beet pulp	15.6 MJ/kg
Sugar beet slops	15.6 MJ/kg
Wheat straw	17.2 MJ/kg

n-hexane	45.1 MJ/kg
Wood @ 50% moisture content	8.4 MJ/kg
Wood @ 25% moisture content	13.8 MJ/kg
Wood @ 15% moisture content	16.0 MJ/kg
Wood @ 10% moisture content	17.0 MJ/kg
Bagasse @ 50% moisture content	11.8 MJ/kg
Bagasse pellets (10% moisture content)	15.1 MJ/kg
Olive cake	19.3 MJ/kg
Grass at 10% MC	14.4 MJ/kg
Grass at 15% MC	13.6 MJ/kg
Grass at 25% MC	11.9 MJ/kg
Charcoal	30.0 MJ/kg
RDF	15.5 MJ/kg
Biological fraction of MSW	5.8 MJ/kg
Straw @ 15% moisture content	15.2 MJ/kg
Biogas (52% methane)	21 MJ/Nm^3
Biomethane	34 MJ/Nm^3
Methane	36 MJ/Nm^3
Fuel efficiencies	
Truck for dry product (Diesel)	0.81 MJ/t.km

Truck for liquids (Diesel)	0.87 MJ/t.km
Truck for FFB transport (Diesel)	2.24 MJ/t.km
Tanker truck MB2318 for vinasse transport	2.16 MJ/t.km
Tanker truck with water cannons for vinasse transport	0.94 MJ/t.km
Dumpster truck MB2213 for filter mud transport	3.60 MJ/t.km
Ocean bulk carrier (Fuel oil)	0.20 MJ/t.km
Ship /product tanker 50kt (Fuel oil)	0.12 MJ/t.km
Local (10 km) pipeline	0 MJ/t.km
Rail (Electric, MV)	0.21 MJ/t.km
Transport exhaust gas emissions	
Truck for dry product (Diesel)	0.0034 gCH_4/t.km
Truck for dry product (Diesel)	0.0000 gN_2O/t.km
Truck for liquids (Diesel)	0.0036 gCH_4/t.km
Truck for liquids (Diesel)	0.0000 gN_2O/t.km
Truck for FFB transport (Diesel)	0.0002 gCH_4/t.km
Truck for FFB transport (Diesel)	0.0000 gN_2O/t.km
Tanker truck MB2318 for vinasse transport	0.000 gCH_4/t.km
Tanker truck MB2318 for vinasse transport	0.000 gN_2O/t.km
Tanker truck with water cannons for vinasse transport	0 gCH_4/t.km
Tanker truck with water cannons for vinasse transport	0 gN_2O/t.km

Dumpster truck MB2213 for filter mud transport	0 gCH_4/t.km
Factor	**Value**
Dumpster truck MB2213 for filter mud transport	0 gN_2O/t.km
Ocean bulk carrier (Fuel oil)	0 gCH_4/t.km
Ocean bulk carrier (Fuel oil)	0.0007 gN_2O/t.km
Ship /product tanker 50kt (Fuel oil)	0 gCH_4/t.km
Ship /product tanker 50kt (Fuel oil)	0 gN_2O/t.km
Local (10 km) pipeline	0 gCH_4/t.km
Local (10 km) pipeline	0 gN_2O/t.km
Rail (Electric, MV)	0 gCH_4/t.km
Rail (Electric, MV)	0 gN_2O/t.km

Table 17: IPCC Default Values for calculation of soil N2O emissions

Factor	**Value**
IPCC default values for calculation of soil N2O emissions	
Direct N_2O emission factor (calculated from IPCC references given in italics below)	4.65 kg CO_2eq / kg N
Indirect N_2O emission factor from inorganic fertiliser (calculated from IPCC references given in italics below)	1.51 kg CO_2eq / kg N
Indirect N_2O emission factor from organic fertiliser (calculated from IPCC references given in italics below)	1.98 kg CO_2eq / kg N

IPCC Tier 1 default emission factor for N additions from mineral fertilisers, organic amendments and crop residues, and N mineralised form mineral soil as a result of loss of soil carbon	0.01 [kg N_2O-N / (kg N)]
IPCC Tier 1 default emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces	0.0100 [kg N_2O-N / (kg NH_3-N + NOx-N volatilised)]
IPCC Tier 1 default fraction of AN fertiliser that volatilises as NH3 and NOx	0.1000 [(kg NH_3-N + NOx-N) / kg N applied]
IPCC Tier 1 default fraction of urea that volatilises an NH3 and NOx	0.2000 [(kg NH_3-N + NOx-N) / kg N applied]
IPCC Tier 1 default emission factor for N2O emissions from N leaching and runoff	0.0075 [kg N_2O-N / (kg N leached and runoff)]
IPCC Tier 1 default fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff	0.3000 [kg N / kg N additions]
N_2O emissions / N_2O-N emissions	1.5714 [kg N_2O / kg N_2O-N]
IPCC Tier 1 default fraction of organic fertiliser that volatilises as NH_3 and NOx	0.2000 [(kg NH_3-N + NOx-N) / kg N applied]
Nitrogen content of digestate	2.1000 [kg N / t]
Nitrogen content in farm yard manure	6.5000 [kg N / t]

Appendix 4 – Land use change calculations

4.1 This section sets out how to calculate emissions due to land use change. The EC transparency platform has published an annotated example of these emissions calculations.[65]

4.2 Equation 1 is taken directly from the RED GHG calculation methodology.[66] Equations 2-5 are from the EC decision[67] regarding guidelines for the calculation of land carbon stocks. The EC decision was published to establish the rules for calculating land carbon stocks, for both the reference land use (CS_R) and the actual land use (CS_A). Please refer to the EC decision for further information on the similarities required when establishing the extent of an area for which the land carbon stocks are to be calculated.

4.3 The same method should be applied for the calculation of emission savings from soil carbon accumulation via improved agricultural practices. All calculations in this section refer to direct land use changes. Generators do not need to report against, or include in their carbon intensity calculations, emissions from indirect land use change.

4.4 Land use change related emissions should be calculated based on the difference in carbon stocks of the land between its current and previous use (on 1 January 2008), as shown in Equation 1.

Equation 1: Land use change emission

$$e_l = \frac{3.664}{20P}\,(CS_R - CS_A) - e_B$$

Where:

e_l is the annualised GHG emissions due to land use change (measured as mass of CO2eq per unit energy)

CS_R is the carbon stock associated with the reference land use (ie the land use in January 2008 or 20 years before the feedstock was obtained, whichever the later) (measured as mass of carbon per unit area, including both solid and vegetation)

CS_A is the carbon stock associated with the actual land use (measured as mass of carbon per unit area, including both soil and vegetation). In cases where the carbon stock accumulates over more than one year, the value attributed to CSA shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever the earlier.

P is the productivity of the crop (measured as energy per unit per year)

e_B is a bonus of 29gCO2eq/MJ if the bioliquid feedstock is obtained from restored degraded land under the conditions set out in the paragraphs below

4.5 The EC decision defines the calculation of the carbon stocks as:

[65] http://ec.europa.eu/energy/renewables/biofuels/doc/2010_bsc_example_land_carbon_calculation.pdf
[66] Annex V, Part C, Para 7.
[67] 2010/335/EU - Commission Decision of 10th June 2010 on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC – available on the EC Transparency Platform.

Equation 2: Carbon stock

$$CS_i = (SOC + C_{VEG}) \times A$$

Where:

CS_i is carbon stock of the area associated with the land use i (measured as mass of carbon per unit area, including both soil and vegetation)

SOC is the soil organic carbon (measured as mass of carbon per hectare)

C_{VEG} is the above and below ground vegetation carbon stock (measured as mass of carbon per hectare)

A is the factor scaling to the area concerned (measured as hectares per unit area**)**

4.6 The key part of the land use change calculation is therefore an estimation of the change in carbon stocks. This is based on the difference between the carbon stock now and the carbon stock either in January 2008 or 20 years before the feedstock was obtained, whichever is later.

4.7 Carbon stock estimates are based on:

- previous land use
- climate and in some cases ecological zone
- soil type
- soil management (for both previous and new land use)
- soil input (for both previous and new land use).

4.8 The location and nature of the land use change must be known by the generator reporting land use change. When the change is known, it is possible to use the look-up tables in the EC decision for the different parameters listed above to estimate the change in carbon stock.

- climate, ecological zone and soil type can be taken from maps and data provided in the EC decision and on the EU Transparency Platform
- soil management (whether full-till, reduced-till or no-till) and soil inputs (low, medium, high-with manure, and high–without manure) are factors that would need to be reported by the generator reporting that land use change has taken place.

4.9 There are two land types (settlements[68] and degraded land) for which the carbon stock has not yet been defined in the existing EC decision. In the absence of specified carbon stock for settlements, we advise that the carbon

[68] Based on the 2006 IPCC Guidelines for National GHG inventories (Vol. 4), a settlement includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories.

stock of the settlement should be measured. We also advise measuring that the carbon stock of any land claimed to be degraded land.

Soil organic carbon

4.10 Generators may use several methods to determine soil organic carbon, including measurements.[69] As far as the methods are not based on measurements, they should take into account climate, soil type, land cover, land management and inputs.

4.11 As a default method, the following equation can be used:

Equation 3: Soil organic carbon

$$SOC = SOC_{ST} \times F_{LU} \times F_{MG} \times F_I$$

Where:

SOC is soil organic carbon (measured as mass of carbon per hectare)

SOC_{ST} is the standard soil organic carbon in the 0 – 30 cm topsoil layer (measured as mass of carbon per hectare)

F_{LU} is the land use factor reflecting the difference in soil organic carbon associated with the type of land use compared to the standard soil organic carbon (no unit)

F_{MG} is the land use factor reflecting the difference in soil organic carbon associated with the principle management practice compared to the standard soil organic carbon (no unit)

F_I is the land use factor reflecting the difference in soil organic carbon associated with different levels of carbon input to soil compared to the standard soil organic carbon (no unit)

4.12 SOC_{ST} can be located in the EC decision depending on climate region and soil type. The climate region can be determined from the climate region data layers available on the EC transparency platform.70 The soil type can be determined by following the flow diagram on page 12 of the EC decision or following the soil type data layers also available from the transparency platform.

4.13 F_{LU}, F_{MG} and F_I can be located in Tables 2 to 8 of the EC decision depending on climate region, land use, land management and input.

4.14 If a generator does not report a land use change but wishes the carbon intensity calculation to take into consideration an increase in soil carbon resulting from improved agricultural practices, the same calculations are performed but only F_{MG} or F_I will change between CS_R and CS_A.

Organic soils (histosols)

[69] Soil organic carbon levels can traditionally be measured using mass loss on ignition or wet oxidation. However, newer techniques are being developed, which can either be carried out in the field or remotely (near infrared reflectance spectrometry, remote hyperspectral sensing).

[70] The climate region and soil type data layers are available online from http://eusoils.jrc.ec.europa.eu/projects/RenewableEnergy/

4.15 There is no default method available for determining the soil organic carbon (SOC) value of organic soils. The method used by parties should however take into account the entire depth of the organic soil layer as well as climate, land cover and land management and input. An appropriate method could be to measure the SOC of the soil.

4.16 Where carbon stock affected by soil drainage is concerned, losses of carbon following drainage shall be taken into account by appropriate methods, potentially based on annual losses of carbon following drainage.

Above and below ground vegetation carbon stock

4.17 For some vegetation types, CVEG can be directly read in Tables 9 to 18 of the EC decision.

4.18 If a look-up value is not available, vegetation carbon stock should be determined using the following equation:

$$C_{VEG} = C_{BM} + C_{DOM}$$

4.19 This takes into account both above and below ground carbon stock in living stock (C_{BM}) and above and below ground carbon stock in dead organic matter (C_{DOM}). See Equations 4a-d for calculating C_{BM} and C_{DOM}. For C_{DOM} the value of 0 may be used, except in the case of forest land (excluding forest plantations) with more than 30% canopy cover.

Equations 4a, b, c and d: Above and below ground carbon stock in living stock

$$C_{BM} = C_{AGB} + C_{BGB} \quad [a]$$

Where:

$$C_{AGB} = B_{AGB} \times CF_B \quad [b]$$

And:

$$C_{BGB} = B_{BGB} \times CF_B \quad [c]$$

Or

$$C_{BGB} = C_{AGB} \times R \quad [d]$$

Where:

C_{BM} is the above and below ground carbon stock in living biomass (measured as mass of carbon per hectare)

C_{AGB} is the above ground carbon stock in living biomass (measured as mass of carbon per hectare)

C_{BGB} is the below ground carbon stock in living biomass (measured as mass of carbon per hectare)

B_{AGB} is the weight of above ground living biomass (measured as mass of carbon per hectare)

B_{BGB} is the weight of below ground living biomass (measured as mass of carbon per hectare)

C_{FB} is the carbon fraction of dry matter in living biomass (measured as mass of carbon per hectare)

R is the ratio of below ground carbon stock in living biomass to above ground carbon stock in living biomass

4.20 The values for Equation 4a-d are determined as follows:

- For cropland, perennial crops and forest plantations, the value of B_{AGB} shall be the average weight of the above ground living biomass during the production cycle.
- For CFB the value of 0.47 may be used.
- For cropland, perennial crops and forest plantations, the value of BBGB shall be the average weight of the above ground living biomass during the production cycle.
- R can be read in Tables 11 to 18 of the EC decision.

Equation 5a, b and c: Above and below ground carbon stock in dead organic matter

$$C_{DOM} = C_{DW} + C_{LI} \quad [a]$$

Where:

$$C_{DW} = DOM_{DW} \times CF_{DW} \quad [b]$$

And

$$C_{LI} = DOM_{LI} \times CF_{LI} \quad [c]$$

Where:

C_{DOM} is the above and below ground carbon stock in dead organic matter (measured as mass of carbon per hectare)

C_{DW} is the carbon stock in dead wood pool (measured as mass of carbon per hectare)

C_{LI} is the carbon stock in litter (measured as mass of carbon per hectare)

DOM_{DW} is the weight of dead wood pool (measured as mass of carbon per hectare)

CF_{DW} is the carbon fraction of dry matter in dead wood pool (measured as mass of carbon per hectare)

DOM_{LI} is the weight of litter (measured as mass of carbon per hectare)

CF_{LI} is the carbon fraction of dry matter in litter (measured as mass of carbon per hectare)

4.21 These values for Equations 5a to c are determined as follows:

- For CFDW the value of 0.5 may be used
- For CF_{LI} the value of 0.4 may be used

Appendix 5 – Example templates for mass balance chain of custody records

5.1 This appendix provides two tables with examples of mass balance records that parties in the supply chain could use. The examples mention several steps in the supply chain. In reality, however, there may be other steps in addition to these.

Table 18: Example of an output record from a farm supplying certified rapeseed to crusher

Consignment no.	Transaction date	Receiving Company	Product	Quantity (tonnes)	Country of origin	NUTS 2 compliant region	Voluntary Scheme	Land Use on 1 January	Crop yield (t/ha)[71]	Nitrogen fertiliser (kg/ha)
22001	16-1-2011	C1	Rapeseed	1,000	UK	Y	LEAF	Crop land-non protected	30	180

Table 19: Example of an input record from a rapeseed crusher. This crusher receives certified rapeseed from farms F1 and F2.

Consignment no.	Transaction date	Supplying	Product	Quantity (tonnes)	Country of origin	NUTS 2 compliant .	Voluntary	Land Use on 1 January	Carbon intensity (g

[71] Farmers/plantation owners can also report on carbon intensity but the key data are crop yield and use of nitrogen fertiliser.

220001	16-1-2011	F1	Rapeseed	1,000	UK	Y	LEAF	Cropland - non protected	30
220002	16-1-2011	F2	Rapeseed	1,000	UK	Y	LEAF	Cropland - non protected	30

Table 20: Example record of crusher conversion factor

Conversion parameters	**Rapeseed to rapeseed oil**
Input	Rapeseed
Output	Rapeseed oil
Unit	kg rapeseed oil / kg rapeseed
Value	0.40
Valid from	1-1-2011
Valid until	1-6-2011

Table 21: Example of an output record from a crusher. This crusher supplies operator of an eligible installation 'G' with rapeseed oil.

Consignment	Transaction	Receiving	Product	Feedstock	Quantity	Country of	NUTS 2	Voluntary	Land Use on 1 January 2008	Carbon	Bonus degraded land	Factor soil carbon	Installation in operation on
23001	20-1-2011	G	Rapeseed oil	Rapeseed	400	UK	Y	LEAF	Cropland-non protected	32	N	N	Y
23002	20-1-2011	G	Rapeseed oil	Rapeseed	800	UK	Y	LEAF	Cropland-non protected	36	N	N	Y

Table 22: Example of an input record from a generator of an eligible installation. This generator receives palm oil based HVO from bioliquid producers B1 and B2.

Consignment no.	Transaction date	Supplying	Bioliquid type	Feedstock	Production process	Quantity (tonnes)	Country of origin	NUTS 2 compliant	Voluntary Scheme	Land Use on 1 January 2008	Carbon intensity (g CO2e/MJ)	Bonus degraded	Factor soil carbon accumulation	Installation in operation on 23
33001	20-1-2011	B1	HVO	CPO	Methanecapture	900	Indonesia	-	RSPO	Cropland-nonprotected	29	N	N	Y
33002	20-1-2011	B2	HVO	CPO	-	300	Malaysia	-	RSPO	Cropland-nonprotected	62	N	N	Y

Appendix 6 - Glossary

A	AD	Anaerobic Digestion
B	BEIS	Department for Business Energy and Industrial Strategy
	BS	British Standard
C	CEN	The European Committee for Standardization
	CHP	Combined Heat and Power
	CO_{2eq}	Carbon dioxide equivalent
D	DECC	Department of Energy and Climate Change
DEFRA		Department of Farming and Rural Affairs
	DME	Dimethyl ether
E	EC	European Commission
	EN	European Norm (Standard)
	ETBE	Ethyl tert-butyl ether
	EU	European Union
F	FIT	Feed-in Tariffs
	FMS	Fuel Measurement and Sampling
	FSC	Forest Stewardship Council
G	GHG	Greenhouse gas
I	ISAE	International Standard on Assurance Engagements
	ISO	International Organisation for Standardisation
L	LUC	Land use change
K	KG	Kilogram
M	MBS	Mass Balance system
	MJ	Megajoule
	MTBE	Methyl tert-butyl ether
N	NUTS	Nomenclature of Territorial Units for Statistics
O	OFGEM	Office for Gas and Electricity Markets
P	PERC	Programme For the Endorsement of Forest Certification

R	RED	Renewable Energy Directive
	RFA	Renewable Fuels Agency
	RHI	Renewable Heat Incentive
	RO	Renewables Obligation
	RTFO	Renewable Transport Fuels Obligation
S	SRF	Short Rotation Forestry
T	TAEE	Tertiary amyl-ethyl ether
U	UK-TPP	UK Timber Procurement Policy
V	VS	Voluntary scheme