GHG methodologies for biofuels: French developments

2nd GBEP Task Force meeting on GHG methodologies
Washington D.C., 6-7 March 2008
UN Foundation

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IFP, Economy Department
The French context

- Biofuels an historical initiative for security of supply and agriculture policy support with reference to GHG issues in the "Plan Climat" (2004)

- New objectives in relation with European initiatives (2005)
  - 5.75% up to 7% in 2010
  - Fiscal incentives mechanism
  - A need to review the GHG impact of biofuels (2002 Ademe-Direm study) with the Ademe/IFP seminar on 1st March 2007
  - Decision of launching a new study to explore the Methodology issues and define the most as possible efficient recommendations

- The "Grenelle de l'environnement" initiative
  - Working group with various stakeholders (2007)
  - Operational committee by thematic to propose actions to the government: one on the Renewables and specially on biofuels (certification, economic and fiscal issues...) on work.
  - Measures to be adopted in 2008 (Laws and regulations)
GHG methodology development

- Seminar IFP/ADEME in March 2007
  - state of the art of the thematic
  - an international review: JRC, LBST, IFEU, Ecofys, M. Wang for USA

- New French study (kick-off 1st October 2007 and final results expected mid March 2008)
  - 1st generation in France
  - Energy, GHG and other atmospheric pollutants
  - Allocation procedure recommendations
  - identification of key data issues
Structure and content

**TITLE:**
"ETUDE SUR LA METHODOLOGIE à appliquer pour établir le REFERENTIEL DES BILANS d'énergie, de gaz à effet de serre et des polluants atmosphériques locaux des BIOCARBURANTS DE 1ERE GENERATION en France"

**Organisation**
- financing: ADEME, Agriculture, Environment and Energy Ministeries, IFP
- Selection of a consultant (Bio Intelligence Services)
- two committees:
  - steering committee with the financing
  - technical committee to support data and pathways specificities:
    - members of ST
    - Technical and scientific institutes: INRA, Arvalis, CETIOM, ITB, ITERG,
    - Industry: Total, Renault, PSA Peugeot-Citroën, Saipol-Diester-Industrie, Téréos, Cristal-Union, Véolia,
    - NGO: Réseau Action Climat
Méthodologie
Référentiel Biocarburants
Conclusions de l’étude

- Infrastructures and material issues
- $\text{N}_2\text{O}$ emissions
- Change of Land use
- Allocation: massic, energy content, economic, avoided impact
pathways list

- Ethanol: corn, wheat and sugar beet including ETBE
- Esters (methyllic and ethyllic) of RS and SF
- Esters methyllic of animal greases
- Direct RS or SF vegetable oils
- Ethanol from sugar cane: imports
- Esters of palm and soybean oil: imports
- Gasoline SP95
- Diesel fuel
Emission factors for N\textsubscript{2}O

**Ampleur de la problématique**

- **PRG du N\textsubscript{2}O**: 296 kg éq. CO\textsubscript{2} par kg de N\textsubscript{2}O émis.
- **Facteur d’émissions directes**: 1% [IPCC 2006]
- **Facteur d’émissions indirectes**: 0,1% (volatilisation) et 0,23% (lessivage) [IPCC 2006]

<table>
<thead>
<tr>
<th></th>
<th>Contribution du N\textsubscript{2}O au bilan total</th>
<th>Contribution du N\textsubscript{2}O à l’étape agricole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol de blé</td>
<td>21%</td>
<td>33%</td>
</tr>
<tr>
<td>Ethanol de maïs</td>
<td>17%</td>
<td>27%</td>
</tr>
<tr>
<td>EMHV de colza</td>
<td>28%</td>
<td>36%</td>
</tr>
<tr>
<td>EMHV de tournesol</td>
<td>15%</td>
<td>25%</td>
</tr>
<tr>
<td>EMHV de soja</td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>HVP de colza</td>
<td>35%</td>
<td>36%</td>
</tr>
</tbody>
</table>

*Calculs BIO IS – only direct emissions*
Emission factors for $\text{N}_2\text{O}$

**A strong influence**

No real consensus on the model due to regional influences

<table>
<thead>
<tr>
<th>Modèle</th>
<th>Consensus Scientifique</th>
<th>Périmètre d’applicabilité</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCC</td>
<td>++</td>
<td>Transversal</td>
</tr>
<tr>
<td></td>
<td>Consensus par défaut</td>
<td></td>
</tr>
<tr>
<td>DNDC</td>
<td>+</td>
<td>Contexte européen</td>
</tr>
<tr>
<td></td>
<td>Moindre niveau de validation que l’IPCC</td>
<td></td>
</tr>
<tr>
<td>SKIBA</td>
<td></td>
<td>Mesures expérimentales locales</td>
</tr>
<tr>
<td>Crutzen</td>
<td></td>
<td>Remises en cause fortes, publication récente</td>
</tr>
</tbody>
</table>
Emission factors for N₂O

Recommendations:

- direct emissions, on the basis of IPCC factor: 1%.
- indirect emissions, on the basis of IPCC factor: 0,1% (volatilization) & 0,225% ("lessivage").
- develop INRA works to evaluate "local" factor distribution in a longer term.
Change of land use

- **A priori two distinct problems but...**
  - **direct change**: conversion of a land whatever the initial use towards a culture allowing biofuel production
  - **indirect change**: competition between different crops and forest...
  - Within EU should be limited to crop rotation issues

- **Modelisation of CLU**: IPCC 2006, Volume 4
  - Stocks **in the vegetation** (above/under the ground)
  - stocks in the soil
Change of land use

A strong influence: could more than cancel the biofuel benefits

A real difficulty to have a average scenario by crop and/or region and no efficient way to measure indirect CLU (local versus global)
Change of land use

Recommendations

- **Regional CLU differences**

<table>
<thead>
<tr>
<th>Geographical area</th>
<th>Direct change</th>
<th>Indirect change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>Null or marginal impact</td>
<td>Unknown with uncertainties</td>
</tr>
<tr>
<td>Africa</td>
<td>Unknown with uncertainties</td>
<td>Unknown with uncertainties</td>
</tr>
<tr>
<td>North America</td>
<td>Unknown with uncertainties (to be clearly defined)</td>
<td>Unknown with uncertainties</td>
</tr>
<tr>
<td>South America</td>
<td>Unknown with uncertainties</td>
<td>Unknown with uncertainties</td>
</tr>
<tr>
<td>Asia</td>
<td>Unknown with uncertainties</td>
<td>Unknown with uncertainties</td>
</tr>
</tbody>
</table>

- **Review systematically results under the perspectives of a scenario of CLU:** develop a regional and worldwide scenario of potential pressure due to biofuel development on the "available" land (forest...), including for production development.
Allocations in case of co-products

- Methodology issue
  - precise definition of the system
  - Base of the allocation:
    - massic
    - valorized massic
    - economic value
    - energy content

- Massic « strict »
  - Vinasses : 90%
  - Flegmes : 10%

- Massic « corrected »
  - Vinasses (DDGS ms): 44%
  - Flegmes : 56%
Allocations : avoided impact allocation

- **Methodology issues**
  - Choice of the valorization mode of the co-product
  - Choice of the product to be substituted,
  - Choice of the criteria for defining the ratio of substitution between the two products (example: protein content, digestive content, dry mass, ...)

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Allocations : simulation

- example of results: Rapeseed methyllic ester
Allocations:

- **Recommendations:**
  - Base: avoided impact when process clearly identified
  - Energy content allocation for other cases as it limits the risks of over-allocation of impacts to the co-products compared with massic allocation

<table>
<thead>
<tr>
<th>Classe</th>
<th>Méthode recommandées</th>
<th>Précaution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPREADING</td>
<td>Substitution</td>
<td>NPK Flow Balance</td>
</tr>
<tr>
<td>ANIMAL FOOD</td>
<td>Prorata énergétique</td>
<td>Faire une analyse de la réalité physique du process en amont</td>
</tr>
<tr>
<td>INDUSTRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENERGY</td>
<td>substitution</td>
<td>Mix énergétique si export d’électricité</td>
</tr>
</tbody>
</table>

Still under discussion as the heat/power substituted could be difficult to defined
Reference value:

- Recommendation and points of discussion:
  - problems of the infrastructure: on a comparative objective, verify the potential impact (5% threshold) and require to recover oil sector evaluation and update the agriculture part
  - the allocation issue is another difficulty for refining system in order to differentiate gasoline and diesel fuel. Various options with no consensus:
    - incremental calculation of JRC study
    - Marginal content from linear model
    - Allocation (massic/energy content, economic)
    - Common value for both fuels on global energy content allocation