Comparing the Green Gold Label CO_2 Calculation Methodology with the NTA8080

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1 Introduction

SKAO, the manager of the CO_2 Performance Ladder (CO_2-Prestatieladder), has asked for CO_2 reduction factors that have been calculated according to the NTA8080 certification scheme. The Green Gold Label (GGL) Foundation, that manages the Green Gold Label certification system, would like to see whether it can be concluded that the Green Gold Label applies the same methodology as the NTA8080 methodology and that this methodology would also be suitable for the CO_2 Performance Ladder.

The GGL Foundation has asked CE Delft to conduct a comparative analysis of the GGL (GGLS8) and NTA8080 methodologies.

In order to provide a robust comparison of these two standards, a comparison of both the mathematical methodology for calculating greenhouse gas emissions, as well as a procedural comparison for certification has taken place.

2 The Standards and Other Relevant Publications

The GGLS8, otherwise known as the *Greenhouse Gases and Energy Balance Calculation Standard* of the Green Gold Label Program, is a standard which provides the rules and reference values for calculating greenhouse gas emissions and energy balances for biomass products. The standard document, provides a concise calculation methodologies, clearly outlining how a greenhouse gas emission should be calculated for a given product. It is important to mention that GGLS8 is one of many GGL standards. The consideration of the other standards is outside the scope of this study.

In contrast to the GGLS8, the NTA8080 document consists of regulatory framework which specifies sustainability criteria for biomass used for energy purposes. Since only a limited number of calculation requirements are outlined, one must refer to the report 'A greenhouse gas calculation methodology for biomass-based electricity, heat and fuels' (CE, 2006). The NTA8080 also refers to GHG emission calculations that are available in a CO_2 tool, which has an accompanying calculation methodology. The original tool that the NTA8080 makes reference to has since been updated ('Methodology CO_2 tool for electricity, gas and heat from biomass', Agentschap NL, 2011). In addition to these Dutch publications, NTA8080 and GGLS8 also make reference to the Renewable Energy Directive ('Directive 2009/28/EC', EU, 2009). Other publications referred to in the NTA8080
and GGLS8 include:
- CEN/TC 383 'Sustainably produced biomass for energy applications (CEN, 2008);
- Testing Framework for Sustainable Biomass (Agentschap NL, 2007));
- NTA 8003:2008 Classification of biomass for energy application (NEN, 2008).

These supplementary publications will be used in carrying out the comparison between the CO_2 calculation method of the NTA8080 and the GGLS8 when necessary.

3 Methodological Framework

The Renewable Energy Directive specifies the following expression for calculating the greenhouse gas emissions from the production and use of transport fuels:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

where:

E = *total emissions from the production of the fuel before energy conversion*
e_{ec} = *emissions from the extraction or cultivation of raw materials*
e_l = *annualised emissions from carbon stock changes caused by land use*
e_p = *emissions from processing*
e_{td} = *emissions from transport and distribution*
e_u = *emissions from the fuel in use, that is green house gases emitted during the combustion of solid and gaseous biomass*
e_{sca} = *emission savings from soil carbon accumulation via improved agricultural management*
e_{ccs} = *emission savings from carbon capture and geological storage*
e_{ccr} = *emission saving from carbon capture and replacement*
e_{ee} = *emission savings from excess electricity from cogeneration*

This methodology is the basis of both the GGL and the NTA8080.

The factors used in the formula are dependent upon whether or not a biomass stream can be considered a process by-products or not. Certain biomass streams, are sometimes either waste stream outputs (compost from household waste) or they result from the production of a main product (i.e. straw in the case of wheat production). The extent to which this expression is adjusted fore residual stream will be compared for GGLS8 and NTA8080 in the following section.

The publication ‘A greenhouse gas calculation methodology for biomass-based electricity, heat and fuels’ (CE, 2006), illustrates the biomass chain and fossil reference chain as follows (see Figure 1).

Figure 1 Biomass chain and fossil reference life cycle (CE, 2006)

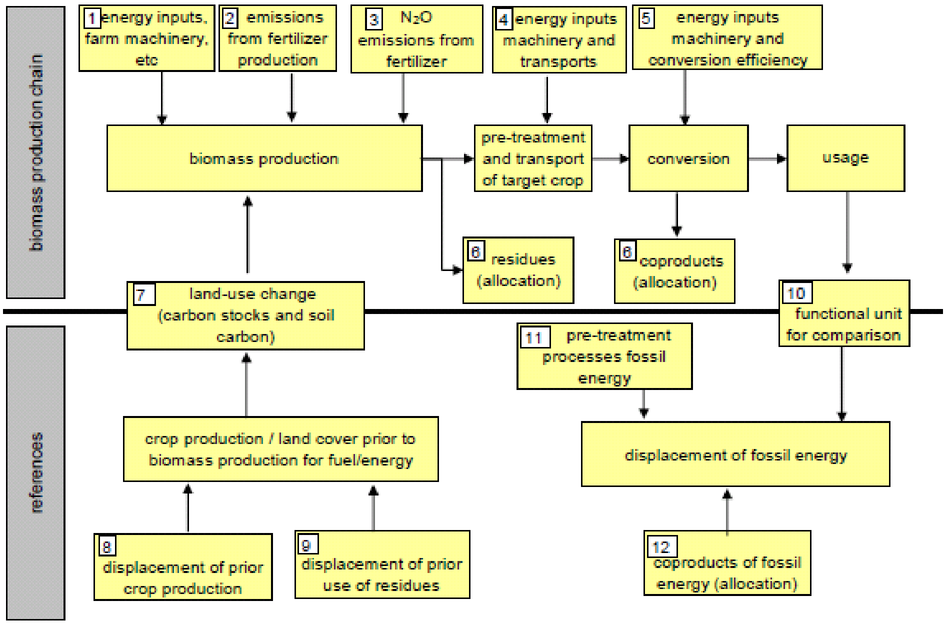
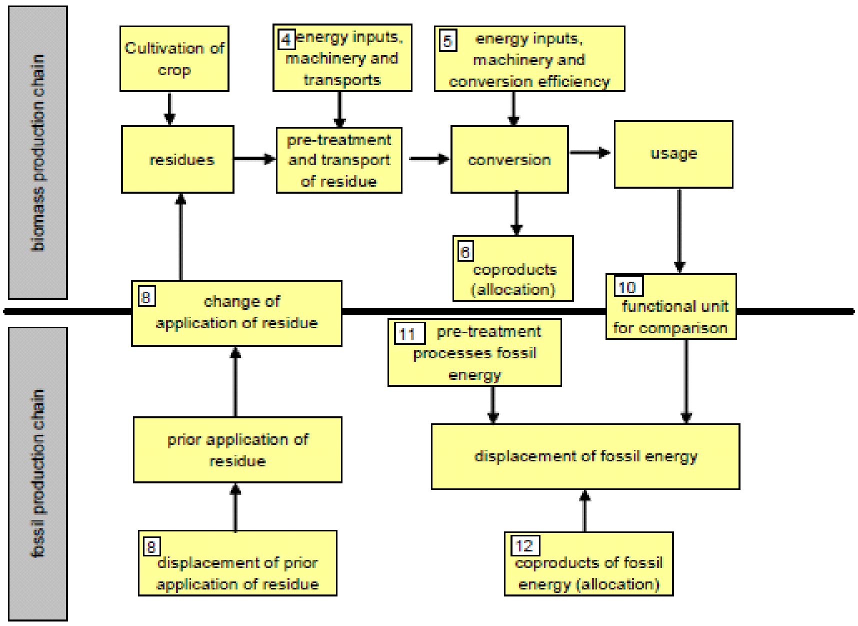


Figure 2 Residual biomass and fossil reference life cycle (CE, 2006)



Although this publication does not explicitly describe calculations required for the individual emissions (as described in Equation 1), the relationship between various inputs and outputs and lifecycle stages can be gained from the flow diagram.

4 Comparing the Mathematical Approaches

Equation 1 defines the complete GHG gas balance for biomass production. In order to fully compare the GGLS8 and the NTA8080, the standards will be analysed in terms of their fulfilment of the terms in the expression. The formulae from the GGLS8 will be compared with the formulae derived from the flow diagrams in Figure 1and Figure 2.

4.1 General GHG Calculation Savings

The general approach taken for calculating the GHG savings of biomass production relative to the production of an equivalent fossil fuel can be described using the following equation:

[GHG saving] = ([GHG fossil fuel reference] - [GHG biomass calculation])/ [GHG fossil fuel reference]

In addition, the NTA8080 and the GGLS8 both specify that the GHG balance of the production life cycle and application of the biomass should be positive. This means that the GHG saving is positive.

4.2 Total Production Emissions (E)

As described in Section 3, the total emissions of biomass production can be calculated using Equation 1. The extent to which this equation is utilised is dependent on whether the biomass stream analysed is cultivated principally as an energy source or whether it is considered a residual stream or waste product. NTA8080 and NTA8003 provide a classification system as to how various streams should be classified. The GHG emission of a residual stream will exclude a number of the terms in the Equation 1 expression. The GGLS8 and NTA8080 will be compared based on the terms that are included/excluded from this calculation.

4.2.1 GGLS8

Although the GGLS8 does not provide mathematical expressions for the calculation of GHG for energy crops and for residual streams, it does provide two simplified flow diagrams. From these diagrams, the following expression can be determined:

Energy crops (default)

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

Residual streams

$$E = e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

4.2.2 NTA8080/ Sustainable Production of Biomass (2006)

The NTA8080 itself does not provide any mathematical relationships either in the form of expressions or flow diagrams. The Sustainable Production of Biomass (2006) will be referred to for this purpose:

Energy crops (default)

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

Residual stream

$$E = e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

4.2.3 Analysis

The mathematical expressions used in both the GGLS8 and NTA8080 methodologies are essentially the same. There are differences, however in the level of detail provided in the methodologies regarding the various emissions. In the case of the GGLS8, the first stages of the life cycle are grouped together under the heading 'Land preparation /Maintenance/Harvesting/ Cultivation', where this group is entirely excluded for residual streams. Conversely, the NTA8080 approach for residual streams includes a flow (see Figure 2) that relates to the fossil fuel reference scenario, such that the displacement of prior application of residue is specifically defined. For example, if wheat straw is used in the production of bioenergy instead of being used for animal bedding or feed, then other materials will be needed to replace that portion of lost bedding material or feed. In this case, it is likely that additional crops would need to be grown for these purposes.

4.3 Cultivation and Extraction Emissions (e_{ec})

In the case of energy crops, the cultivation and extraction of the crops take place at the beginning of the life cycle. These emissions can include the application of fertilizers and pesticides, as well as the use of fossil-fuelled farm machinery. The calculation methodologies of the GGLS8 and the NTA8080 will be compared below:

4.3.1 GGLS8

The GGLS8 splits this emission category into 'Waste and Fertilising' and 'Harvesting'. The formulae defined in the GGLS8 are given below:

Waste and Fertilising

[GHG emission from waste and fertilizing per MT of biomass] = [total GHG emissions from waste and fertilizing used in the cultivation and maintenance process] / [total annual mass of biomass grown in MT])

*[GHG emission from electricity for cultivation and maintenance per MT of biomass] = ([Total energy use for cultivation and maintenance] * [fossil fuel emission factor of the energy mix]) / [total annual mass of biomass grown in MT])*

*[GHG emission from fossil fuel use for cultivation and maintenance per MT of biomass] =([Total fossil fuel use for cultivation and maintenance] * [emission factor of the fossil fuel]) / [total annual mass of biomass grown in MT])*

Harvesting

*[GHG emission from electricity for harvesting per MT of biomass] = (([Total energy use for harvesting] * [fossil fuel emission factor of the energy mix]) / [total annual mass of biomass harvested in MT])*

*[GHG emission from fossil fuel use for harvesting per MT of biomass] = (([Total fossil fuel use for harvesting] * [emission factor of the fossil fuel]) / [total annual mass of biomass harvested in MT])*

4.3.2 NTA8080/Sustainable Production of Biomass (2006)

The derivation of formulae will be done according the flow diagrams given in Sustainable Production of Biomass (2006).

(Derived from Figure 1)
GHG of biomass production (cultivation and extraction) = GHG emissions of energy inputs from farm machinery + GHG emissions from fertilizer production + N_2O emissions from fertilizer

(Derived from the above formula)
*GHG emissions of energy inputs from farm machinery (per ton crop) = liters diesel burned for a given hectare * crop yield (ton/ha) * GHG emission factor per litre fuel (production + combustion)*

*GHG emission from fertilizer production (per ton crop) = kg of fertilizer for a given hectare * crop yield (ton/ha) * GHG emissions factor per kg fertilizer production*

*GHG emission (N_2O) from fertilizer application (per ton crop) = kg of fertilizer applied for a given hectare * crop yield (ton/ha) * N_2O emissions per kg fertilizer applied*

4.3.3 Default Values

The LowCVP model uses a default value of 6.69 kg CO_2-eq./kg for nitrogen fertilizer production (CE, 2006)

For crop production in Europe, N_2O emissions vary between 4 and 8 kg N_2O/ha.yr (CE, 2006)

Calculated thus, fuel and oil consumption for the cultivation of oilseed rape in the Netherlands is an estimated 130 litres per ha of rape (CE, 2006).

4.3.4 Analysis

Other than the fact that the GGLS8 categorises the production and application emissions of fertilizers together, the GGLS8 and NTA8080 approaches are essentially identical for the cultivation and extraction emissions.

4.4 Carbon Stock Changes Through LUC Emissions (e_l)

Crops that are produced primarily for bioenergy cause changes in the carbon stocks in the soil. This change is as a result of the removal of pre-existing vegetation, leading to a reduction of the carbon stocks in the soil. The relative change in carbon stocks is dependent on various factors including the region, and the type of biome/ecosystem.

4.4.1 GGLS8

Changes in carbon stocks in GGLS8 are calculated as follows:

*[GHG emission per MT of biomass] = 3.664 * ([Average 20 year carbon storage per hectare after the change] - [Average 20 year carbon storage per hectare before the change]) * [number of hectares] / (20 [total annual mass of biomass grown in MT] - bonus)*

*[total annual mass of biomass grown in MT] =[biomass - raw material conversion factor] * [total annual mass of raw material grown in MT]*

This part of the standard does not need to be included in the calculation when the biomass product is on the NTA 8080 list of residual products and it is not the main product of the process.

4.4.2 NTA8080/Sustainable Production of Biomass (2006)

Based on Figure 1, the GHG emissions of carbon stock changes can be estimated as follows:

GHG emissions carbon stock (per ton)= GHG emission crop production/land prior to biomass production

A more precise equation as provided in the GGLS8 is not given in the NTA8080. This level detail is provided in the RED.

4.4.3 Default Values

The following reference values (GGL, 2012) can be used for calculating the value of the carbon stocks:

Table 1 Reference values carbon stocks

land use	Carbon stock in tonne C (carbon) per hectare
Oil palm plantation	189
Permanent grassland (older than 5 years)	181
Lightly forested area (not continuously forested)	181
Arable and non-permanent grassland)	82
Desert and semi-desert	44

Source: GGL, 2012.

4.4.4 Analysis

The GGLS8 gives a specific calculation methodology in which the carbon balance for the creation of new agricultural land is accounted for. The NTA8080, however does not go into this detail, however reference is made to the adoption of IPCC calculations (on which the RED LUC methodology is based). Thus, while the actual calculations cannot be compared, it can be assumed that the approaches are similar.

4.5 Processing Emissions (e_p)

Processing emissions are created when the biomass crop is treated and converted into a useful fuel. The calculation of these emissions in the GGLS8 and NTA8080 are given below.

4.5.1 GGLS8

[Conversion factor intermediate products of part of the chain] =[annual amount of product produced in this part of the chain in MT] / [annual amount of incoming raw material or intermediate products in this part of the chain in MT]

*[GHG emission from electricity for production per MT of biomass] =(([Total annual electricity use for production] * [fossil fuel emission factor of the energy mix]) / [total annual mass of biomass produced in MT])*

*[GHG emission from fossil fuel use for production per MT of biomass] =(([Total annual fossil fuel used for production] * [emission factor of the fossil fuel]) / [total annual mass of biomass produced in MT])*

4.5.2 NTA8080/Sustainable Production of Biomass (2006)

GHG emissions from processing crop (per ton) = GHG emissions for pre-treatment + GHG emissions from conversion to fuel

*GHG emissions for pre-treatment (per ton)= litres of diesel burned by machinery (per ton crop) * GHG emission per litre (production + combustion)*
*GHG emissions from conversion to fuel = litres/MJ of fossil fuel burned by machinery (per ton crop) * GHG emission per litre/MJ (production + combustion)*

According to Figure 1 and Figure 2 the processes are applicable to both the main energy crops as well as residual streams.

4.5.3 Default Values

The following default values can be used for calculating the process emissions (GGL, 2012):

Table 2 Reference values process emissions

Fuel type	Default CO_2 emission factor (kg/GJ)	Default NCV (GJ/MT)	Density kg/m^3
	Sources: EU 2004 [1] or IPCC 2006 [2]	Source: IPCC 2006 [2]	Source: AGO 2003 [3]
Gas/diesel oil	74.1	43.0	822
Marine diesel oil			846
Residual fuel oil	77.4	40.4	995
Liquid petroleum gas	63.1	47.3	534
Gasoline	69.3	44.3	746
Natural gas	56.1	48.0	
Other Bituminous Coal	94,6	25.8	
Brown Coal Briquettes	97.5	20.7	
Peat	106.0	9.76	

Source: GGL, 2012.

4.5.4 Analysis

The process emissions calculation methodology can be considered equivalent in both the GGLS8 and the NTA8080. Although certain emissions along the life cycle may be different between crops and residual products (extra refining steps for residuals, for example), these differences will be the same between the two standards.

4.6 Transport and Distribution Emissions (e_{td})

4.6.1 GGLS8

*[GHG Emission of the transport] = ([average distance travelled in km] * [fossil fuel use per km] * [GHG Emission factor of the fossil fuel used]) / [average amount of MT of biomass transported]*

4.6.2 NTA8080/Sustainable Production of Biomass (2006)

Based on Figure 1 and Figure 2, it is assumed that three transport phases take place. These were included in the following expression:

GHG emissions from transport (per ton) = GHG emissions to pre-treatment + GHG emissions to conversion + GHG emissions to usage venue

The calculation of the emissions for each term in the above expression can be estimated as follows:

*GHG emissions to pre-treatment/conversion/usage venue (per ton)= distance travelled * litres fuel combusted per km * GHG emission per litres fuel (production + combustion)/amount of biomass (ton) transported*

4.6.3 Default Values

The following are default emissions which can be used to calculate the GHG emissions of transport and distribution (GGL, 2012):

Table 3 Default emissions of transport and distribution

Transport type	Fuel type	Default CO_2 - equivalent emission factor (kg/GJ)	Default NCV (GJ/MT)	Density kg/m^3
		Source: EU 2004 [1)]	Source: IPCC 2006[2)]	Source: AGO 2003 [3)]
Gasoline truck	Gasoline	72.2	44.3	740
Gasoline truck with catalyst	Gasoline	71.0	44.3	740
Heavy diesel truck	Gas/diesel oil	75.3	43.0	822
Diesel train	Gas/diesel oil	82.7	43.0	822
Sea Going vessels	Residual fuel oil	78.2 [4)]	40.4	995

Source: GGL, 2012.

4.6.4 Analysis

The GGLS8 and NTA8080 calculation methodologies from transport are in agreement.

4.7 Biomass Combustion Emissions (e_u)

Although the combustion of biomass is taken into consideration as a matter of system definition (see Figure 1 and Figure 2), short cycle crop production results in a net CO_2 uptake/release of zero. That is, the CO_2 uptake during crop growth is assumed to be equal to the CO_2 release upon combustion. This is addressed in the same way in the GGLS8 and NTA8080.

4.8 Soil Carbon Accumulation Emissions Savings (e_{sca})

4.8.1 GGLS8

A savings of 29 g CO_2/MJ (as defined in the Renewable Energy Directive) is calculated if the biomass is grown on severely degraded land or heavily contaminated land, thus improving the carbon stocks in the soil.

4.8.2 NTA8080/Sustainable Production of Biomass (2006)

This accumulation of soil carbon is not specifically mentioned either of these publications. However, the absence of this calculation in the publications (consideration its inclusion in the RED) does not imply that this is not relevant

4.8.3 Analysis

The possibility for calculating soil improvement is briefly mentioned in the GGLS8 and not in the NTA8080. Since this is a RED specification its inclusion/exclusion should not determine whether or not the GGLS8 and NTA8080 are equivalent in approach.

4.9 Carbon Capture and Storage Emissions (e_{ccs})

The Renewable Energy Directive states that:

> "Emission saving from carbon capture and geological storage *eccs*, that have not already been accounted for in *ep*, shall be limited to emissions avoided through the capture and sequestration of emitted CO_2 directly related to the extraction, transport, processing and distribution of fuel."

This avoidance of emissions by capture is not mentioned in either or the standards. This emission type is not considered a standard emission in the calculation of biomass production. Its inclusion in the RED is in the interest of consistency within the chosen system boundary for biomass production.

4.10 Carbon Capture and Replacement Emissions (e_{ccr})

The Renewable Energy Directive states that:

> "Emission saving from carbon capture and replacement, *eccr*, shall be limited to emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 used in commercial products and services."

Similarly to CCS, CCR can be considered a non-standard emission type, and thus its exclusion from both the GGLS8 and NTA8080 is inconsequential.
If it is determined that these emissions are to be included, the choice of methodology will not impact the calculation.

4.11 Excess Electricity from Cogeneration Emissions Savings (e_{ee})

4.11.1 GGLS8

This case is not specifically addressed in the GGLS8, however in the final use of biomass step (page 9), general instructions for calculating savings through excess energy production are given. In addition, factors are provided in Appendix 1.

4.11.2 NTA8080/Sustainable Production of Biomass (2006)

The possibility of including emissions savings from excess electricity production from cogeneration, is mentioned in the later publication. The inclusion of these emissions savings is stated to possibly result in savings that are too positive, depending on the chosen avoided electricity production (marginal energy, average grid electricity, etc.).

4.11.3 Analysis

As with the previous two emission types, this type of emissions savings refers to a very specific case in which the reference energy production is a co-generation plant.

4.12 Overall Analysis

Despite a few superficial differences in how the calculations are set up or described, the calculation methodologies in the GGLS8 and NTA8080 can be considered equivalent.

5 Comparing the Procedures

5.1 Comparing the Requirements

In addition to a comparison of the calculation procedures, the certification process of the two standards will be compared. As opposed to comparing the NTA8080 regulation with the GGLS8 (as was done in the comparison of the mathematical approaches), the certification process of the GGLS8 will be compared to the NTA8080 requirements. The NTA8080 requirements originate from relevant criteria found in the publication, *Testing Framework for Sustainable Biomass* (Agentschap NL, 2007).

A more detailed certification scheme is provided in NTA8081. The NTA8081 addressed management procedures of certification, including the requirements for reviewers, and a structured reviewing scheme which allows the certifying body to verify the fulfilment of various criteria. For the greenhouse gas criteria, the following criteria are relevant:
– check on use of valid calculation methodology;
– verification of variable input values on location;
– check based on readily accessible data;
– documentation check based on utilised procedure;
– visual inspection of biomass unit.

For the purpose of transparency and unambiguity, it important to state that the NTA8080 criteria also include several non- CO_2 related criteria. Only those criteria relevant to GHG emissions will be included in the analysis. The comparison of the criteria with relevant statements in the GGLS8 can be seen in Table 4 below.

Table 4 Comparing the NTA8080 GHG emission criteria with the GGLS8

NTA8080 Criteria	GGLS8	Comment
Principle 1		
The greenhouse gas balance of the production chain and application of the biomass must be positive.	Comparing it against a reference value for the European fossil fuel mix for the energy grid that the biomass is to replace, in order to decrease the amount of fossil GHG, the balance needs to be positive and above a given value. With the energy balance the total fossil energy used for production and transport of the biomass is subtracted from the final green power produced by the biomass.	Both documents seem to agree on the fact that the GHG balance for biomass must be positive. However, the minimum percentages are somewhat different, particularly in the case of the chosen references, i.e. EU mix vs. NL mix.
Minimum GHG emissions savings: Electricity, coal = 70% Electricity, natural = 50% Electricity, NL grid = 70%	**Minimum GHG emissions** (2 options) <u>Option 1</u> Electricity (EU grid mix) = 60% Biofuel = 35% <u>Option 2</u> Electricity from natural gas = 50% Electricity from NL grid = 70% Biofuel = 50% (the uncertainty is assumed to be 5%)	

NTA8080 Criteria	GGLS8	Comment
Principle 2		
Biomass production must not be at the expense of important carbon sinks in the vegetation and in the soil.	The change in carbon stock as a result of land use should be taken into account when the land use change happened less than 20 years ago. The change in carbon stock shall be calculated as emission and divided over 20 years. The carbon stock should include the carbon storage in vegetation and in the soil.	While the NTA8080 criterion states that biomass should not be produced at the expense of important carbon sinks, the GGLS8 states that these changes must penalise the outcome of the GHG emissions calculation of those biomass products.

The GGLS8 only addresses those criteria that directly impact the calculation of GHG emissions for a biomass production chain. Other GGL standards address the more procedure aspects of the label programme. As such, they are not mentioned in the standard.

The minimum GHG emissions savings are the main difference between the two standards, as these refer to different fossil fuel references. It would be easy to report the GGL CO_2 figures using the minimum values mentioned in the NTA8080.

The calculation of the carbon sinks of the NTA seems stricter (no expense of important carbon sinks) but it is not clear what an important carbon sink is. The more mathematical approach of the GGL8 is clearer. In practice, the GGL calculation would get a very high figure for carbon emission from soil if important carbon sinks were destroyed. This would result in a negative CO_2 emission reduction. In practice the soil approach of the GGL8 leads to the same results and is technically more precise.

5.2 Comparing the Certification Processes

Aside from fulfilling the criteria given in the NTA8080, the standards both apply certification processes. An overview of the certification processes for each standard will be given below, followed an analysis of the similarities and differences these have.

5.2.1 NTA8080 Certification Process

The certification of the requirements given in the standard must be conducted by an independent body that has the necessary competence in order to assess the sustainability of the biomass and evaluated the GHG balance calculation. This independent body must make the following data public: 1) a summary of the audit report, including the type of resource, addresses of production location and the crop land area, and 2) an overview of the granted certification. The audit team itself must fulfil certain requirements, most importantly for the lead auditor. The certifying body must offer the option for group certification of small holders.

5.2.2 GGLS8 Certification Process

Certification can either done through direct Green Gold Label certificates or though combined GGLS8/NTA8080 certificates. Details about certification for GGL can be found in the Certification Regulation document ('Certification requirements', GGL, 2011). This document specifies the requirements for certifying bodies, as well as specifics for certifying GGLS8. The certifying organisation must be independent and approved by the GGL board of accreditation.

The conditions of certifying GGLS8 include, requiring minimum levels of GHG savings compared to default energy processes. For biomass used for electricity a minimum of a 60% reduction is required, while for biofuels a minimum savings of 35% is required. In the case of the combined GGLS8/NTA8080 certificates, minimum GHG reductions are specified at: 50% for natural gas, 70% for the Dutch electricity mix, 60% for biogas and 50% for biofuels.

In addition these requirements, the certification document specifies (for GGLS8 certification) that:

- application must be submitted to an approved certifying body;
- one announced site inspection per annum must be conducted;
- audits should be according to ISO19011:2002;
- one internal inspection must be conducted per annum (the inspection report must follow ISO/IEC 17020);
- the entire production process must meet requirements of GGL,

5.3 Analysis

The NTA8080 certification process and the GGL/GGLS8 certification process are described in detail in the respective documents and associated documents. Both standards specify that an approved independent certifying body/auditor must be utilised in the certification process. While the NTA8080 certification requirements are focused on which data must be reported by the certification body, the GGL/GGLS8 certification requirements specify that an annual external site inspection, as well as an annual internal inspection must take place. In general, both systems utilise a similar certification procedure and therefore the credibility of the results of both systems can be considered equivalent.

6 Conclusions and Recommendations

The GGLS8 is one among several standard documents in the Green Gold Label (GGL) programme. The GGLS8 is in fact titled the 'Greenhouse Gases and Energy Balance Calculation Standard' and its aim is to provide all actors in the biomass supply chain the rules and reference values in order to calculate greenhouse gas emissions and energy balances for biomass. In contrast, the NTA8080 is set up more as a regulatory standard, which provides definitions as well as criteria for what constitutes sustainable biomass in addition to providing criteria for GHG gas emissions. This comparative study focused solely on the aspects of both standards that covered GHG emissions of biomass produced for energy.

Considering the nature of these two documents, it was necessary to also consider related documents in the analyses. In the case of NTA8080, calculation methodology was obtained by referencing other publications including: 'Methodology CO_2 tool for electricity, gas and heat from biomass' (Agentschap NL, 2011 – update to earlier tool methodology), 'Testing framework for sustainable biomass' (Agentschap NL, 2007), 'A greenhouse gas calculation methodology for biomass-based electricity, heat and fuels' (CE, 2006).

The calculation methodology for the two standards is never actually in conflict, however the GGL standard provides a complete and specific methodology for completing the GHG emissions balance, whereas the NTA8080 does not go into this detail. Instead the expressions were derived using flow diagrams in CE (2006). For a few of the GHG emissions balance equation terms, specific formulae or calculation methodologies could not be ascertained. In most cases, it was concluded that the two standards follow the same calculation methodology.

As for the procedures, the GGLS8 only addresses those NTA8080 criteria that directly impact the calculation of GHG emissions for a biomass production chain. As such, the minimum GHG emissions savings were the main focus of the comparison. The minimum GHG emissions savings for each standard were found to be somewhat different. This discrepancy could result in the choice of one standard over the other in order to utilise a more 'favourable' minimum requirement.

The certification procedures outlined in the standards, take somewhat different approaches in terms of their focuses. The NTA8080 focuses on the requirements for the auditing process and the auditor itself, while assuming that the fulfilment of the criteria will be inherently carried out.
The NTA8081 further expands on the fulfilment of the requirements through a comprehensive certification scheme. The GGL/GGLS8 certification requirements specify that an annual external site inspection, as well as an annual internal inspection must take place. Thus, some aspects of the certification processes are similar, while for other aspects the specific requirements are different. Both systems require certification by an independent body. In general the certification systems are very similar.

General Conclusion

If exact CO_2 reduction figures are communicated, the GGLS8 CO_2 calculation method can be considered equal to the CO_2 calculation method of the NTA8080.
Also the certification rules for an independent certification organisation are similar, so the credibility of the figures can be considered to be equivalent.

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