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From innovation to operational assistance

“Sustainable biomass imports for energy production : Challenges for the implementation of GHG LCA methodology within an operational verification procedure”

Workshop IEA Task 38 - Greenhouse Gas Balances of Biomass and Bioenergy Systems

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Overview

1. GHG accounting in Belgium regulation
2. Implementation of GHG balance
3. LCA methodology for GHG accounting
4. RES-D for solid biomass fuels
5. Perspectives

Legislation for Green Certificates

Flanders :

- green certificates granted according to energy balance of supply chain and reference CHP PP

$$\#GC = \text{net } MWh_{el} - \text{electricity use} - \text{fossil } MWh_p * 55\%$$

Wallonia :

- green certificates granted according to proven sustainability, CO_2 balance of supply chain and reference CHP PP
- All fuels have reference CO_2 emission according to LCA
  - Natural gas = 251 $kgCO_2/MWhp$
  - Coal = 396 $kgCO_2/MWhp$
  - Wood pellets = 55 $kgCO_2/MWhp$

$$\#GC = \left(1 - \frac{55}{251} * \frac{55\%}{34\%} = 65\%\right) * MWhel$$

Obligation Green Certificates

Flanders: 55 TWh, RES only

Co-firing allowed

Market: 105 €/MWhe Fixed: 85 €/MWhe

Co-firing coal

>50 MWe, ratio< 60%, 50% reduction gc

- 2010 : 6% ;
- 2011 : 7% ;
- 2012 : 8% ;
- 2013 : 9% ;
- 2014 : 10% ;
- 2015 : 10,50% ;
- 2016 : 11% ;
- 2017 : 11,50% ;
- 2018 : 12,00% ;
- 2019 : 12,50% ;
- 2020 : 13%.....

Wallonia: 35 TWh

Co-firing not allowed

Market: 85 €/MWhe, Fixed 65 €/MWhe

CHP+RES

- 2010 : 11,25% ;
- 2011 : 13,50% ;
- 2012 : 15,75% ;
- 2013 : 18,00% ;
- 2014 : 20,25% ;
- 2015 : 22,50% ;
- 2016 : 24,75% ;
- 2017 : 27,00% ;
- 2018 : 29,25% ;
- 2019 : 31,50% ;
- 2020 : 33,75%.....

Specific rate of fossil GHG generation in kg CO_2eq/MWh **primary** energy (CWaPE-WAL)

	kgCO_2/MWhp	%Green Cert
❖NON FOSSIL		
❖ wind/solar/hydraulics	0	100
❖ organic biodegradable matters	0	100
❖ milling	4	98
❖ transport on max. 200 km	5	97
❖ drying	10	94
❖ corn crops	22	87
❖ wood	23	87
❖ cultivated wood (short rotation coppices)	45	74
❖ coleseed oil	65	63
❖ bio-diesel	80	54
❖FOSSIL		
❖ natural gas	251	
❖ gasoil	306	
❖ light fuel oil	310	
❖ heavy fuel oil	320	
❖ coal	385	

the reference →

Reference choice = CHP natural gas !

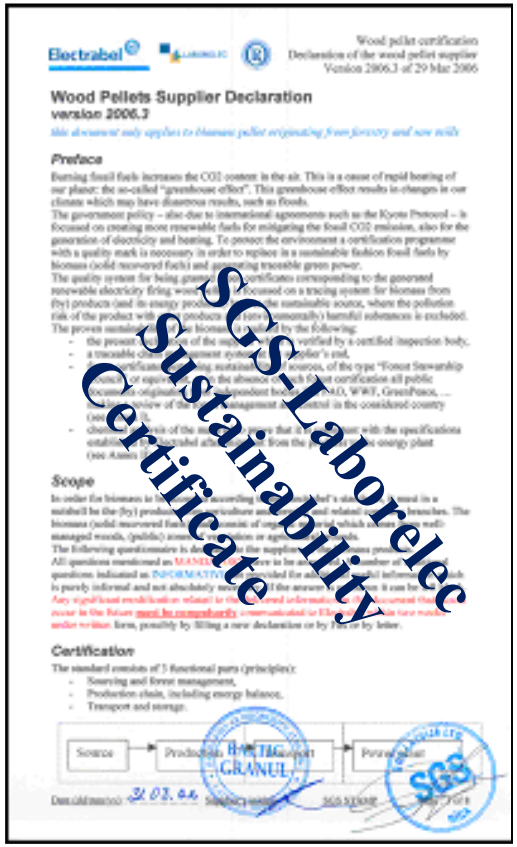
2. Implementation of GHG balance
Verification procedure

- Certified or at least evidence for responsible management of the forests including afforestation plans
- Controlled impact on environment (soil, air, water)
- Enforcement of legislations
- Traceability
- Origin of raw material
  - primary product or residue
  - bio-fuel or waste
  - rely on international certification
    - FSC, PEFC, …
- Energy/CO_2 balance of supply chain
  - electricity use
  - fossil primary energy use
  - transport

Track & trace system

Electrabel Fuel Logistics

Independent reporting



2. Implementation of GHG balance
Independent inspection of supply chain

Raw material → **Pellets** → **Transport** → **Harbour** → **Power Plant**

Audit in the wood-based industry (sawmill,..):
Origin and type of wood used

Local audit :
- Means of transport
- Average distance

Local audit :
- Means of transpo
- Average distance

Audit in pellet factory:
- Production process
- Energy consumption
- Origin and type of the raw material used

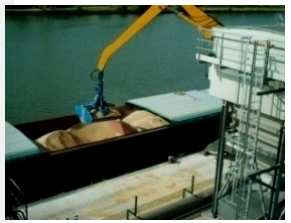
Raw material transport
Pellet transport
SGS verifications
Other verifications

Analysis of the quality of the wood pellets

Transport verification

Certification : « Certificat de garantie d'origine »

Gauging of the arriving barges
Sampling: Wood pellet analysis



Based on bibliography and on local auditors data, SGS analyses:
- the countries forests regulations,
- the existing certification systems
- the state of the forests

Currently not in use

Verification of the declaration filled in by the supplier

Meters control

Transport verification

Ship lading control
Sampling: Wood pellet analysis

Ship lading control
Transhipment in barges and gauging

Transport verification

Document prepared by SGS

2. Implementation of GHG balance
Key factors for an operational system

- **Minimum criteria:**
  - energy balance or CO_2 balance for the supply chain
  - overall traceability of the primary resources
  - independent report over local resource management and respect of local and international legislations

- **Operational:**
  - it is not expensive (< 0,05 €/ton)
  - can be fast (< 2 weeks)

- **Pragmatic approach:**
  - implement first a scheme that works in practice and is affordable
  - then improve the certification scheme in time

Return on LCA experience

Ecoinvent database = international reference for LCA

Operational side:

- Time consuming
- Lack of certain international data (e.g. Canada, Australia, Africa, Asia)
- Data from mixed origin

On the methodology side

- GWP_{100y} : Robustness due to international agreement on IPCC factors … CH_4?
- Responsibility?
  GHG → GWP = Impact on global scale. Definition of the perimeter.
- Impacts of "allocation rules" → From positive to negative balance!

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

where

E = total emissions from the use 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 change;

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use; = 0 for biomass

e_{sca} = emission savings from soil carbon accumulation via improved agricultural management;

e_{ccs} = emission savings from carbon capture and geological storage, and;

e_{ccr} = emission savings from carbon capture and replacement.

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

where

E = total emissions from the use of the fuel **before** energy conversion;

astes

***econdary biomass and primary forest and agricultural crop residue**s, incl. tree tops and branches, straw, bagasse, husks, cobs and nut shell*

GHG of Life Cycle = 0 UNTIL COLLECTION

esidues** from **processing**, including crude **glycerine

$e_{collection}$

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use; = 0 for biomass

e_{ccr} = emission savings from carbon capture and replacement.

SGS – LBE procedure

For wastes and residues: $E = e_{collection} + e_p + e_{td} + e_u - e_{ccr}$

! Increasing demand for biomass

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

Member States implementation of the RED

! Not beyond RED , No Market Distortion (Third Countries) , Fossil Reference

! Multiplication of verification schemes = higher costs, barrier trade

→ Positioning of our system is necessary

EC GHG methodology : operational?

e_{ec} = *emissions from the extraction or cultivation of raw materials;*

e_{l} = *annualised emissions from carbon stock changes caused by land use change;*

e_{p} = *emissions from processing;*

e_{td} = *emissions from transport and distribution;*

e_{u} = *emissions from the fuel in use;*

e_{sca} = *emission savings from soil carbon accumulation via improved agricultural management;*

e_{ccs} = *emission savings from carbon capture and geological storage, and;*

e_{ccr} = *emission savings from carbon capture and replacement.* ***?***

- **Default values (Typical if same processes)**
- **Own values to be assessed and amended by the Commission**

  → is it operational?

  → availability of the data?

  → accreditation of reference bodies?

GHG methodology: fossil references?

$$SAVING = (EC_{F\,(h,el,c)} - EC_{h,el,c})/EC_{F\,(h,el,c)}$$

$EC_{h,el,c}$ = total emissions from the heat, cooling or the electricity; and

$EC_{F\,(h,el,c)}$= total emissions from the fossil fuel comparator for heat, cooling or electricity.

Fossil reference.

Whereas the VREG and the CWAPE adopted the **CHP natural gas** as **fossil reference**, the European Commission use other reference systems.

Biomass energy conversion	Electricity	Heat	Cooling (absorption heat pumps)
Fossil fuel comparator	$EC_{F(el)}$	$EC_{F(h)}$	$EC_{F(c)}$
Value	**198** gCO_{2eq}/MJ electricity	**87** gCO_{2eq}/MJ heat	**57** gCO_{2eq}/MJ cooling

Sustainability criteria : iLUC or not?

Currently: only reporting from the EC for the 31st December 2011

At company level:

☑ independent reporting on regional context (reference date = 2008?)

☑ audits on site → picture of the local context

Gaps:

- little control on primary suppliers of biomass (☹ LUC?)
- no existing LCA tool – too many assumptions underlying

Question:

Transparent allocation methodology for iLUC accounting ?

Internationally agreed model according to REDD, SFM, Agri policies ?

THANK YOU FOR YOUR ATTENTION

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"You may never know what results come of your action, but if you do nothing there will be no result"

Gandhi

[Five reasons for you to choose Laborelec]

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Coefficients d'émission de CO2 de sources d'énergie primaires

Sources d'énergie	Valeur conventionnelle N1+N2 kg CO_2/MWhp
SOURCES D'ENERGIE FOSSILES	
gaz naturel	251
LPG	267
gasoil	306
fuel léger/moyen/lourd	310
fuel extra-lourd	320
charbon	385
SOURCES D'ENERGIE RENOUVELABLES	
Hydraulique / Eolien / Solaire / Géothermie	0
Fraction organique biodégradable (biomasse) *	
des déchets industriels et municipaux	0
des produits, déchets et résidus provenant de l'agriculture	
Biométhanisation (MWhp = MWhp biogaz)	
Fumier et lisier	0
Herbes (ensilage)	17
Maïs	22
Biocarburants	
Huile (vierge) de colza	65
Biodiesel d'huile (vierge) de colza	80
des produits, déchets et résidus provenant de la sylviculture et industries connexes	
Bois cultivé à finalité énergétique	40
Autres types de bois	
Granulés de bois	30
Résidus de la sylviculture (rémanents)	20
Résidus des industries connexes	0

*** Les valeurs conventionnelles sont d'application pour une valorisation sur site.**
Le cas échéant, les opérations élémentaires nécessitées pour la préparation du combustible non comptabilisées dans les valeurs conventionnelles seront ajoutées.
En cas de transport de la ressource vers le lieu de production de l'électricité verte, il y a lieu d'ajouter les émissions associées à ce transport.

En ce qui concerne les filières bois, les valeurs indicatives suivantes seront utilisées :

VALEURS INDICATIVES PAR OPÉRATION ÉLÉMENTAIRE DANS LE CAS DES FILIERES BOIS	
culture	20
collecte (abattage - débardage)	6,5
broyage	3,5
séchage	10
densification	10
transport dans un rayon de maximum 200 km	5
transport dans un rayon supérieur à 200 km	25