ofgem Making a positive difference for energy consumers

Non-Domestic Renewable Heat Incentive

www.ofgem.gov.uk/ndrhi

# Sustainability Self-Reporting Guidance
## (version 2)


**Publication date:** 31 March 2021



**Contact:** RHI Operations Team

**Tel:** **0300 003 2289**

**Email:** RHI.enquiry@ofgem.gov.uk


### Overview

This document explains how to demonstrate compliance with the sustainability criteria under the Non-Domestic Renewable Heat Incentive Regulations 2018 (as amended), which came into force from 5 October 2015. This document is for use of those Non-Domestic RHI applicants and participants in England, Scotland and Wales using solid biomass or biogas to generate heat (or heat and electricity), and producers of biomethane for injection, who are using the self–reporting option to demonstrate compliance with the sustainability criteria. In this document the sustainability criteria is also referred to as the requirements.

If you are using the Biomass Suppliers List (BSL) or Sustainable Fuel Register (SFR) exclusively to demonstrate compliance against the sustainability requirements (not available to CHP or biogas installations or producers of biomethane), you **do not need to read this guidance.** You can find all the information you need in chapter 4, volume 2 of the Non-Domestic RHI Guidance.

An Easy Guide[1] is available and is recommended as the first point of reference for those new to this topic.

[1] https://www.ofgem.gov.uk/publications-and-updates/easy-guide-sustainability

# Context

The Renewable Heat Incentive (RHI) is a world-first government financial incentive scheme designed to increase the uptake of renewable heat technologies and reduce carbon emissions.

The Secretary of State for Energy and Climate Change used powers contained in the Energy Act 2008 ('the Act') to introduce the Renewable Heat Incentive (RHI) in Great Britain. The Renewable Heat Incentive Scheme Regulations 2011 came into force on 28 November 2011, and has been subject to amending regulations being made in 2012, 2013, 2014, 2015, 2016, 2017 and 2018. The government is responsible for developing the underlying RHI policy including setting tariffs, establishing the legislative framework, and introducing any future changes to the scheme elements.

The NDRHI scheme will close to all new applications (including applications for accreditation, preliminary accreditation, registration, preliminary registration, additional capacity, additional biomethane and Tariff Guarantees (TG) from midnight at the end of 31 March 2021, barring some exceptions.

This guidance describes the sustainability requirements and related reporting requirements for participants using solid biomass or biogas and producing biomethane for injection in England, Wales and Scotland from 5 October 2015.

# Associated documents

The following documents support this publication:

**Legislation**

- Energy Act 2008[2]
- Renewable Energy Directive
- The Renewable Heat Incentive Regulations 2018[3]
- The Domestic Renewable Heat Incentive Scheme and Renewable Heat Incentive Scheme (Amendment) Regulations 2021[4]

**Guidance**

All guidance is available at www.ofgem.gov.uk.

The following three documents are available here: www.ofgem.gov.uk/ndrhi-guidance

- Non-domestic RHI Guidance Volume 1: Eligibility and How to Apply
- Non-domestic RHI Guidance Volume 2: Ongoing Obligations and Payments
- Non-domestic RHI Guidance: Fuel Measurement and Sampling

**Other Relevant Publications**

Woodfuel Advice Note (published by DECC (now BEIS)): see https://www.gov.uk/government/publications/woodfuel-guidance

[2] http://www.legislation.gov.uk/ukpga/2008/32/contents
[3] http://www.legislation.gov.uk/all?title=renewable%20heat%20incentive
[4] https://www.legislation.gov.uk/uksi/2021/76/contents/made

# Contents

1. Introduction ..... 7
2. Overview of sustainability requirements ..... 8
Quarterly and annual reporting requirements for self-reporters ..... 10
Demonstrating compliance with the sustainability requirements ..... 11
Overview of ongoing obligations related to fuel ..... 12
3. Self-reporting details ..... 17
Demonstrating compliance with the requirements ..... 19
Recognised voluntary schemes ..... 19
4. Fuel classification ..... 23
Definitions ..... 25
Considering fuel classification ..... 27
5. Greenhouse gas (GHG) criteria ..... 32
Performing GHG calculations ..... 33
Land use change emission calculation ..... 46
Useful tools and sources of information ..... 48
6. Land criteria ..... 51
Solid biomass which is wood or wholly derived from wood ..... 51
Demonstrating compliance for solid biomass which is wood or wholly derived from wood ..... 52
Solid biomass which is not wood-based ..... 55
Demonstrating compliance for solid biomass which is not wood-based ..... 56
7. Consignment and mass balance ..... 62
Determining a consignment ..... 62
The operation of a mass balance system ..... 70
Demonstrating compliance and record keeping ..... 72
Appendices ..... 75
Appendix 1 – UK recognised voluntary schemes ..... 76

Appendix 2 – Common fuel classifications ..... 77
Appendix 3 – Default values and standard input data ..... 82
Appendix 4 – Land use change calculations ..... 87
Appendix 5 – Example templates for mass balance chain of custody records ..... 94
Appendix 6 – Glossary ..... 95



Any enquiries related to the text of this publication should be sent to Ofgem at:

10 South Colonnade, Canary Wharf, London, E14 4PU. Alternatively, please call Ofgem on 0207 901 7000.

This publication is available at www.ofgem.gov.uk. Any enquiries regarding the use and re-use of this information resource should be sent to: psi@nationalarchives.gsi.gov.uk

# Executive Summary

This document describes the sustainability requirements for owners of accredited biomass or biogas installations, registered producers of biomethane, independent auditors and other interested parties. It focuses on how participants who will have to self-report can meet the sustainability requirements of the Non-Domestic Renewable Heat Incentive and includes an explanation of the sustainability criteria and reporting requirements for these participants.

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 legislation requires participants using biomass or biogas, or those producing biomethane, to report against, and meet, the sustainability criteria in order to be eligible for support under the scheme.

Participants have the option to follow a number of reporting routes depending on their technology type. This document only covers the self-reporting route of demonstrating compliance with the sustainability requirements.

Participants will be requested to provide specific information and declarations each quarterly period relevant to the reporting route they are using. Additionally, certain participants will have to provide a sustainability audit report on an annual basis which verifies the information provided to Ofgem during the year. More information on the reporting requirements can be found within this document. The audit report requirement is also supported by the publication of a further guidance document, details of which can be found in the Associated Documents section.

This document has been specifically created for the Renewable Heat Incentive scheme. It is for guidance only and not intended to be a legal guide.

# 1. Introduction

1.1. Some areas of the legislation are prescriptive, others give us discretion. Where the legislation is prescriptive, this guidance is intended to help participants understand what we require. Where the legislation gives us discretion, the document gives guidance as to how we might exercise that discretion. It also explains what we need, practically, from participants and auditors to enable them to demonstrate they meet these requirements.

1.2. In instances where parties other than participants are involved in the RHI (for example the auditor appointed to conduct the annual sustainability audit), the participant is responsible for ensuring any guidance is distributed accordingly.

1.3. This document cannot anticipate every scenario which may arise. Where a scenario arises which is not addressed in this guidance, we will adopt an approach consistent with the relevant legislation.

1.4. In this document the Renewable Heat Incentive Scheme Regulations 2018, which came into force on 22 May 2018, are referred to as 'the Regulations'[5].

1.5. This is a guidance document only. It is the responsibility of the participant to ensure that they are aware of the requirements of the Regulations. It is not intended to provide comprehensive legal advice on how the Regulations should be interpreted. Where necessary, participants should seek their own technical or legal support.

1.6. As a working document it may be updated from time to time and should be read in conjunction with other guidance documents listed in the Associated Documents section, and the relevant legislation. Any separate guidance published in addition to this document will be posted on our website.

[5] http://www.legislation.gov.uk/all?title=renewable%20heat%20incentive

# 2. Overview of sustainability requirements

2.1. From 5 October 2015 all participants generating heat (or heat and power) from biomass or biogas and those producing biomethane for injection, will have to comply with sustainability requirements. Waste or fuel wholly derived from waste is considered to meet the sustainability requirements[6].

2.2. The regulatory requirement is that "A participant who generates heat or heat and power from solid biomass or biogas in an accredited RHI installation on or after 5 October 2015 must use only sustainable solid biomass or sustainable biogas" and "A participant who produces biomethane for injection on or after 5 October 2015 must produce for injection only sustainable biomethane"[7].

2.3. This requirement applies to all those participants regardless of when they submitted their application or of their date of accreditation.

2.4. If the requirements are not met, this will be a breach of ongoing obligations and may result in any of the enforcement actions available under the Regulations being taken, which includes reducing or withholding RHI payments.

2.5. The requirements are made up of:

- a greenhouse gas (GHG) emissions limit of 34.8g$CO_{2(eq)}$ per MJ of heat generated[8] or MJ of biomethane injected
- land criteria which considers factors associated with the land from which the biomass was sourced

2.6. There are four routes to demonstrate compliance available to participants:

[6] Regulations, Part 5, Regulation 49
[7] Regulations, Part 5, Regulation 48(2)
[8] Or 125.28 kg of $CO_2$ eq per MWh

1. Use fuel listed on the Biomass Suppliers List (BSL)[9] for woody fuels or Sustainable Fuel Register (SFR)[10] for non-woody fuels
    - Applies to biomass installations generating heat (not heat and power) only
2. Register as a self-supplier on the BSL, or SFR
    - Applies to installations under 1MWth only
3. Compliance with the RO sustainability requirements
    - Applies to biomass and biogas CHP installations 1MWe or above only
4. Self-report on the criteria
    - Mandatory for CHP (if not using the option above), biogas and biomethane installations; although other installation types can also use this route. **This document details the self-reporting route (i.e. route 4 listed above). For information on the three other routes of demonstrating compliance, please see the ongoing fuel eligibility requirements chapter, Guidance volume 2.**

2.7. It is possible to use a combination of compliance routes. For example, some fuels could be listed on the BSL or SFR, whilst others are self-reported against. It is also permitted to change compliance routes during the participant's 20 years on the scheme.

2.8. The sustainability requirements are separate to the air quality requirements which are designed to limit emissions of particulate matter and nitrogen oxides. It is still necessary for participants to use only fuels which are listed on their emission certificate in addition to meeting the sustainability requirements. The air quality requirements only apply to those with a date of accreditation on or after 24 September 2013. Please see Guidance volume one, chapter 9[11] for further details.

[9] Biomass Suppliers List: http://biomass-suppliers-list.service.gov.uk/
[10] https://www.sfregister.org
[11] https://www.ofgem.gov.uk/publications-and-updates/guidance-volume-one-two-and-fuel-measurement-and-sampling-guidance

2.9. These new sustainability requirements are in addition to the current sustainability information reporting requirements for biomass installations 1MWth and above, and for biomethane injection. Please see Guidance volume two, chapter 9[12] for further details.

## Quarterly and annual reporting requirements for self-reporters

2.10. There are specific regulatory reporting requirements which must be complied with as part of the ongoing obligations.

2.11. All participants must declare whether the consignment(s) of fuel used each quarter meet(s) the sustainability requirements.

2.12. As part of the quarterly periodic data submissions made to Ofgem, participants will be asked to provide the following information in the 'Sustainability Information' section via the RHI Register:

- A declaration as to whether the consignment of fuel used was waste and if not, a declaration as to whether the consignment of fuel met the GHG and land criteria which will need to be accompanied with a GHG emissions figure for that consignment.
- Annual sustainability audit reports (applicable to participants with installations 1MWth and above, including those using waste, and all biomethane producers) will need to be uploaded in the audit report section of the RHI Register.

2.13. It is only necessary to report on the fuels used during that quarter. Different fuels may be used over different quarters. Table 1 below sets out the reporting requirements for the different types of installations.

Table 1: Summary of sustainability reporting requirements

[12] https://www.ofgem.gov.uk/publications-and-updates/guidance-volume-one-two-and-fuel-measurement-and-sampling-guidance

| Installation type | Quarterly declaration | Authorisation number(s) of fuel(s) used | GHG emission figure(s) | Annual sustainability audit report |
|---|---|---|---|---|
| Biomass (heat only) sourcing from BSL | ✓ | ✓ | x | x |
| Self supplier registered on BSL (<1MWth only) | ✓ | ✓ | x | x |
| Biomass/biogas self-reporting <1MWth | ✓ | x | ✓ | x |
| Biomass/biogas self-reporting ≥ 1MWth | ✓ | x | ✓ | ✓ |
| Biomass/biogas self-reporting using waste/excreta <1MWth | ✓ | x | x | x |
| Biomass/biogas self-reporting using waste/excreta ≥1MWth | ✓ | x | x | ✓ |
| Biomass CHP ≥1MWe compliant with RO | ✓ | x | x | x |
| Biomethane | ✓ | x | ✓ | ✓ |

## Transition quarter for existing participants

2.14. Participants who have a date of accreditation before 5 October 2015 will probably have a quarterly reporting period that is split on either side of 5 October 2015. These participants will be asked to provide sustainability information as part of the quarterly periodic data submission. However this information should only cover the period of that quarter that falls on 5 October 2015 onwards. This means that participants who are self-reporting will only need to report against the consignments of fuel used from 5 October 2015 and the GHG emission figure(s) should only relate those consignments of fuel.

## Demonstrating compliance with the sustainability requirements

2.15. To enable accurate and confident reporting to Ofgem, participants must gather suitable evidence. Where the participant is setting out that they meet the criteria, or is making use of relevant exemptions, they must retain evidence which demonstrates their compliance. This evidence will be required for the annual independent sustainability audit report, where relevant, and may be required for Ofgem audits or requests for information.

## Waste

2.16. Installations using waste as fuel do not have to demonstrate compliance with the land and GHG requirements. This is because waste is deemed to be sustainable under the Regulations. However, participants must declare that the consignment of fuel used is waste and be able to demonstrate that their consignment of fuel meets the regulatory definition of a 'waste[13]'. For more information on what constitutes a waste, please see chapter 6.

2.17. Installations with a capacity of 1MWth or above using waste, or producers of biomethane from waste, must provide an annual independent sustainability audit report to Ofgem. As part of the audit, these participants will need to provide evidence to support their consignment classification.

2.18. A mix of waste and non-waste fuels may be used in individual installations, but the non-waste fuels must meet the sustainability criteria.

## Overview of ongoing obligations related to fuel

2.19. The amendments made to the RHI Regulations, including the introduction of the sustainability requirements from 5 October 2015, mean there are a number of ongoing obligations related to the fuel(s) which participants use in their installation. In summary, these are:

- The fuel used must meet the sustainability requirements as described in paragraph 2.5.
- For solid biomass installations, the fuel used must be listed on the emissions certificate for the participant's boiler which would have been submitted to Ofgem at the time of application.[14]
- Any contaminated or ancillary fossil fuel used must adhere to the relevant limits.[15]

[13] "waste" has the meaning given in Article 3(1) of Directive 2008/98/EC of the European Parliament and of the Council on waste(5) and includes excreta produced by animals: http://www.legislation.gov.uk/uksi/2015/197/regulation/3/made
[14] Please see chapter 9 of the volume one Guidance for further details. This only applies to those with a date of accreditation on or after 24 September 2013. Where Ofgem has been notified of any updated emissions certificates which comply with scheme requirements, fuels must be listed on an emissions certificate which is valid for that boiler
[15] Please see chapter 4, volume 2 for further details.

## Fossil Fuel use in anaerobic digestion (AD):

2.20. From 1 April 2021 participants combusting biogas produced by AD, or injecting biomethane produced from biogas made by AD, will be able to use feedstock derived from fossil fuel as long as the contribution of the fossil fuel (that forms part of the feedstock) to the energy content of the biogas does not exceed 10%. The methodology you propose for determining the percentage contribution of the fossil fuel energy content of the biogas, in a quarterly period must be agreed with Ofgem via an agreed Fuel, Measurement and Sampling (FMS) procedures.

2.21. The percentage of the energy content of biogas from feedstock derived from fossil fuel, is the energy content of the fossil fuel expressed as a percentage of the energy content of the biogas used in that quarterly period to generate heat or produce biomethane.

2.22. RHI payments will not be issued for any heat or biomethane derived from fossil fuel.Where a participant uses feedstock derived from fossil fuel, the periodic support payment calculated must be reduced pro rata to reflect the percentage of the energy content of biogas from the fossil fuel component of the feedstock used by the participant in the relevant quarterly period.

2.23. In cases where , if the contribution of the fossil fuel to the energy content of the biogas is below 10%, Ofgem will reduce the RHI payments in line with the percentage contribution of the fossil fuel.

2.24. Where the contribution of the fossil fuel to the energy content of the biogas exceeds 10%, Ofgem may take compliance action (if relevant) to recover any payments made in relation to biogas produced by fossil fuel. It is important to note, as previously stated, RHI payments will not be issued for any heat or biomethane derived from fossil fuel.

2.25. Please note, it is the responsibility of the participant to produce the evidence necessary to demonstrate the percentage of the energy content of biogas from feedstock derived from fossil fuel, is accurate.

2.26. In some cases we may require the participant to arrange for samples of the fuel used (or to be used), or of any gas or other substance produced as the result of the use of such fuel, to be taken by a person (and analysed in a manner) specified by us and for the

results of that analysis to be provided to us in such form as we require. Participants must fill out the relevant sections of the FMS Questionnaire to ensure compliance with the fuel contamination criteria.

- For more information on eligibility requirements and fuel please see Guidance Volume 1 and 2
- Records of all fuels used in the installation must be kept. Ofgem can request these fuel records at any time.

## Criteria for woodfuel quality

2.27. From 1 April 2022, solid biomass which is wood and is used to generate heat in an accredited RHI installation must meet the for woodfuel quality criteria outlined below. The RHI regulations defines "woodfuel" in the context of the woodfuel quality criteria as "woodchip, logs, wood pellets and wood briquettes, regardless of whether the wood will undergo any other process before burning".

1. All wood pellets must meet the EN Plus A1 standard[16] or an equivalent standard.

2. All other woodfuel must meet fuel quality standard EN 15234-1:2011[17] , EN15234/ISO 9001: 2015[18] , EN ISO 17225-4 :2014[19] or an equivalent standard.

3. All woodfuel must be certified by the Woodsure Certification Scheme[20] or an equivalent certification scheme as meeting the standard in points 1 or 2 The certification scheme must provide assurance of the supply chain of the woodfuel

[16] https://www.enplus-pellets.eu/en-in/
[17] https://standards.iteh.ai/catalog/standards/cen/18307fb9-4548-40e6-8352-b7f0c462768e/en-15234-1-2011
[18] https://www.iso.org/standard/62085.html
[19] https://standards.iteh.ai/catalog/standards/cen/acae5637-0946-4570-8613-eac7a6be6b27/en-iso-17225-1-2014
[20] https://woodsure.co.uk/about-woodsure/

2.28. Participants will be required to provide evidence to show the woodfuel they have used in their accredited RHI installation meets the wood fuel quality criteria. This information will be requested on a quarterly basis alongside meter readings and sustainability information.

2.29. Participants using solid biomass which is waste or is wholly derived from waste in their accredited RHI installation will not be required to meet the woodfuel quality criteria set out above.

2.30. From 1 April 2022 participants who source their solid biomass from the Biomass Suppliers List (BSL) and or self- report against the sustainability requirements, will be required to demonstrate the solid biomass they used in their accredited RHI installation meets the woodfuel quality requirement every quarter.

2.31. BEIS have indicated that they will amend the terms of the Biomass Suppliers List (BSL) for woody fuels to ensure that all the fuel that they accredit complies with the new criteria. This will allow participants to demonstrate to Ofgem that the fuel they are using in their biomass boilers meets the NDRHI sustainable criteria to claim payments

2.32. We expect certification bodies to publish guidance that provides the details of how to comply with this requirement.

2.33. Ofgem will only signpost NDRHI participants to organisations that supply fuel compliant with the scheme. Fuel suppliers are therefore required to demonstrate their compliance to their certification bodies. For instance, if a fuel supplier uses the BSL, this new requirement may require them to obtain a new BSL number that demonstrates compliance.

2.34. Where participants self-report to Ofgem, the onus will be on the participant to show compliance with the new woodfuel quality critera. Participants will need to collate evidence that demonstrates that the consignments of fuels they used in each quarter comply with the fuel quality standard, in addition to meeting the land and greenhouse gas (GHG) emission limit criteria.

2.35. If any changes are made related to the above ongoing obligations participants must notify Ofgem within 28 days of these changes taking place. Failure to comply with the above

obligations or failure to notify Ofgem of changes within the specified timescale constitutes non-compliance with the scheme regulations and may affect RHI payments.

# 3. Self-reporting details

3.1. Participants who are not sourcing from the BSL or SFR, registered as a self-supplier on either list,or meeting the RO sustainability requirements must self-report on their fuel or biomethane against the sustainability requirements.

3.2. Participants with a biogas installation and biomethane producers must always self-report.

3.3. Participants must provide their GHG emissions figure for each consignment used per quarter and declare that it meets the GHG criteria. Please see chapter 5 for details of GHG emissions calculations and chapter 7 for details of how consignments are defined.

3.4. Participants must also declare whether each consignment meets the land criteria. Please see chapter 6 for details of the land criteria.

3.5. Any consignments classified as 'waste[21]' according to the definition in the Regulations do not need to meet the GHG and land criteria as waste is considered to be sustainable. However, they must declare on a quarterly basis whether the fuel or feedstock is classified as a waste. Please see chapter 4 for further information on fuel classification.

## Annual sustainability audit report for installations ≥1MWth

3.6. Those with an installation capacity of 1MWth and above (including those using waste), and biomethane producers, must also provide an annual sustainability audit report. This must be submitted within 3 months of the date of accreditation or its anniversary.

3.7. For participants with a date of accreditation before 5 October 2015, if the anniversary of the date of accreditation falls on or after 5 October 2015 but before 6 April 2016, the first annual sustainability audit report will not be required until within 3 months of the next

[21] ""waste" has the meaning given in Article 3(1) of Directive 2008/98/EC of the European Parliament and of the Council on waste(**5**) and includes excreta produced by animals: http://www.legislation.gov.uk/uksi/2015/197/regulation/3/made

anniversary following 5 October 2016. However, this report must cover the period from 5th October 2015, i.e. it will cover a period of a year or longer.

3.8. The annual sustainability audit report must be prepared by a person who is not the participant, and is not a connected person[22].

3.9. It must be prepared in accordance with the International Standard on Assurance Engagements 3000 (Revised) or an equivalent standard.

3.10. The purpose of the audit report is for there to be independent assurance provided on the quarterly declarations and information provided by participants, to ensure there is evidence and information to support claims that fuel is sustainable, or the fuel classification. 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 enforcement actions available under the Regulations may be taken, which includes reducing or withholding RHI payments.

3.11. Please see the 'Renewable Heat Incentive: Sustainability Audit Guidance for Participants and Auditors'[23] for further details.

3.12. Please note that if your installation capacity is below 1MWth and consequently does not require an annual sustainability audit report, you may still be audited by Ofgem, during which you would need to provide the relevant evidence and information to demonstrate the sustainability criteria have been met in previous quarters from 5 October 2015 onwards. If you have a CHP installation using solid biomass with a capacity of 1MWe (this is the electrical capacity, not the thermal capacity) or above, for which you are receiving ROCs on the electricity output and which is compliant with the RO sustainability requirements, you do not have to provide a separate annual sustainability audit report as this is already a requirement under the RO. If the annual sustainability audit report submitted to the RO finds that during the previous year, any consignment of fuel used did not meet the

[22] "connected person" means any person connected to the participant within the meaning of section 1122 of the Corporation Tax Act 2010
[23] https://www.ofgem.gov.uk/publications-and-updates/draft-guidance-documents-sustainability-requirements-

sustainability requirements, this may result in RHI payments being affected. Evidence may need to be provided that the fuel(s) in question met the RHI sustainability criteria.

## Demonstrating compliance with the requirements

3.13. Applicants will need to complete and submit a Fuel Measurement and Sampling (FMS) questionnaire at application stage so that the classification of consignments can be agreed with Ofgem. If consignments are mixed it will also be necessary to agree the approach to account for consignments used per quarter. This will need to be agreed before the application can be accredited. Please see the FMS Guidance for further details[24].

3.14. To enable accurate and confident reporting to Ofgem the participant must gather suitable evidence which demonstrates their compliance. This evidence forms the basis of the independent audit report.

3.15. Some of the evidence may lie with other parties in the supply chain (for example evidence for meeting land criteria). While the physical evidence does not need to move through the supply chain with the biomass, the participant should have sufficient information to have confidence in reporting sustainability information to Ofgem. For this the participant may be relying on contractual agreements.

3.16. Aside from the option to collect evidence, it is also possible to use voluntary schemes to demonstrate compliance with the sustainability criteria. The following sections set out further information on the use of voluntary schemes.

## Recognised voluntary schemes

3.17. Voluntary schemes are certification schemes that offer a route to providing assurance that a fuel meets part or all of the RHI sustainability requirements. These schemes will often provide further information and additional guidance on demonstrating compliance with the relevant criteria.

[24] https://www.ofgem.gov.uk/publications-and-updates/non-domestic-rhi-main-guidance

3.18. Voluntary schemes typically have a specific scope for which they are recognised. In this case, the participant may use more than one voluntary scheme, or a combination of voluntary schemes and the collection of other information, to demonstrate compliance with the RHI sustainability requirements.

3.19. Where all or part of the supply chain is covered by a voluntary scheme, it is possible that the participant can use this as evidence for demonstrating compliance with the relevant aspects of the RHI sustainability criteria for audit purposes. Where there is a break in the voluntary scheme certification in the supply chain, the certification cannot be used as 'automatic' compliance and instead this would need to form part of the evidence provided for audit purposes.

3.20. 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. To maintain certification, further audits will normally be required in accordance with the requirements of the voluntary scheme.

3.21. The participant may make use of voluntary schemes approved by the European Commission or recognised by the UK government to demonstrate compliance with the sustainability requirements (see paragraph 3.27). As parties will have been audited by the voluntary scheme, a participant's independent auditor may be able to rely on the audit conclusion/assessment result when providing assurance within the RHI sustainability audit report. For more information on the role of voluntary schemes in the annual sustainability audit report please refer to 'Renewable Heat Incentive: Sustainability Audit Guidance for Participants and Auditors[25]'.

3.22. Any voluntary schemes which are neither EC approved or recognised by the UK government may still be used to demonstrate compliance with aspects of the RHI sustainability criteria, but these will be considered alongside other evidence as part of the annual independent sustainability audit or Ofgem audit. The voluntary scheme will need to be reviewed at audit to consider which aspect(s) of the RHI sustainability criteria the scheme rules correspond with.

[25] https://www.ofgem.gov.uk/system/files/docs/2016/11/sustainability_audit_guidance_oct_16.pdf

## Using EC approved voluntary schemes

3.23. The EC undertakes formal assessments of voluntary schemes for biofuels to judge whether they deem the schemes appropriate to demonstrate compliance with the Renewable Energy Directive (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.

3.24. 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.

3.25. A situation may occur where the EC decides not to approve a scheme for the same scope previously recognised in an assessment for the UK government. In most cases, we will continue to recognise the scheme for the outlined scope for the remainder of year up to the next anniversary of the date of accreditation. 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 RHI sustainability requirements.

3.26. EC decisions on voluntary schemes will be published on the EC's transparency platform. The transparency platform also sets out a useful table noting the schemes and the scope for which each has been approved.

## Using UK recognised voluntary schemes

3.27. In 2012 Ofgem benchmarked a number of voluntary schemes against the Renewables Obligation's (RO) land criteria (Renewables Obligation Order (ROO) 2009 (as amended)) for use on the RO scheme. In 2015, the Ofgem RO team undertook an exercise to benchmark these schemes against the ROO 2015 land criteria for woody biomass for the purpose of the

RO scheme. As of 24 March 2016, the results of the 2015 RO benchmarking exercise were extended to the RHI scheme.

3.28. Appendix 1 provides further details of the 2012 benchmarking results. Further information about the 2015 RO benchmarking exercise can be found in the Renewables Obligation Sustainability Criteria Guidance.

# 4. Fuel classification

4.1. It is important that participants who are self-reporting understand the classification of their fuel(s) or feedstocks as it can affect both the GHG and land criteria reporting requirements.

4.2. The term 'fuel classification' refers to the process that determines whether biomass is a product, co-product, waste or a type of residue.

4.3. If the participant believes the fuel being used should be classed as a waste or a type of residue, there are different requirements regarding the sustainability criteria. Participants will need to gather evidence to demonstrate the classification of their fuel to Ofgem if requested and, where applicable, to their independent auditor as part of their annual sustainability audit.

4.4. It is not necessarily the final fuel that needs to be considered as a waste or 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.

Table 2: Fuel classification reporting requirements

| Fuel Category | SOLID BIOMASS | | BIOGAS | | BIOMETHANE | |
|---|---|---|---|---|---|---|
| | Land Criteria | GHG Criteria | Land Criteria | GHG Criteria | Land Criteria | GHG Criteria |
| Waste[26] | Deemed to be met | Deemed to be met | Deemed to be met | Deemed to be met | Deemed to be met | Deemed to be met |
| Biomass wholly derived from waste[27] | Deemed to be met | Deemed to be met | n/a | n/a | n/a | n/a |

[26] The Regulations define '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". This Article provides the meaning of waste as "any substance or object that the holder discards or intends or is required to discard"

[27] This term is not used in the legislation for biogas or biomethane fuels in relation to whether or not it is sustainable

| | | | | | | |
|---|---|---|---|---|---|---|
| Processing residues | If not wood – meets land criteria<br>If wood - must report against land criteria | Emissions during and from the process of collection only | If not wood - meets land criteria<br>If wood - must report against land criteria | Emissions during and from the process of collection only | If not wood - meets land criteria<br>If wood - must report against land criteria | Emissions during and from the process of collection only |
| **Fuel Category** | **SOLID BIOMASS** | | **BIOGAS** | | **BIOMETHANE** | |
| | **Land Criteria** | **GHG Criteria** | **Land Criteria** | **GHG Criteria** | **Land Criteria** | **GHG Criteria** |
| Residues from agriculture | Reporting required | Emissions during and from the process of collection only | Reporting required | Emissions during and from the process of collection only | 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 | Reporting required | Emissions during and from the process of collection only | Reporting required | Emissions during and from the process of collection only |
| Residues from arboriculture | Meets land criteria | Emissions during and from the process of collection only | Meets land criteria | Emissions during and from the process of collection only | Meets land criteria | 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 | Reporting required | Emissions during and from the process of collection only | Reporting required | Emissions during and from the process of collection only |
| Products, co-products | Reporting required | Full life-cycle emissions | Reporting required | Full life-cycle emissions | Reporting required | Full life-cycle emissions |

# Definitions

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

4.6. 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, participants should seek their own legal or technical advice.

## Definition of waste

4.7. The Regulations define '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". This Article provides the meaning of waste as "any substance or object that the holder discards or intends or is required to discard"[28].

4.8. 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'.[29]

4.9. Where participants are using waste wood, there may be two options of compliance available. If the participant is obtaining the waste wood – or it is being obtained on behalf of the participant – from the place where it first becomes waste, and the installation is less than 1MWth, the participant could register as a self-supplier on the BSL. This would make the process of demonstrating compliance to Ofgem simpler. If this route is not taken, or cannot be taken, participants will need to self-report which will involve demonstrating to Ofgem that the fuel used meets the definition of waste.

[28] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF
[29] Available from DEFRA website at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69590/pb13813-waste-legal-def-gui

4.10. All feedstock that may be classified as waste should be considered carefully by operators to ensure the waste hierarchy[30] has been applied and alternative markets have been considered before using them to generate energy.

4.11. The manipulation or modification, including contamination, of the state or condition of a substance or object in an attempt to make it fit the definition of a waste will not be considered a waste for the purposes of the RHI.

### *Waste as fuel for sustainability and accreditation*

4.12. There are cases where a participant may be accredited as a 'solid biomass' installation (rather than a 'solid biomass contained in waste' installation) but their fuel actually meets the regulatory definition of 'waste'. In these cases, the sustainability requirements applicable to using waste as a fuel can still be applied, as per the guidance in Table 2.

## Definition of residues

4.13. The Renewable Energy Directive (RED) 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." Furthermore, "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".

4.14. 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.

4.15. Co-products will not be considered residues in cases where they have been deliberately diverted from viable alternative uses.

[30] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf

4.16. Residues from arboriculture are not defined in the Regulations. However, in line with the DECC consultation response in August 2014[31], 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.

4.17. Owners of biogas installations and registered biomethane injectors should seek additional guidance from Ofgem if liquids, which are not classified as waste, are to be used in their installation as such feedtsocks are ineligible under the RHI Regulations.

## Considering fuel classification

4.18. Appendix 2 of this document 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.

4.19. Ofgem 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 with the potential to re-assess if we deem necessary.

4.20. 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 Regulations, lead us to a different approach on the same material.

4.21. It is necessary on the Non-Domestic RHI, Feed In Tarrif and the RO for Ofgem to take a view on whether a substance is a residue or a waste. Please note that this is relevant only to the sustainability criteria, and where applicable feedstock restrictions, of the applicable scheme. Ofgem's view will have no influence on the Environment Agency when it is making

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

decisions on substances. This applies both to the common classification tables at Appendix 2, and to any subsequent views Ofgem reaches on wastes and residues.

## Approach for the applicants

4.22. When considering the classification of a fuel, it is recommended that applicants refer in the first instance to the common classification tables at Appendix 2 of this document. Should their fuel be listed in the common classification tables, fitting the description provided, the applicant will need to gather evidence to support the identified classification. This evidence will be required to be presented to the auditor as part of the annual sustainability audit report where applicable, or to Ofgem on request.

4.23. Should the applicant consider 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, and include evidence and reasoning for this classification, for review by Ofgem.

4.24. Any discussions in respect of fuel classification should occur during the accreditation process, following the submission of the application which includes the FMS questionnaire for the fuel(s). This will need to be agreed by Ofgem as part of the accreditation decision.

### *Process for fuel classification discussions*

4.25. Fuel classification will be agreed as part of the review of applicants' Fuel Measurement and Sampling (FMS) procedures when an application for accreditation or registration is submitted. Each FMS questionnaire will contain questions referencing fuel classification. Where the participant considers the fuel to be a waste or a type of residue which is not covered in the common classification tables (see Appendix 2), Ofgem will ask the participant to provide evidence of the fuel classification. Participants 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.

4.26. When determining whether a particular material is a co-product, residue or a waste, operators may be asked to complete a Fuel Classification Consideration questionnaire. The questions contained within this document will ensure the operator presents relevant information to support any further discussions.

4.27. In addition to these questionnaires, operators may wish to refer to the Renewables Obligation (RO) Fuel Classification Flow Diagram, a guidance document that can be used to help determine the fuel classification of materials that are not already listed in the Common Fuels Classification table (see Appendix 2).

4.28. The Fuel Classification Consideration questionnaire will need to be completed as part of the FMS questionnaire. Both questionnaires can be found on the Ofgem website. Ofgem will consider the information provided by the applicant. During this process, we may seek further information from other parties. The participant should be aware that the information they provide to Ofgem may be shared[32].

4.29. Where the information presented is unclear or incomplete, we will raise queries with the participant to seek further information in order to provide our view on fuel classification.

4.30. Any view from Ofgem on fuel classification does not remove the requirement for evidence of fuel classification to be assessed at audit. We expect the participant'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 participant as part of the fuel classification review.

4.31. 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 participant has reported and, where relevant, any associated RHI payments.

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

## Demonstrating Compliance

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

4.33. 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.

4.34. This evidence will be verified by the annual sustainability audit report if applicable, or during an Ofgem audit. This means that a participant must demonstrate to the auditor's satisfaction that the biomass used is as per the common classifications list or the separately established agreement with Ofgem. More information on the expectations of the auditor – where an annual sustainability audit report is required - in respect to fuel classification can be found in the 'Renewable Heat Incentive: Sustainability Audit Guidance for Participants and Auditors'.

## Calculating GHG Emissions - Process of Collection

4.35. 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.[33]

4.36. 'Process of collection' refers to the beginning of the process of collection which includes all emissions involved in collecting the residue, and further processing and transport. This is

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

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.

# 5. Greenhouse gas (GHG) criteria

5.1. This chapter outlines the GHG criteria and the principles behind calculating GHG emissions for the fuels you use. This is relevant for self-reporters only. If you are demonstrating compliance with the sustainability criteria by purchasing fuel listed on the BSL or SFR, or by registering as a self-supplier on an approved list, then it will not be necessary for you to be familiar with the principles in this chapter.

5.2. The Regulations require that participants must produce renewable heat with lifecycle greenhouse gas emissions of less than or equal to 34.8 grams of carbon dioxide equivalent per megajoule of heat generated, or, if they are injecting biomethane instead of producing heat, the biomethane must have lifecycle greenhouse gas emissions of less than or equal to 34.8 grams of carbon dioxide equivalent per megajoule of biomethane (measured as the net calorific value).

5.3. For biomethane calculations, the biomethane injected should be calculated using net calorific value. This is because the methodology in Schedule 2A of the Regulations includes a definition of 'energy content' which specifies that this should be measured as 'net calorific value'. It is therefore interpreted that "MJ of biomethane injected[34]" is measured in line with this definition. It should also be noted that the ingredients added as part of the biomethane production process are excluded from the calculations.

5.4. The Regulations set out that reporting of GHG emissions must be per consignment of solid biomass or biogas used, or biomethane produced[35] for each quarterly period and provides the methodology for calculations. It is not permitted to average GHG emissions values between consignments.

5.5. As set out in chapter 3, the classification of the biomass will determine how the participant is required to report against the sustainability criteria. Where the biomass used is exempt from the GHG emission criteria, or the participant only has to report emissions from the

[34] RHI Regulations, Schedule 3, Paragraph 1
[35] RHI Regulations, Regulation 49(2)

process of collection, they should gather appropriate evidence to demonstrate the correct fuel classification.

5.6. Where full life cycle GHG emission calculations are not required participants should refer to Table 2 (chapter 3) for the relevant fuel classifications.

5.7. Throughout this chapter we refer to GHG emissions of biomass, biogas and biomethane as 'carbon intensity'. This is measured in terms of the lifecycle GHG associated with the fuel as carbon dioxide equivalent (CO2eq). It therefore includes GHG other than carbon dioxide (eg methane and nitrous oxides) but excludes combustion emissions.

## Performing GHG calculations

5.8. Where a participant is self-reporting the carbon intensity of their fuel, they have the following methods available to them:

- Default value method (see 5.11 – 5.13). This can be used by participants as long as neither of the following factors apply:
    - The participant is producing biomethane for injection
    - The participant is using heat for a process (as opposed to 'space heating' or 'water heating') in an accredited RHI installation with an installation capacity of 1MWth or above
- Actual value method (see 5.14 – 5.58). This can be used by all self-reporters, and *must* be used by those to whom the default method is not applicable.

5.9. Where a participant 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 participant 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. Default carbon intensities are set out that are conservative, ie they are expected to be higher than the emissions calculated using the actual value method. Only certain fuels are covered.

5.10. If more than one fuel is being used, and the participant is able to choose between the actual value method and the default value method, they are permitted to use both methods, ie they may use the default value method for their 'wood chips from forest residues' and the actual value method for their wood pellets.

## Default Value Method

5.11. The default value method involves using a default carbon intensity of the fuel(s) being used for the purpose of reporting GHG emissions to Ofgem. The fuels which have default values associated with them are specifically set out within Schedule 2A in the Regulations. For ease of reference, the default values are replicated in Appendix 3.

5.12. The participant must be able to demonstrate that the fuel specified in Schedule 2A for which they are utilising the default carbon intensity value, does correspond to the actual fuel they are using.

5.13. The default values for GHG emissions savings for the various biomass feedstocks only provide the carbon intensity of the fuel itself, and not the heat generated, which is what needs to be reported to Ofgem. Therefore, before reporting to Ofgem, the participant must perform a single calculation using the default value and the actual conversion efficiency of the plant. This calculation is set in paragraphs 4.23-4.26. Please note that this is not refering to the boiler efficiency but refers to the actual fuel efficency.

## Actual Value method

5.14. 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 Schedule 2A of the

Regulations. 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 the RHI.

5.15. 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 participant 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].

5.16. 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.

5.17. 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 Regulations 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 participants can make use of these values – but it must always be considered whether they require adapting for the participant's particular fuel chain(s).

5.18. 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
- emissions from transport and distribution

5.19. These can be broadly categorised into three main stages:

[36] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN
[37] There is some standard input data pre-built into the Carbon Calculator that participants 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.

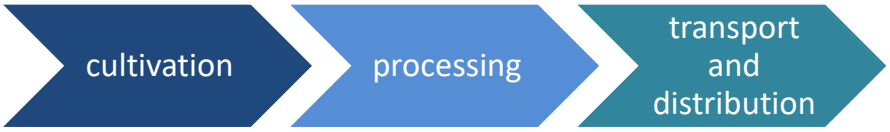



Figure 2: Summary of key steps in GHG calculations

5.20. In an actual supply chain, there may be more than one transport or processing step. Figures 3 and 4 set out some of typical fuel chains.


Figure 3: Example of a solid biomass to heat generation fuel chain: short rotation coppice pellets.
(KEY: Dark blue: Cultivation and harvesting, Teal: Transport and distribution, Blue: Processing, Orange: Heat generation.)


Figure 4: Example of a crop to heat generation fuel chain through the production of biogas: sugar beet (KEY: Dark blue: Cultivation and harvesting, Teal: Transport and distribution, Blue: Processing, Orange: Heat generation.)

5.21. 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.

5.22. 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.

## Efficiency calculation

5.23. For both the default value method and the actual value method, a calculation to take into account the efficiency of the plant must be included for biomass and biogas plants.

5.24. For biomass and biogas plants producing heat only, the GHG emissions value to report to Ofgem must be calculated using the following formula:

$$\frac{E}{\eta_h}$$

For biomass and biogas plants producing heat and power, the GHG emissions value to report to Ofgem must be calculated using the following formula:

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

Where:

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

$\eta_h$ = the efficiency of the plant in the generation of heat, which is equal to H/F, where:

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

F = the energy content (net calorific value) of all those fuels (MJ) in the relevant quarter

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

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

$C_h$ = 0.3546 where the temperature of the heat produced by the plant 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 plant in the form of liquid or steam.

Please note that the boiler efficiency and actual fuel efficiency are different values.

## Important information for Biogas and biogas CHP applicants using AD.

5.25. In line with sustainability requirements, any plant fuelled from a common gas line from the AD tank will need to consider how they will derive the fuel to plant component when calculating greenhouse gas values. Note that plate efficiency is not an acceptable method for determining plant efficiency.

5.26. When finding "the total heat produced by the plant in the form of liquid or steam", this should take into account all of the heat produced, not just heat used for eligible purposes.

5.27. For biomethane, the Regulations do not require an efficiency calculation. Therefore the GHG emissions value to report to Ofgem will be the GHG emissions associated with the biomethane injected.

## Allocation factors, input data and emission factors

5.28. 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*

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

5.30. 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.

5.31. 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.

5.32. 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 (ie 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 plant (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 plant (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 plant (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.

5.33. If the co-product is excess electricity from co-generation during the production of biomass or biogas, an emission saving should be calculated equivalent to the avoided emissions that the same amount of electricity would have produced when generated in an electricity only power plant using the same fuel. However, this saving cannot be applied if the fuel used in the CHP unit is a co-product other than an agricultural crop residue.

5.34. The following steps explain how to calculate the emission savings due to excess electricity cogeneration.

**Step 1:** Identify the amount of excess electricity being co-produced with the heat used in the module.[40]

**Step 2:** Determine the carbon intensity of electricity produced in an electricity only power plant using the same fuel as the co-generation unit (identified in step 1) by looking up the appropriate emission factor for the electricity.

**Step 3:** Give the output electricity a credit which is equal to the amount of exported electricity produced, multiplied by the carbon intensity of power plant produced electricity. This credit should be negative (ie reduces the carbon intensity of the fuel).

## *Input data*

5.35. When using the actual value method, participants 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 per cent 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[41]
- Fuel type and demand
- Electricity demand
- Co-product yield and energy content[42]

5.36. Aside from the restrictions noted in paragraph 5.42, it is possible to use standard input data in place of actual data. When using standard input data the participant should be sure that values correspond to the type of biomass fuel being used at the plant in terms of feedstock type, form, region of origin and if relevant, the drying technique.

[40] In accounting for that excess electricity, the size of the cogeneration unit shall be assumed to be the minimum necessary for the cogeneration unit to supply the heat that is needed to produce the fuel
[41] ie tonnes of product per tonne of input
[42] 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.

5.37. A range of input data was agreed by BEIS 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.

5.38. There are some forms of input data which are heavily interdependent. Table 3 below sets out these compulsory dependencies which participants 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 3: Compulsory links between interdependent parameters

| Input one | Input two |
|---|---|
| ***Crop production*** | |
| Crop yield[43] | Nitrogen fertiliser application rate |
| Nitrogen fertiliser application rate | Soil $N_2O$ emissions[44] |
| ***Conversion*** | |
| Efficiency | Any co-product yield |
| Electricity or heat exported | Fuel use |

## *Emissions factors*

5.39. 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 CO2eq per kg of nitrogen applied (kgCO2eq/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

[43] This compulsory link does not apply to sugar beet.
[44] 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.

of the use of the nitrogen fertiliser to the overall carbon intensity of the production of the crop (in kgCO2eq/t crop).

5.40. 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 Ofgem if requested. The value used must fulfil the following requirements:

- the standard emission factor should be obtained from an independent and recognised author or organisation[45];
- 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.

5.41. When accounting for the consumption of electricity that is not co-produced within the biomass production plant, 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, eg the latest version of the International Energy Agency CO2 emissions from fuel combustion database.[46] 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 5.32.

5.42. If the electricity is provided to the fuel production process from a power plant that is not connected to the electricity grid, participants 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*

5.43. 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

[45] 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.
[46] Other sources may also be used.

(Steps 1 to 10) it must then be converted into the appropriate units for reporting to Ofgem as show in Step 11:

Table 4: Step by step approach for actual value method

| **Step 1 – Define the supply chain** |
|---|
| Define the steps which occur during the production of the biomass, biogas or biomethane. 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 (eg wood chips, biogas, etc). All emissions within a module should be calculated per unit of this product (ie in kg $CO_{2eq}$/t product or kg$CO_{2eq}$/MJ product if the product is a gas[47]). |
| **Step 3 – Identify the inputs of each module** |
| Within each module, identify all inputs (material and energy) which will have an impact of more than 1 per cent on the final carbon intensity of the biomass.<br>Each input must then be measured and expressed per unit of the exported product (i.e. in MJ or t input/t product).[48] |
| **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 5.37 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 (i.e. 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.[49] |
| **Step 6 – Accounting for co-products in conversion modules** |

[47] 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

[48] 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.

[49] 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].

Within each conversion module, identify if there are co-products, i.e. products that are 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 5.26 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 (e.g. an anaerobic digestion plant), the unit of the efficiency should be in MJ output/t input, and the value will usually be much bigger than 1.

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.[50]

**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:

$$\frac{\textit{(Total GHG emissions of exported product – emission savings for module) x (allocation factor of module or any downstream modules)}}{\textit{Efficiency of any downstream modules}}$$

[50] 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)

| **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 $kgCO_{2eq}$/unit (unit is 'tonnes' for solid biomass or 'MJ' for biogas and biomethane). |
| **Step 10 – Converting carbon intensity into relevant units** |
| The carbon intensity has to be converted to $gCO_{2eq}$/MJ biomass.<br>- For a solid biomass chain, this is done by dividing the results of step 9 by the energy content (in terms of lower heating value) of the biomass (in MJ biomass/kg biomass) and then multiplying by 1000 to convert the kg $CO_{2eq}$ to $gCO_{2eq}$.<br>- For a biogas and biomethane 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.<br>The energy content (ie lower heating value) of typical biomass types can be found in the standard emission factors list (see Appendix 4). |
| **Step 11 – Final calculation for value to report to Ofgem** |
| The Regulations require the carbon intensity to be calculated per MJ of heat generated for biomass and biogas, or per MJ of biomethane injected.<br>This means that for biomass and biogas, the efficiency of the plant must be taken into account. See paragraph 5.22 for how to do this. |

## Land use change emission calculation

5.44. As set out in chapter 5, 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 5.

5.45. All calculations for land use change at present refer to direct land use changes. There are currently no requirements on participants 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.

## Soil carbon accumulation via improved agricultural management

5.46. 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

5.47. A bonus[51] of 29 gCO2eq/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.

5.48. 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.

5.49. 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.

[51] As set out in the RED - Annex V, Part C, Para 8.

## Useful tools and sources of information

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

## Carbon Calculator

5.51. Available to download from the Ofgem website[52] is the UK Biomass and Biogas Carbon Calculator (for solid biomass, biogas and biomethane fuel chains).

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

5.53. 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 (eg cultivation, transport and distribution, etc). Furthermore, accepted default emission factors are included in the calculator.

5.54. There is a user manual48 specifically for RHI participants, and other involved parties, which explains how to use the calculator.

## *Other tools*

5.55. Other IT-based tools are available which a participant can seek to use when calculating the GHG emissions for their fuel chain. Alternatively, participants could create their own tool. If a participant wishes to use a tool other than the UK Carbon Calculator, the onus is on them to ensure – and be able to demonstrate to Ofgem - that it meets the methodology as set out in the Regulations and that any in-built standard input data is appropriate.

[52] Available at https://www.ofgem.gov.uk/publications-and-updates/uk-solid-and-gaseous-biomass-carbon-calculator

## *Sources of information*

5.56. In January 2013, CEN published a standard (EN 16214-4) titled 'Methods of the greenhouse gas emission balance using a life cycle analysis'[53] which participants 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.

5.57. There is further information published on the EC transparency platform[54] which participants 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

5.58. The legislation does not necessarily provide practical direction to support participants (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 Ofgem. We have set these out in guidance to support a consistent approach.

5.59. This is recommended guidance only. The suitability of the approach taken by the participant 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 Ofgem.

5.60. In accounting for transport emissions the participant will likely consider the emissions associated for the single journey from 'A' to 'B', on the basis that the transport vehicle (lorry, ship, etc) will be returning to 'A' or onto another destination with further

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

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 participant 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.

5.61. In accounting for transport emissions, the participant 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 participant should seek to apportion the emissions accordingly.

5.62. 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. Participants 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 plant.

5.63. It is not necessary to account for methane losses from the storage of digestate that was co-produced as part of biogas production since this is outside the scope of the methodology outlined in the Regulations.

# 6. Land criteria

6.1. This chapter outlines the land criteria for the different types of feedstock. This is relevant for self-reporters only, who must demonstrate compliance with the relevant criteria. If you are demonstrating compliance with the sustainability criteria by purchasing fuel listed on the BSL or SFR, or by registering as a self-supplier on either list then it will not be necessary for you to be familiar with the principles in this chapter.

6.2. 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.

6.3. Where the participant is required to undertake an annual sustainability audit report, the evidence they have collated will be reviewed by their appointed auditor to ensure they are satisfied there is sufficient evidence to show the land criteria have been met. For more information on the annual independent verification, please refer to the 'Renewable Heat Incentive: Sustainability Audit Guidance for Participants and Auditors'.

6.4. As set out in chapter 2, the following is considered to meet the land criteria:

- Solid biomass which is waste, or is wholly derived from waste
- Biogas or biomethane which is made wholly from feedstock which is waste

6.5. In this instance the participant will need to collect information to justify the applied fuel classification. For these participants, the remainder of the chapter will not be relevant, unless non-waste fuels are also used.

## Solid biomass which is wood or wholly derived from wood

6.6. Where the biomass used to generate heat was wood or derived from wood, the participant is required to meet the requirements of Part 2 of Schedule 2B of the

Regulations. This aligns with the Timber Standard for Heat & Electricity, which is published as a standalone document on the BEIS website[55].

6.7. The Woodfuel Advice Note[56] has been published by DECC to provide accessible advice and guidance on the requirements and how to demonstrate compliance against them. It is recommended that applicants/participants refer to this document to become more familiar with the requirements.

6.8. 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 Woodfuel Advice Note
- the fuel used is certified by an environmental quality assurance scheme[57] which ensures that at least 70% of the solid biomass certified by the scheme meets the sustainability requirements outlined in the Woodfuel Advice Note

## Demonstrating compliance for solid biomass which is wood or wholly derived from wood

6.9. Evidence to demonstrate compliance with the RHI land criteria requirements 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 Ofgem would expect to be used:

[55] Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/278372/Timber_Standard_for_Heat_and_Electricity_under_RO_and_RHI_-_10-Feb-2014_for_pdf_-_FINAL_in_new_format.pdf

[56] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/352488/Woodfuel_Advice_Note.pdf

[57] ""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.

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

6.11. It is recognised that it may be challenging to meet the criteria via the use of Category B evidence and therefore to support this, the Ofgem RO team have benchmarked these schemes against the ROO 2015 legislation.

6.12. 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 DECC's consultation response in August 2014[58], 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.

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

6.14. Further advice on how to comply with these requirements has been provided by the Central Point of Expertise on Timber (CPET) and published by DECC. This includes the Woodfuel Advice Note, guidance on the consignment and mass balance approach, and

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

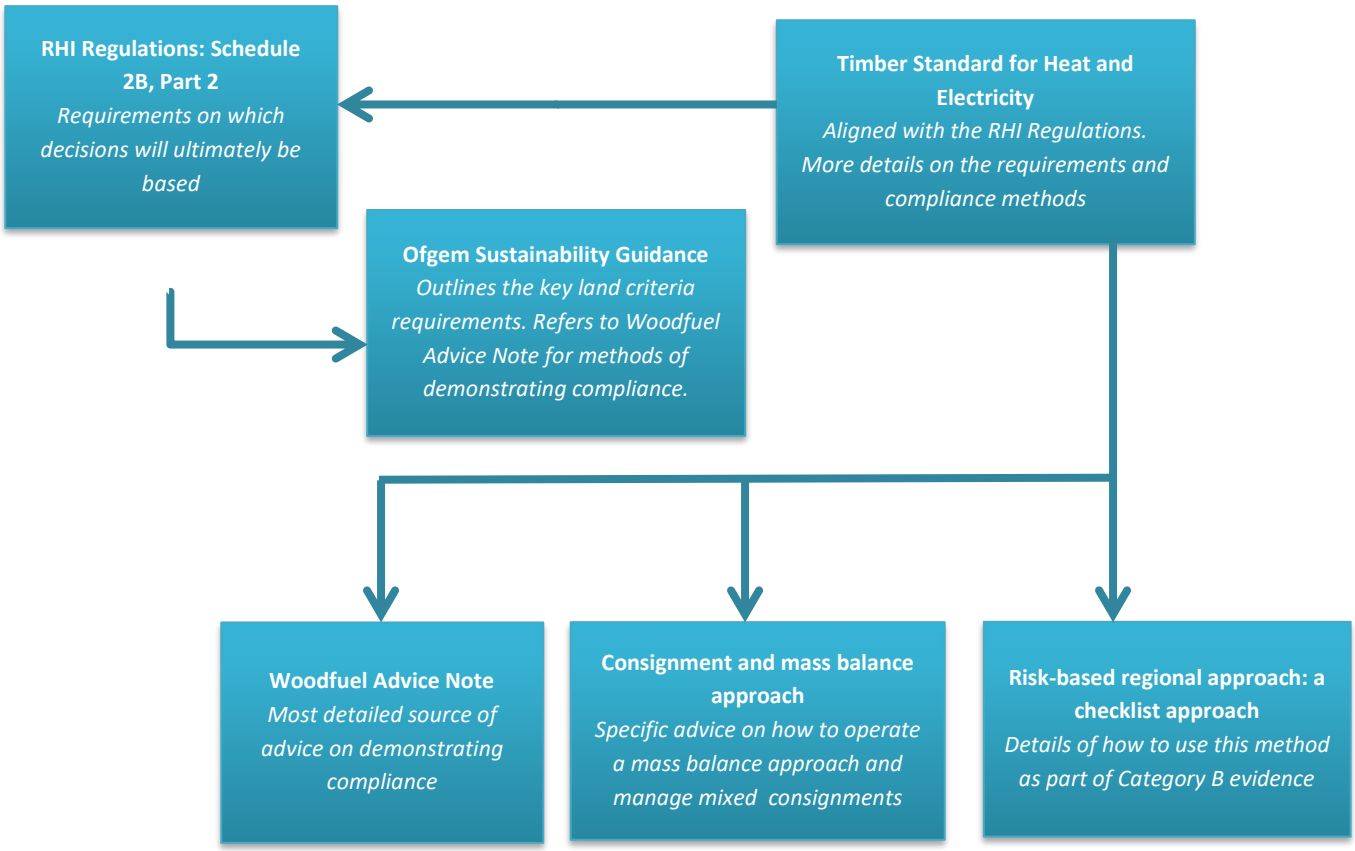
guidance on the checklist approach to the risk-based regional approach to demonstrating compliance.[59]

6.15. Whilst CPET provide advice on the land criteria, participants should note that decisions regarding the RHI scheme (including accreditation, RHI payments, compliance with the sustainability criteria, etc) remain with Ofgem.

## Documentation

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

6.17. For clarity, Figure 5 provides a summary of available guidance documents:




[59] Woodfuel Advice Note: https://www.gov.uk/government/publications/woodfuel-guidance

Figure 5: Summary of available guidance documents[60]

## Solid biomass which is not wood-based

6.18. For biomass that is not wood or derived from wood, the participant must meet the land criteria outlined in Part 3 of Schedule 2B.

6.19. 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:

- 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.

6.20. 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 – see chapter 5 for further details.

[60] Timber Standard: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/278372/Timber_Standard_for_Heat_and_Electricity_under_RO_and_RHI_-_10-Feb-2014_for_pdf_-_FINAL_in_new_format.pdf
Woodfuel guidance documents: https://www.gov.uk/government/publications/woodfuel-guidance

### *Residues*

6.21. Solid biomass which is not wood-based but can be classified as a residue – other than a residue directly arising from agriculture, aquaculture, fisheries or forestry – will be considered to have met the land criteria.

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

### *Energy Crops*

6.23. 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.

6.24. The Energy Crops 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.

6.25. If a participant 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.

6.26. Please refer to paragraph 6.41 for further information on suitable evidence for demonstrating compliance for energy crops.

## Demonstrating compliance for solid biomass which is not wood-based

6.27. To demonstrate compliance with the land criteria, the participant can use relevant voluntary schemes (see chapter 3) and/or collect evidence to support the land use from where the biomass was sourced.

6.28. Where the participant 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).

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

6.30. The evidence collected can be direct or indirect with regard to the format of the information supplied. For example, compliance with the criterion regarding primary forest could be shown by:

- An aerial photograph of the land, showing it to be 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

6.31. It may be useful for participants to draw on other sources of guidance to aid with the process of determining the land use and gathering evidence of this to demonstrate compliance with the land criteria.

6.32. The EC has produced a guidance document to help identify the status of the land in January 2008 for demonstrating compliance with land criteria. The EC document has been produced for use with bioliquids and biofuels to demonstrate compliance with the RED land criteria however will likely be useful for solid biomass, biogas and biomethane where the same criteria are relevant. It is available on the Transparency Platform.[61]

6.33. For UK sourced biomass DEFRA is likely to be a useful source of information regarding land use. They have compiled a list of evidence sources within the UK that might be useful for participants in demonstrating compliance with the RHI land criteria. This list has been designed specifically for biofuels under the RTFO and is not designed to be

[61] Inventory of data sources and methodologies to help identify land status. Available at http://ec.europa.eu/energy/renewables/biofuels/sustainability_criteria_en.htm

exhaustive. Participants may need to draw on several sources as the work undertaken by DEFRA was not specifically to show compliance with the RHI sustainability criteria.[62]

6.34. The European Committee for Standardization[63] (CEN) has published a number of sustainability standards for bioliquids and biofuels including one titled 'biodiversity and environmental aspects related to nature protection purposes' (published August 2012). This seeks to provide guidance on the provision of evidence that the production of raw material has not interfered with nature protection purposes for the land criteria. This may be useful in relation to biomass, biogas and biomethane as well.

6.35. The Forestry Commission, Forestry Commission Scotland, Natural Resources Wales and other countryside agencies may be able to assist participants with useful resources and providing guidance on the provision of evidence.

## Land Categories

6.36. To establish whether the land from which the biomass is obtained is compliant, the participant must consider the type of land from which the biomass is sourced – ie the land category. To provide assistance to the participant Table 5 sets out some common land categories and indicates which land categories may comply with the land criteria.

6.37. 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.

[62] Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/2625/rtfo-supporting-claims-compliance.pdf
[63] CEN Sustainability criteria for biomass: http://www.cen.eu/cen/Sectors/Sectors/UtilitiesAndEnergy/Fuels/Pages/Sustainability.aspx

Table 5: Categories of land and whether they may comply with the land criteria

| Land category | Description | Land Criteria |
|---|---|---|
| Cropland - non-protected | The Cropland is not in a nature protected area as defined in Schedule 2B of the RHI regulations. This category includes cropped land, (including rice fields and set-aside[64]), and agro-forestry systems where the vegetation structure falls below the thresholds used for the forest land categories.[65] | Complies. |
| Cropland – protected | Same as above, but the Cropland is in a nature protection area as defined in Schedule 2B of the RHI regulations. | 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 and the ecological processes are not significantly disturbed. | Complies only if the solid biomass was obtained previous to January 2008.<br>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.[66]. | 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. |

[64] '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 benefits. From 2007 set-aside land has been abolished under the CAP.

[65] EC Communication 2010/C 160/02 considers that perennial crop plantations, including oil palm plantations, are classified as cropland.

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

| | | |
|---|---|---|
| Highly biodiverse grassland | This can be either:<br>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.<br>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 settlement types and is not accounted for in another land use category.[67] | Complies. |

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

6.38. In some cases the actual land cover may not be the same as the land category designated in a country's land registry. Participants 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.

## Energy Crops

6.39. 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.

6.40. 'Energy crop' is defined in Regulation 2[68], so the participant must be able to demonstrate that their fuel meets this definition in order to demonstrate that the land criteria has been met in accordance with the previous paragraph.

6.41. 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 participant 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.

[68] RHI Regulations, Regulation 2 as amended: http://www.legislation.gov.uk/uksi/2015/145/regulation/3/made

# 7. Consignment and mass balance

7.1. The Regulations require participants to report per consignment of solid biomass used, biogas or biomethane produced. To report accurately against the sustainability criteria for each consignment of biomass, and for the information to be verifiable, the sustainability information must be able to be traced through the supply chain. This concept of traceability from raw material to end product is known as the 'chain of custody'.

7.2. 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.

7.3. Where consignments are mixed, we recommend that participants 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.

7.4. To identify whether a mass balance chain of custody system is required, the participant 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 participant 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

7.5. The Regulations do 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 Renewables

Obligation69. 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[70];
- Biomass form (solid biomass only);
- Country of origin[71];
- Classification of the fuel (waste, residue, product etc.);
- Compliance with land criteria;
- Compliance with GHG criteria.

7.6. This list is not intended as a legal guide.

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

7.8. 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.

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

7.10. 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 the RHI.

---

[69] 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

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

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

7.11. Where there are a number of source locations in the same country of origin (e.g. sawdust 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.

7.12. Many biomass pellets contain biomass binders which will not necessarily have the same characteristics as the rest of the pellet. In this case, where the binder is <2 per cent by weight, it will be considered to have the same sustainability characteristics as the pellet. In all other cases the sustainability characteristics of the binder, in its entirety, will have to be reported separately to the rest of the pellet.[72]

7.13. To assist participants, Figures 6-9 provide examples of determining consignments following the bullets set out in paragraph 7.5.

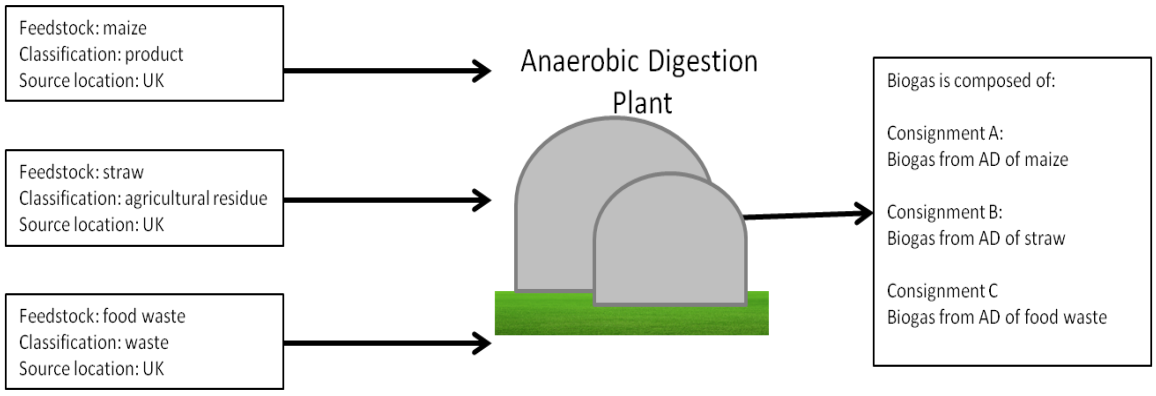



Figure 6 - Example of determining a consignment for biogas from AD

7.14. The example shown in Figure 6 is of a UK-based AD plant. 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[73] 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.

[72] See Schedule 2A of the Regulations
[73] ie. the biogas from each feedstock would meet the GHG criteria separately

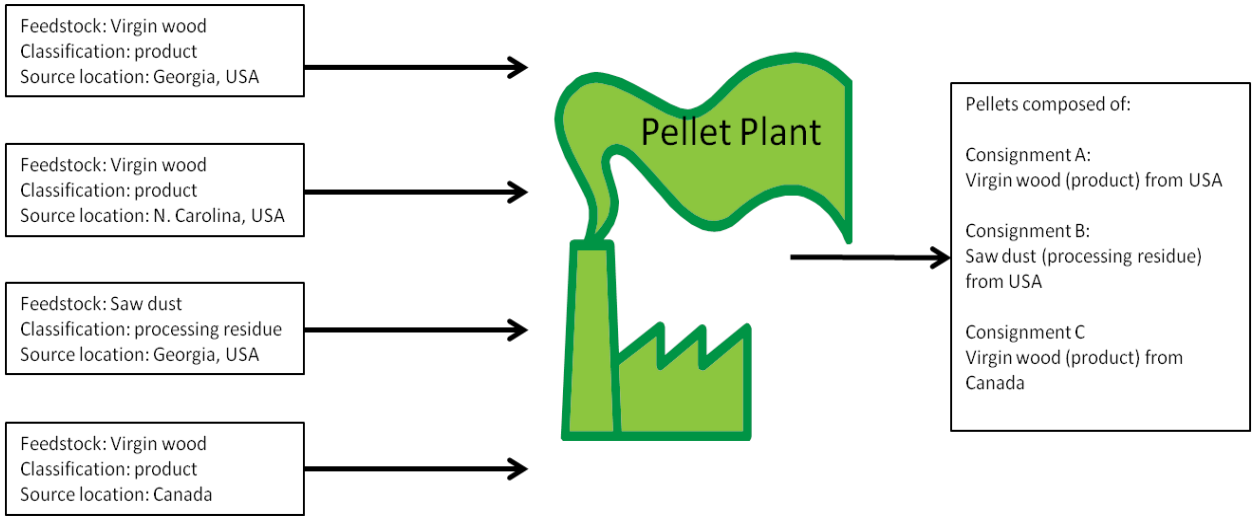



Figure 7 - Example of determining a consignment for wood pellets

7.15. The example shown in Figure 7 outlines a pellet plant which is taking in different materials from different locations in North America. In this example, the biomass used is wood in pelleted form. The supply chain has voluntary scheme certification and each biomass input into the pellet satisfies the land criteria and GHG criteria. Consignment A within the pellet includes the virgin wood from both Georgia and North Carolina as both, if taken individually, was considered to meet the GHG criteria within this particular example. The main determining factors here as to the number of consignments within the wood pellets is based on the fuel classification and country of origin.

7.16. We recognise that biomass pellets can be made from multiple types of biomass with differing sustainability characteristics, in particular with different fuel classifications. The legislation is clear on the need to report per consignment. We will work with participants during the FMS review process to develop appropriate procedures to report on a consignment basis. For more information on this, please see the FMS guidance document[74].

7.17. Once the number of consignments has been determined the participant will need to establish whether the consignments are mixed at the installation or elsewhere in the

[74] https://www.ofgem.gov.uk/publications-and-updates/fuel-measurement-and-sampling-questionnaire

supply chain. Where they are, a mass balance system will need to be used to trace the biomass and its associated sustainability characteristics.

7.18. Where the participant and parties in the supply chain are making use of a relevant voluntary scheme, as per the guidance in chapter 2, they should follow the scheme rules for the purpose of tracking sustainability information associated with each consignment of biomass.

7.19. In the event that a mass balance system is required, and the participant 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

7.20. 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.

7.21. Mass balance systems should be used where a mixing of consignments takes place, either at the participant'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 participant to implement the appropriate process and procedures.

7.22. Although consignments with different sustainability information can be physically mixed, sustainability information cannot be mixed between different consignments of biomass. For example, if a participant 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 participant could therefore not assign the outgoing consignment as 'short rotation forestry from Germany'.

## Types of mass balance systems

7.23. 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 (i.e. 40 per cent is 'A' and 60 per cent is 'B'). See Figure 8.
- 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 9.

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

- For solid biomass installations 1MWth or above, biogas installations using gasification or pyrolysis and biomethane producers using anaerobic digestion, RHI payments are not made on any heat generated from fossil fuel contamination. This means that any consignments containing fossil fuel contamination will need to be subject to proportionate mass balancing.
- 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, ie 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.

7.25. 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.

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

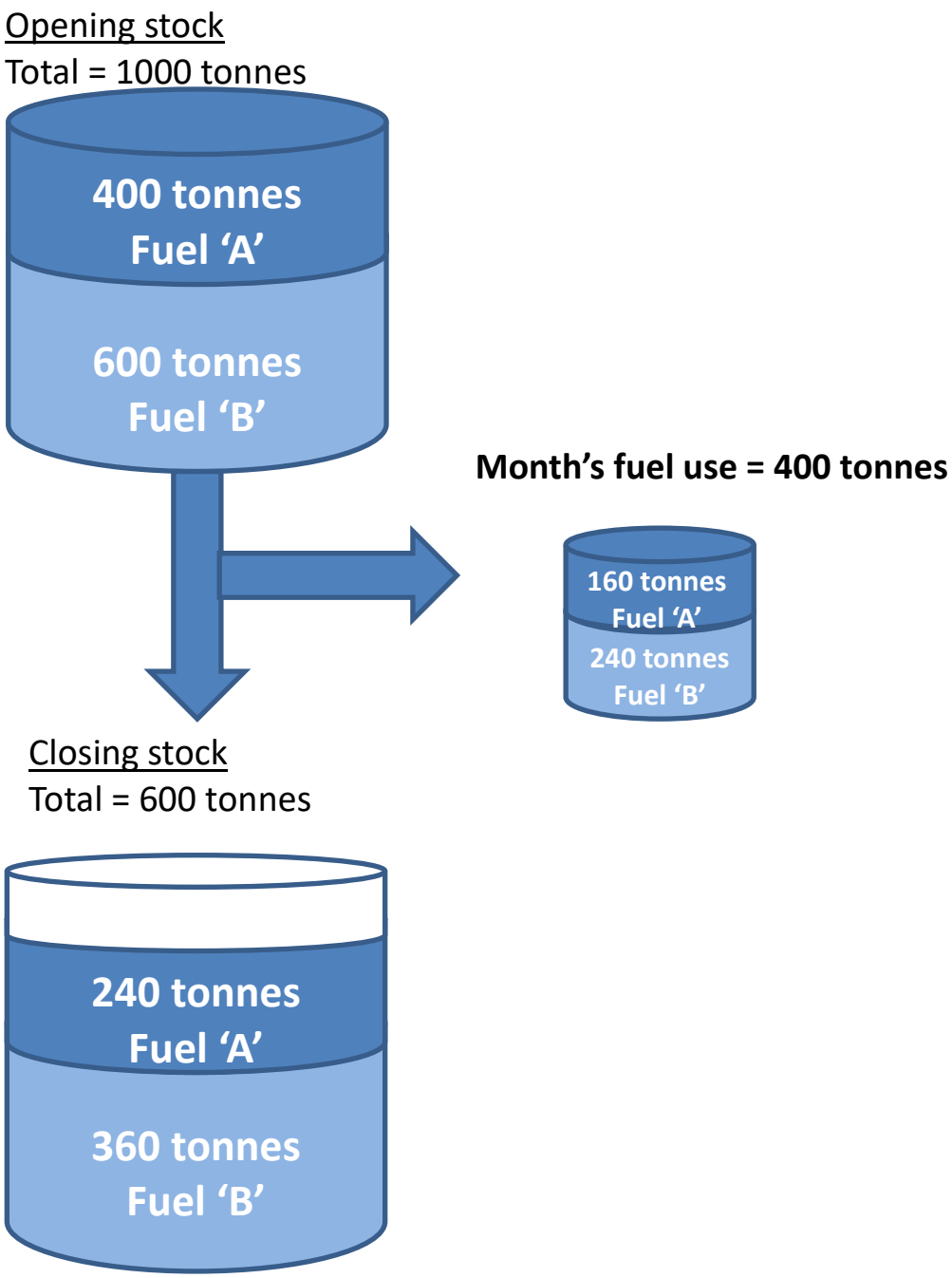



Figure 8 – Example of proportional mass balance

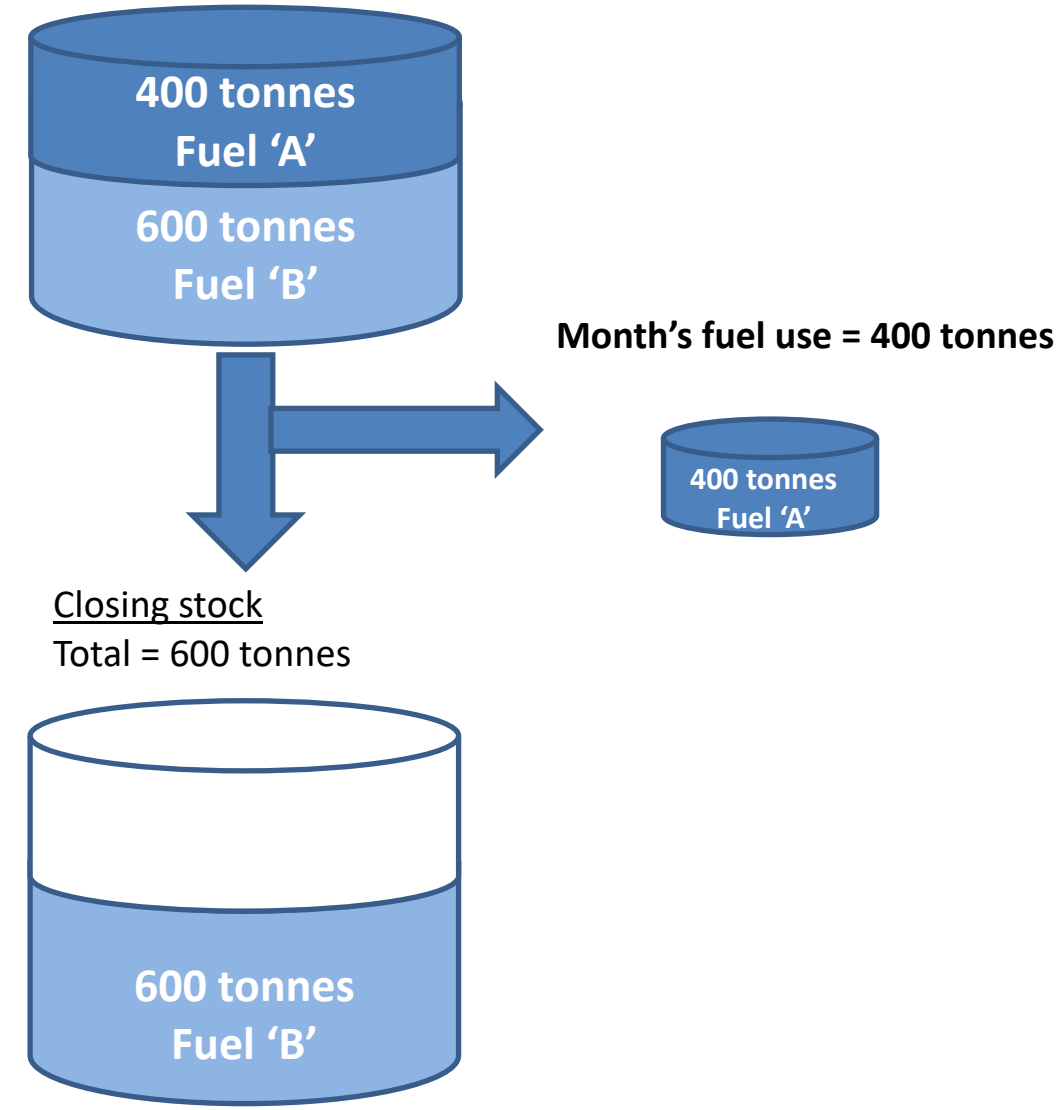



Figure 9 – Example of non-proportional mass balance

## The operation of a mass balance system

7.27. 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

7.28. 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'.[75] A site can include multiple silos or tanks, as long as they are at the same physical site.

7.29. 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

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

7.31. 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.[76]

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

[75] Defined in 'Communication from the Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme'. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:160:0001:0007:EN:PDF

[76] Participants 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

## Passing information through the supply chain

7.33. 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 participant for them to have confidence in reporting to Ofgem against the sustainability criteria on a quarterly basis. Any information or evidence should be kept and made available if required for verification purposes.

7.34. It is good practice if participants 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.

7.35. 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.

7.36. Participants may wish to seek additional information from their biomass supplier in order to be confident that the biomass they are buying meets the RHI sustainability criteria.

## Demonstrating compliance and record keeping

7.37. Where a participant 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.

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

7.39. As set out in chapter 3, where the participant 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.

7.40. Where a participant 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.

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

7.42. 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 5 sets out the recommended records to maintain and example formats for these records are illustrated in Appendix 5.

Table 5: Recommended records and associated information for mass balance

| Record type | Information to record |
|---|---|
| **Input and output records of biomass data and sustainability information**<br>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)<br>• Description of the physical product to which the biomass data refer<br>• Volume of physical input/output to which the biomass data refer<br>• Supplying/receiving company<br>• Transaction date<br>• Any biomass and sustainability information. |
| **Conversion factor records**<br>These records refer to the conversion factor of inputs to outputs (e.g. SRF to pellets) and 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.<br>If no records are kept for the conversion factor a standard input value must be used. | • To which input product it refers<br>• To which output product it refers<br>• The units in which the conversion factor is expressed<br>• The value of the actual conversion factor<br>• When the specific conversion factor was valid<br>• The calculation and supporting documentation that determines the conversion factor. |

| | |
|---|---|
| **Periodic inventory of biomass data**<br>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)<br>• Volumes of inputs with identical biomass and sustainability information in the respective period. These volumes must coincide with the input records described above;<br>• Volume of outputs with identical biomass and sustainability information in the respective period. These volumes must coincide with the output records described above<br>• Conversion factor(s) used in the respective period<br>• 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)<br>• Purchase and sales invoices should be retained. |

# Appendices


| Appendix | Name of Appendix | Page Number |
|---|---|---|
| 1 | UK recognised voluntary schemes | 75 |
| 2 | Common fuel classifications | 76 |
| 3 | Default values and standard input data | 81 |
| 4 | Land use change calculations | 86 |
| 5 | Example templates for mass balance chain of custody records | 93 |
| 6 | Glossary | 94 |

# Appendix 1 – UK recognised voluntary schemes

1.1. As set out in the Self-Reporting chapter above, in 2012 the Ofgem Renewables Obligation (RO) teams benchmarked a number of voluntary schemes against the land criteria (ROO 2009 (as amended)). The results of the 2012 benchmarking exercise are available in Appendix 2 of the RO Sustainability Criteria Guidance[77].

1.2. The Ofgem RO team have undertaken an exercise to benchmark these schemes against the ROO 2015 land criteria for woody biomass for the purpose of the RO scheme. The results of the 2015 benchmarking exercise are available in Appendix 2 of the RO Sustainability Criteria Guidance[78].

1.3. As of 24 March 2016, the results of the 2015 RO benchmarking exercise were extended, and made applicable to the RHI scheme.

[77] https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-sustainability-criteria
[78] https://www.ofgem.gov.uk/publications-and-updates/renewables-obligation-sustainability-criteria

# Appendix 2 – Common fuel classifications

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

1.5. 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 legislation, case law principles and other relevant indicators.

1.6. 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. As described in chapter 4, we may periodically review and update this list on our website, if sufficient evidence emerges to indicate that a substance should be treated differently.

1.7. For more information on fuel classification, including definitions and reporting requirements please see chapter 4.

Table 7: Products

| Material | Description |
|---|---|
| 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.<br>If it is put to another use first, e.g. as animal bedding, before being used as fuel then it will be a waste. |
| Material | Description |
| Acid ester | Esters are produced intentionally and are therefore 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). |
| 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:<br>http://www.environment-agency.gov.uk/static/documents/Business/MWRP_RPS_030_v2_biodiesel_22-12-10.pdf<br>http://www.environment-agency.gov.uk/static/documents/Business/Biodiesel_QP_NIEA_GEHO0311BTPC-E-E.pdf<br>Note that the approach we have taken for category 3 tallow is that the participant 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 participant 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 8: Residues from agriculture, aquaculture, forestry and fisheries

| Material | Description |
|---|---|
| Forestry residues | Forestry residues are identified explicitly by the RED as residues.<br>Following statements from the EC[79] and the Environment Agency[80], 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.<br>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.<br>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 roads and railways. Residues from arboriculture should not include forestry residues. |
| Straw | Straw is specifically named as an agricultural crop residue in the RED.<br>As an agricultural residue, it must meet the land criteria. 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.<br>As an agricultural residue, it must meet the land criteria. 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.<br>As an agricultural residue, it must meet the land criteria. 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.<br>As agricultural residues, they must meet the land criteria. 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.<br>Cobs are an agricultural residue, so must meet the land criteria. Cobs are deemed to have zero GHG emissions up to the point of collection. |

[79] 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].
[80] Statement from the Environment Agency http://www.environment-agency.gov.uk/static/documents/Research/PS_005_Regulation_of_wood_v3.0.pdf

Table 9: Processing Residues

| Material | Description |
|---|---|
| | |
| Palm processing residues:<br>empty palm bunches<br>fibre and shell from palm oil production<br>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.<br>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 10: Wastes

| Material | Description |
|---|---|
| Waste wood | Any waste wood, including "non-virgin" wood, will be considered a waste.<br>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).<br>The phrase "non-virgin" wood refers to materials such as post consumer waste and construction and demolition waste. |
| 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 regulation 2 of the Renewable Heat Incentive Scheme (Amendment) Regulations 2015. |
| 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.<br>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.<br>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:<br>http://www.environment-agency.gov.uk/static/documents/Business/MWRP_RPS_030_v2_biodiesel_22-12-10.pdf<br>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. (Upon FMS questionnaire revision, participant may be asked to split the consignments of food 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. |

# Appendix 3 – Default values and standard input data

1.8. Table 11 sets out the default values of carbon intensities for solid biomass and biogas fuels for use in the default value method as defined in Schedule 2A of the Regulations. This method can't be used by biomethane producers, or for installations which are 1MWth or above and using heat for a process.

1.9. Table 12 provides typical values that can be used by participants when calculating their GHG emissions as part of the actual value method. This method can be used by all self-reporting participants. These values have been determined by DECC and are pre-built into the Carbon Calculator.

Table 11: Solid biomass and biogas default carbon intensities

| **Biomass production pathway** | **Default carbon intensity (CI) [$gCO_{2eq}$/MJ feedstock]** |
|---|---|
| Wood chips from forest residues (European temperate continental forest) | 1 |
| Wood chips from forest residues (tropical and subtropical forest) | 25 |
| Wood chips from short rotation forestry (European temperate continental forest) | 4 |
| Wood chips short rotation forestry (tropical and subtropical e.g. eucalyptus) | 28 |
| Wood briquettes or pellets from forest residues (European temperate continental forest) – using wood as process fuel | 2 |
| Wood briquettes or pellets from forest residues (tropical or subtropical forest) – using natural gas as process fuel | 20 |
| Wood briquettes or pellets from forest residues (tropical or subtropical forest) – using wood as process fuel | 17 |
| Wood briquettes or pellets from short rotation forestry (European temperate continental forest) – using wood as process fuel | 4 |
| Wood briquettes or pellets from short rotation forestry (European temperate continental forest) – using natural gas as process fuel | 22 |
| Wood briquettes or pellets from short rotation forestry (tropical and sub-tropical e.g. eucalyptus) – wood as process fuel | 22 |
| Wheat straw | 2 |
| Bagasse briquettes – wood as process fuel | 17 |
| Bagasse bales | 20 |
| Palm kernel | 27 |
| Rice husk briquettes | 28 |
| Miscanthus bales | 7 |
| Biogas from wheat and straw (wheat whole plant) | 21 |
| Biogas from maize as whole plant (maize as main crop) – organic agriculture | 19 |

Table 12: 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 $gCO_2$-eq/kg |
| $P_2O5$-fertiliser (kg $P_2O5$) | 1176.0 $gCO_2$-eq/kg |
| $K_2O$-fertiliser (kg $K_2O$) | 635.6 $gCO_2$-eq/kg |
| CaO-fertiliser (kg CaO) | 89.6 $gCO_2$-eq/kg |
| Pesticides | 13894.6 $gCO_2$-eq/kg |
| Seeds- rapeseed | 794.0 $gCO_2$-eq/kg |
| Seeds- soy bean | 0.0 $gCO_2$-eq/kg |
| Seeds- sugarbeet | 3820.5 $gCO_2$-eq/kg |
| Seeds- sugarcane | 4.9 $gCO_2$-eq/kg |
| Seeds- sunflower | 794 $gCO_2$-eq/kg |
| Seeds- wheat | 289.9 $gCO_2$-eq/kg |
| Short rotation coppice cuttings | 0.0 [kg $CO_2$eq / cutting] |
| Short rotation coppice setts | 0.0 [kg $CO_2$eq / sett] |
| Emissions due to transport of filter mud cake | 0.0 [kg $CO_2$eq / kg filter mud cake] |
| Emissions due to transport of vinasse | 0.0 [kg $CO_2$eq / kg vinasse] |
| Manganese | 0.8 [kg $CO_2$eq / kg Mn] |
| Rhizomes | 0.3 [kg $CO_2$eq / kg rhizome] |
| Forage maize seeds | 0.3 [kg $CO_2$eq / kg seeds] |
| Urea silage additive | 9.8 [kg $CO_2$eq / kg additive] |
| Propionic acid silage additive | 1.3 [kg $CO_2$eq / L additive] |
| Digestate | 0.0 [kg $CO_2$eq / kg digestate] |
| Farm yard manure | 0.0 [kg $CO_2$eq / kg FYM] |
| **Fuels GHG emission coefficients** | |
| Natural gas (4000 km, Russian NG quality) | 66.20 $gCO_2$-eq/MJ |
| Natural gas (4000 km, EU Mix quality) | 67.59 $gCO_2$-eq/MJ |
| Diesel | 87.64 $gCO_2$-eq/MJ |
| HFO | 84.98 $gCO_2$-eq/MJ |
| HFO for maritime transport | 87.20 $gCO_2$-eq/MJ |
| Methanol | 99.57 $gCO_2$-eq/MJ |
| Hard coal | 111.28 $gCO_2$-eq/MJ |
| Lignite | 116.98 $gCO_2$-eq/MJ |

| | |
|---|---|
| Wheat straw | 1.80 $gCO_2$-eq/MJ |
| **Electricity GHG emission coefficients** | |
| Electricity EU mix MV | 127.65 $gCO_2$-eq/MJ |
| Electricity EU mix LV | 129.19 $gCO_2$-eq/MJ |
| North America | 145 $gCO_2$-eq/MJ |
| Latin America | 55 $gCO_2$-eq/MJ |
| Russia | 237 $gCO_2$-eq/MJ |
| **Conversion inputs GHG emission coefficients** | |
| n-Hexane | 80.53 $gCO_2$-eq/MJ |
| Hydrogen (for HVO) | 94.35 $gCO_2$-eq/MJ |
| Phosphoric acid ($H_3PO_4$) | 3040.6 $gCO_2$-eq/kg |
| **Factor** | **Value** |
| Fuller's earth | 199.8 $gCO_2$-eq/kg |
| Hydrochloric acid (HCl) | 1375.4 $gCO_2$-eq/kg |
| Sodium carbonate ($Na_2CO_3$) | 1267.6 $gCO_2$-eq/kg |
| Sodium hydroxide (NaOH) | 764.4 $gCO_2$-eq/kg |
| Potassium hydroxide (KOH) | 626.1 $gCO_2$-eq/kg |
| Pure CaO for processes | 1099.9 $gCO_2$-eq/kg |
| Sulphuric acid ($H_2SO_4$) | 268.8 $gCO_2$-eq/kg |
| Ammonia | 2554.7 $gCO_2$-eq/kg |
| Cycle-hexane | 723.0 $gCO_2$-eq/kg |
| Lubricants | 947.0 $gCO_2$-eq/kg |
| **Emissions from steam production (per MJ steam or heat)** | |
| $CH_4$ and $N_2O$ emissions from NG boiler | 0.39 $gCO_2$-eq/MJ |
| $CH_4$ and $N_2O$ emissions from NG CHP | 0.00 $gCO_2$-eq/MJ |
| $CH_4$ and $N_2O$ emissions from Lignite CHP | 3.79 $gCO_2$-eq/MJ |
| $CH_4$ and $N_2O$ emissions from Straw CHP | 0.00 $gCO_2$-eq/MJ |
| $CH_4$ and $N_2O$ emissions from NG gas engine | 1.23 $gCO_2$-eq/MJ |
| **Electricity production (reference for credit calculation)** | |
| Electricity (NG CCGT) | 124.42 $gCO_2$-eq/MJ |
| Electricity (Lignite ST) | 287.67 $gCO_2$-eq/MJ |
| Electricity (Straw ST) | 5.71 $gCO_2$-eq/MJ |
| **Density** | |
| Diesel | 832 kg/m3 |
| Gasoline | 745 kg/m3 |
| HFO | 970 kg/m3 |
| HFO for maritime transport | 970 kg/m3 |
| Ethanol | 794 kg/m3 |
| Methanol | 793 kg/m3 |
| FAME | 890 kg/m3 |
| Syn diesel (BtL) | 780 kg/m3 |
| HVO | 780 kg/m3 |
| **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/Nm3 |
| Biomethane | 34 MJ/Nm3 |
| Methane | 36 MJ/Nm3 |
| **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 |

# Appendix 4 – Land use change calculations

1.10. 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. This can be downloaded from their website.[81]

1.11. Equation 1 is taken directly from the RED GHG calculation methodology.[82] Equations 2-5 are from the EC decision[83] 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 (CSR) and the actual land use (CSA). 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.

1.12. 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. Participants do not need to report against, or include in their carbon intensity calculations, emissions from indirect land use change.

1.13. 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.

[81] http://ec.europa.eu/energy/renewables/biofuels/doc/2010_bsc_example_land_carbon_calculation.pdf

[82] Annex V, Part C, Para 7.
[83] 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 1:** Land use change emission

$$e_l = (CS_R - CS_A) \times 3.664 \times (1/20) \times (1/P) - e_B$$

*Where:*

**$e_l$** is the annualised GHG emissions due to land use change (measured as mass of $CO_{2eq}$ 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 $CS_A$ 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 $29gCO_{2eq}$/MJ if the bioliquid feedstock is obtained from restored degraded land under the conditions set out in the paragraphs below

1.1. The EC decision defines the calculation of the carbon stocks as:

**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)

1.14. 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.

1.15. 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).

1.16. The location and nature of the land use change must be known by the participant 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 participant reporting that land use change has taken place.

1.17. There are two land types (settlements[84] 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 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 Mineral soils

1.18. Participants may use several methods to determine soil organic carbon, including measurements.[85] As far as the methods are not based on measurements, they should take into account climate, soil type, land cover, land management and inputs.

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

[84] 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.
[85] 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).

**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) |

1.20. SOCST can be located in Table 1 of 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.[86] 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.

1.21. FLU, FMG and FI can be located in Tables 2 to 8 of the EC decision depending on climate region, land use, land management and input.

1.22. If a participant 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 FMG or FI will change between CSR and CSA.

## Organic soils (histosols)

1.23. 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

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

cover and land management and input. An appropriate method could be to measure the SOC of the soil.

1.24. 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

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

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

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

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

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

Where:

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

And:

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

Or

$C_{BGB} = C_{AGB} \times R$ [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)

**$CF_B$** 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

1.27. 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 $CF_B$ the value of 0.47 may be used.
- For cropland, perennial crops and forest plantations, the value of $B_{BGB}$ 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

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

Where:

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

And

$C_{LI} = DOM_{LI} \times CF_{LI}$ [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) |

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

- For $CF_{DW}$ 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

1.29. 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 14: 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 2008 | Crop yield (t/ha)[87] | Nitrogen fertiliser (kg/ha)87 |
|---|---|---|---|---|---|---|---|---|---|---|
| 22001 | 16-1-2011 | C1 | Rape seed | 1,000 | UK | Y | LEAF | Cropland - non protected | 30 | 180 |

Table 15: Example of an input record from a rapeseed crusher

This crusher receives certified rapeseed from farms F1 and F2.

| Consignment no. | Transaction date | Supplying Company | Product | Quantity (tonnes) | Country of origin | NUTS 2 compliant | Voluntary Scheme | Land Use on 1 January 2008 | Carbon intensity (g CO2e/MJ) |
|---|---|---|---|---|---|---|---|---|---|
| 22001 | 16-1-2011 | F1 | Rapeseed | 1,000 | UK | Y | LEAF | Cropland - non protected | 30 |
| 22002 | 16-1-2011 | F2 | Rapeseed | 1,000 | UK | Y | LEAF | Cropland - non protected | 30 |

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

# Appendix 6 – Glossary

| | | |
|---|---|---|
| **A** | ASTM | American Society for Testing and Materials |
| **B** | BS | British Standard |
| | BSL | Biomass Suppliers List |
| **C** | CEN | The European Committee for Standardization |
| | CHP | Combined Heat and Power |
| | $CO_{2eq}$ | Carbon dioxide equivalent |
| | CPET | Central Point of Expertise on Timber |
| **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** | FMS | Fuel Measurement and Sampling |
| | FSC | Forest Stewardship Council |
| **G** | GHG | Greenhouse gas |
| **I** | 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 |
| | RO | Renewables Obligation |
| | RTFO | Renewable Transport Fuels Obligation |
| **S** | SFR | Sustainable Fuel Register |
| | SOS | Secretary of State |
| | SRF | Short Rotation Forestry |
| **T** | TAEE | Tertiary amyl-ethyl ether |
| **U** | UK-TPP | UK Timber Procurement Policy |
| **V** | VS | Voluntary scheme |