MEETING MINUTES

Meeting:	ILUC meeting with the ethanol supply chain
Date:	12 November 2013
Time:	13:30- 17:30

Attendees:	Daan Peters (chair, Ecofys), Carlo Hamelinck (Ecofys), Hugo Valin, Stefan Frank (IIASA), Maarten van den Berg (E4tech)
	Rob Vierhout (ePURE), Emmanuel Desplechin (ePURE), Tom Gameson (Abengoa), Marco Veselka (Crop Energies), Jesper Kløverpris (Novozymes), Valerie Corre, Paul Jaquelin (Tereos), Vadim Zubarev (Pannonia), Richard Stark (AB Sugar), Thordis Möller (Fuel21/Nordzucker), Elzbieta Jaroslawska (Bioagra), Dominique Dejonckheere (Copa-Cogeca), Dietrich Klein (Bundesverband der Deutschen Bioethanolwirtschaft), Sian Davies (National Farmers' Union), Nicolas Rialland (Planteurs de Betteraves).

1. Explain and discuss the ILUC modelling project

General points concerning the project and its results

A consortium of Ecofys, IIASA and E4tech has been assigned by the European Commission to model feedstock-specific ILUC emission values associated with the consumption of conventional and advanced biofuels in the EU. The consortium uses the GLOBIOM model, developed by IIASA. Project results are expected by early 2015.

The current meeting is part of a series of stakeholder meetings during which the consortium aims to obtain relevant input and suggestions from stakeholders. This will result in a draft Inventory of changes to GLOBIOM and draft baseline and policy scenarios, which are to be published by the end of January. These draft versions are to be discussed with the Advisory Committee, the Commission and stakeholders. After the final changes to GLOBIOM and final baseline and policy scenarios have been agreed upon, IIASA will update the GLOBIOM model, will subsequently run the model and perform sensitivity analysis.

- Stakeholder: would like further stakeholder engagement during the study project, would be good to have an additional stakeholder meeting, not just bilateral discussions with individual stakeholder groups.
  - o Ecofys: agree that additional stakeholder meetings are desirable and will be arranged.
- Stakeholder: Can stakeholders influence the scenario development?
  - o Ecofys: the consortium invites all stakeholders to provide us with input on the most probable baseline and policy scenario's and elements which are relevant for drafting these, input should be substantiated and accompanied with as much data as possible. Suggestions will be added to either the draft Inventory of Changes to the GLOBIOM model or draft baseline and policy scenarios, both to be drafted in

January. We will discuss these with the Commission, Advisory Committee and stakeholders. We can't promise that all input can be taken into account.

- Stakeholder: We understand you work with an Advisory Committee. It would be good to discuss who is and should be on the AC. It would be good to expand the AC with an agricultural expert, current AC is not balanced.
  - Ecofys: We are glad to have an academic Advisory Committee which advises us at three key moments during the study. The AC does not review (interim) results but provides high level expert advice. AC consists of: Richard Plevin, Jacinto Fabiosa, Koen Overmars, Andre Nassar, Robert Edwards, Chris Malins and David Laborde. Criteria for selecting AC members were 1) academics not directly affiliated with stakeholders in ILUC debate 2) involved in ILUC modelling or relevant expertise and 3) availability. We currently contemplate to include some additional members, although no decision on this has been taken. Suggestions welcome.
- Some stakeholders voice their surprise that the EC who commissioned the study also sits on the AC (JRC). Does the EC have a say on the composition of the AC?
  - Ecofys: yes indeed and as they are our client this is only logical.

2. Discussing the GLOBIOM model and the planned modelling

- Stakeholder: Question about regional detail in GLOBIOM.
  - IIASA: GLOBIOM specifies 28 EU MS plus 25 non-EU regions, including some large non-EU countries (e.g. USA, Brazil, Japan, China, Canada. The following regions will additionally be singled out in GLOBIOM within the current project: Malaysia, Indonesia and Argentina.
- Stakeholder: All models to date have their own methodology. Are you aiming for a new methodology or is the aim to develop a methodology that is in line with the current EU RED GHG emission calculation rules?
  - Ecofys: Emission calculations in RED are for dLUC, in the current project we model LUC (dLUC plus iLUC).
  - IIASA: the methodology, from a modelling perspective, is not completely new. GLOBIOM belongs to the same family of models as US FASOM, which has been used by EPA for its Regulatory Impact Assessment of the Renewable Fuel Standards.
- Stakeholder: will ILUC factors be modelled for additional EU biofuels consumption or for the entire EU biofuels consumption?
  - Ecofys: we will model ILUC emissions over the additional increase in EU biofuels consumption, the biofuel consumption level in the base-year will not be part of the 'biofuels shock'.
  - IIASA: Indeed, marginal effects can be different, depending on the initial biofuel consumption level in the baseline.
- Stakeholder: How do you allocate additional emissions to the biofuels? Has been over simplified in past modelling studies and is not mentioned in the GLOBIOM/MIRAGE BioF comparison document.
  - IIASA: in our study we will model feedstock-specific LUC emissions which will be presented in grams of CO_2 equivalent per MJ of biofuel for each of the biofuel pathways included in our study.
- Stakeholder: Which emission allocation period will you use, 20 years as IFPRI did or 30 years as US modelling studies do.
  - Ecofys: We're not bound by 20 years, although choosing a 20 year allocation period fits with the 20 year allocation period for direct LUC emissions in the RED and FQD and would enable easy comparison with the results of the IFPRI study.
- Stakeholder: is GLOBIOM dynamic or static? And if dynamic, how?

- o IIASA: GLOBIOM is dynamic in the sense that equilibrium is calculated for different periods of time and results from one period influence the results of the next period (recursive dynamics setting). The model is not perfect-foresight i.e. economic decision are not influenced by anticipation of prices in the future (difficult for a model of this size). But as time steps are ten years, such effect would be about anticipation in a very far future.
- Stakeholder: will you only apply a biofuels shock for 2030?
  - o IIASA: no, we will model increases in EU biofuel consumption in 2020 and 2030. GLOBIOM uses 2000 as a base year. Some important dataset in the structure of GLOBIOM are only available for the year 2000 (geographically explicit data), which prevents calibrating the full model in 2010. However we take into consideration all available data after 2000 to project our exogenous parameters (population, income, bioenergy demand, etc.) and compare other indicator developments.
- Stakeholder: how do you handle structural changes that take and took place in the 10 year period (1 time step in GLOBIOM) that effect your baseline (e.g. in Eastern Europe)?
  - o IIASA: We intend to focus on that for 2010 and compare with historic data. That will help us to determine if we properly represents the trends or if we miss an important policy driver.

Land availability, (changes to) area harvested

- Stakeholder: question on land availability, harvested area data comes from FAOSTAT, but what will be the source for future harvested area?
  - o IIASA: we use for our definition of cropland an area that is larger than harvested area. Based on CORINE Land Cover in Europe and Global Land Cover 2000 in the rest of the world.
- Stakeholder: Where does pasture data come from?
  - o IIASA: Grassland data comes from the two land cover datasets mentioned above. Area used as pasture is calculated as the area grazed by animals in the dataset on livestock (Gridded Livestock of the World from FAO).
- Stakeholder: Does GLOBIOM account for double cropping?
  - o IIASA: this is technically very challenging, we need good information on where it happens and why. We currently have a knowledge gap on this point and all relevant information is welcome.
- Stakeholder: What is the trigger for change in production?
  - o IIASA: there is an exogenous trend in the baseline to represent technological change. And an endogenous trend that is determined by prices.
- Stakeholder: Could subsistence farming change to other management? IIASA: no, subsistence farming is kept constant in our baseline. But low input systems can change to high input.
- Stakeholder: FAO-statistics do not reflect physical hectares so "area harvested" is presented in a limited way and probably your modelling of area harvested cannot rely on FAOSTAT alone.
  - o IIASA: This is a relevant point. For most regions harvested area is lower than cropland data from Global Land Cover 2000, including for regions with multiple cropping (not taken account in the current version of the model). The difference between harvested area from FAOSTAT and physical area of cropland is well identified in the model and is accounted for as unused cropland. However, there is always a high uncertainty on whether this land can really be cultivated. This uncertainty can only be reduced with when better data becomes available.
- Stakeholder: In recent years we saw a decrease in cropland availability in the EU. Is that accounted for in the baseline of the model?

- o Ecofys: This decrease is indeed a fact and has different causes. Some agricultural land is used to build new houses, roads and industrial estates, this land is no longer available for agriculture. Some land is turned into nature as a means of compensation for infrastructural development, as required by the EU. Some land, finally, is abandoned due to changing economics and could be available for future biofuel crop production. IIASA: Such a decrease in cropland can also occur in GLOBIOM. One of the reasons for instance is increase in yield that leads to a decrease of harvested areas if demand does not grow as fast as yield. Land abandonment can also be driven by policies, and some of them can be added if necessary.
- Stakeholder: How does the area harvested react to changes in yield that have been observed over time?
  - o IIASA: exogenous technical change drivers are included in the baseline so yield improvements over time are accounted for and have a direct effect on land requirement.
- Stakeholder: can you also influence area harvested by changing from low yield to high yield crop on a given hectare?
  - o IIASA: yes, that is exactly what the model represents through changes in systems. Yields are also responding to substitution between crops and reallocation of crops on land with different suitability.
- Stakeholder: How does GLOBIOM take new land expansion into account?
  - o IIASA: expansion on agricultural land is currently based on suitability of new areas and production and land conversion costs. Each supply unit has therefore a different potential for production and the model determines if expansion is profitable in that area. Some policy constraints can also be taken into account.

Validation of modelling results

- Stakeholder: Do you intent to validate results against historical data or do you use a different methodology for past and future?
  - o IIASA: validating GLOBIOM is a concern that goes well beyond the scope of this single project. We of course compare the model results with historical development as a first consistency check. But we are also involved in different model comparison exercises to compare model responses on specific scenarios (AgMIP for instance, www.agmip.org). Last, we collaborate with some regional teams in different deforestation hotspots, in particular Congo Basin and Brazil, to improve our representation of land use change in these regions. Trends in land use remain complex however, because they are shaped by market mechanisms and also by national and local policies. Our representation improves but a lot remains to do. Still, our results so far have already acknowledged by a certain number of publications.
- Stakeholder: Is the model accessible and reproducible as is the case with GTAP?
  - o IIASA: transparency is a core aspect of this project and we will provide information on model assumptions, parameters we use and results. However, we do not envisage to put the code of GLOBIOM online, in order to protect our intellectual property rights. However, that does not mean that the code of GLOBIOM is completely closed, and the institute has many scientific collaborations with other institutes across the world. Some other researchers who come and visit us for a long period can use the model for their research. We are also on an internal reflection on ways of publishing some versions of the model, but this will probably not happen in the curse of this project. Note that a high level of modelling experience is needed to run such model, therefore we are also very careful on

technical requirements of people we collaborate with on this model to ensure its proper use.

<u>Taking into account existing and future policies</u>

- Stakeholder: Do you cover only "no go" areas of the directive (from sustainability criteria) or also beyond?
    - o IIASA: we currently have in the model a representation of protected areas. This information is sourced from the World Database on Protected Areas. However, like in most modelling approaches, we find that the sustainability criteria have little effect as long as they only cover a part of the possible uses of the product (unsustainable producer shift their output to other industries) or are only applied to a limited number of consuming regions (unsustainable producers shift their output to countries not using criteria).
- Stakeholder: You stated you will model current policies, but what about future policies? Is modelling different policies part of this project?
    - o IIASA: we will use the current legislative framework as a starting point. If we have strong indications that certain policy changes will probably be implemented, we could consider them.

<u>Co-products</u>

- Stakeholder: How will you allocate between main and co-products, based on substitution or energy-content?
    - o Ecofys: in this model we look at the entire world in causal relation, so substitution effects are covered. The RED/FQD allocate emissions based on energy content as substitution would be hard to assess for individual producers.
- Stakeholder: Data from Gallagher on co-products, are you going to update them?
    - o IIASA: We will definitely look to use more recent figures, suggestions welcome
- Stakeholder: Important to distinguish the sugar cane and the sugar beet processing and to take into account co-products from sugar beet
    - o IIASA: sugar cane and beet are represented with two different technologies. We currently have some basic information on sugar beet pulp to represent it in the model but better data on its conversion efficiency and use would be welcome.

<u>Price induced yield increase</u>

- Stakeholder: Ethanol from sugar cane and sugar beet should be made explicit because they have different co-products. Your document describing the GLOBIOM model states that bagasse is used to produce electricity, not that only 20% of ethanol plants in Brazil produce electricity for the grid. Also, real-life yield increase differs from what's included in most models. We've seen 1.5-2% annual yield increases with significant reductions in the use of chemicals.
    - o IIASA: we welcome your substantiated input on yield figures. Exogenous yield increase is important and we account for it with a trend in technological change. Contribution of fertilizer to this increase varies depending on the region and highly depending on prices. To what extent the effect of prices has contributed to past trends is more difficult to evaluate, literature does not agree but there are certain upper and lower bound estimates. Finding the right elasticities is challenging for us. We plan to analyse this with sensitivity analyses.
- Stakeholder: are yield elasticities specified per crop in GLOBIOM?
    - o IIASA: yes they are.

- o Ecofys: it might be useful to include in our report tables with yield increases over time per region and crop. Also, we will do our best to pick the most realistic yield elasticity figures.

Soil Organic Carbon

- Stakeholder: GLOBIOM uses IPCC tier 1 data for some land types, you propose to use another source for peatland. IPCC produces a new report in one month, wouldn't that be the best source to use?
  - o IIASA: We will assess the new report. We want to be cautious with respect to peatland drainage emission values and will do our own assessment of the literature as we know these are controversial figures.

Trade

- Stakeholder: In most models, products are always sourced from the region with the lowest price. Following this reasoning there would be no North Sea oil. In business only one thing counts: margin, if you can make an acceptable margin you will do business. High or low production costs only impact the margin. Laborde assumed that because of lower production costs nearly all ethanol would be sourced from Brazil. But it's the margin that counts. Would be good to account for this effect in GLOBIOM. Would result in a 'higher market price' of the model result.
  - o IIASA: what GLOBIOM does is much more in line with what you describe than what CGEs do (Armington elasticies). In GLOBIOM, margins are represented and market price is the marginal producer price, i.e. the price delivered by the last producer coming on the market. All other producers have some margins represented and the same patterns are taken into account for trade. The last producer participating to trade is not the one that has the lowest production costs but the one that can deliver to the market the last unit of good at a given price. Therefore, this producer has the highest production plus transportation costs from all other producers already exporting. That's exactly the same as for oil where the market price is determined by the last unit entering in production, with potentially very high production costs.
- Stakeholder: export figures may change in case biofuels mandates change. How do you incorporate this type of changes?
  - o IIASA: some biofuel policies will already be incorporated in the baseline and influence trade in feedstocks and biofuels. Additional changes will come from the scenarios and also impact this trade.

Commodity prices

- Stakeholder: Concerning prices, do you use farmer price plus processing cost? You have different price levels in the chain and the price paid by final processors will be different from the price paid to the farmer.
  - o IIASA: we don't have all price levels across the supply chain explicitly represented but the price increment between raw product and processed product is accounted for.
  - o Ecofys: if we receive insights on prices from industry stakeholders, we can model this as consistently as possible, it is possible to work with Non-Disclosure Agreements.
- Stakeholder: GLOBIOM does currently not include horticultural land and impact of price change on food demand. How do you address this?
  - o IIASA: Food price changes are included in the model and food demand therefore reacts to price of each single product. One feature that we are currently missing

however is the substitution between different products on demand side, which means consumption of one good is influenced by the price of another good (to substitute it). We're thinking about how we capture this effect. We don't currently have geographically explicit data on products from horticulture, therefore, we do not model it explicitly and assume land use for horticulture is constant. Indeed, this sector uses high value land and we do not expect that this will be easily displaced.

- Stakeholder: question on prices: the difference between farm prices and traded prices is significant, this difference was an issue with the IFPRI study. Does GLOBIOM account for this difference?
    - o IIASA: currently GLOBIOM does not account for this price gap explicitly; in order to do so we would have to include all local transportation costs in the global version of the model. We have done this already in several regional studies, but applying it at global scale currently makes the model too slow to run. Whereas it is a long term objective of our team, it will probably not be part of the current project.
    - o Stakeholder: can the differentiation be made for certain EU regions where it intuitively is most relevant?
    - o IIASA: we will add this to the list of suggested changes to GLOBIOM.
- Stakeholder: do you intend to use average or marginal prices.
    - o IIASA: we use in our model market prices, that are generated by marginal producer costs (see questions on trade).

Processing and production technology

- Stakeholder: which technology do you use for the shock? By the time the report is ready, the technology will have advanced. How is that addressed? Part of sensitivity analyses?
    - o Ecofys: question is what the future will bring. Optimising current capacity, or building new, more efficient installations?
- Stakeholder: there is also the possibility to increase efficiency of existing plants.
    - o Ecofys: there are various places in supply chain where efficiency can be gained. Choice of the full list of technologies to assess will be decided and later in the project. Any information you can provide on this is welcome.

Other points

- Stakeholder: Oil prices are exogenous, what do you take for the baseline?
    - o IIASA: the choice of the baseline will be discussed later in the project, oil prices and bioenergy policies will be part of the discussion.
- Stakeholder: in G4M, how do you decide how much feedstock is available for 2nd generation biofuels?
    - o IIASA: indeed, this is calculated in a different model, G4M, describing the forestry sector. G4M calculates how much biomass can be harvested for a certain price, depending on information on production cost associated to different managements. G4M main assumptions on data will also be provided in the documentation produced for this project.
- Stakeholder: did you consider fracking of natural gas? Has impact on production costs of biofuels, especially in the US.
    - o IIASA: not for the moment, this would indeed impact the production costs. That's probably a domain where your input can be helpful.
    - o Stakeholder: This caused a big change in 2009 in the US. Natural gas prices dropped from 12 cents to 2.50-4. At the same time gasoline prices stayed the same.

- Stakeholder: World Bank report looked at food price spikes in the last decade and concluded that Partial equilibrium models will find higher spikes than CGEs. Can you reflect upon the end result of PE's vs CGE's?
  - o IIASA: this is debated in the modelling community. PEs and CGEs are qualitatively different models. GLOBIOM misses some feedbacks from other sectors of the economy (as outlined in the comparison document) but features more details on production side in agriculture. The impact of different specifications has been compared in particular in the context of the AgMIP community that gathers modelling teams using the two different approaches. What we observed is that, although there was a slight difference on the average effect, there was no systematic difference across model families. In particular, some CGEs could be highly price responsive and some PEs have small responses. Therefore, these differences were more the results of calibration parameters than model family.
- Stakeholder: will you address marginal effects of fossil fuels?
  - o Ecofys: the fossil energy sector is not included in the GLOBIOM model, so we cannot do a lot.
  - o IIASA: An analysis with GLOBIOM would be too coarse on such effect, as we would not be able to represent the fuel market in its current complexity. However, it is interesting to note that a literature starts to emerge on the impact from biofuel on the fossil fuel market. What is usually suggested is that biofuel policies lead to some leakage on the fossil fuel market because substituted fuel are in excess of supply, and are partially consumed elsewhere. But we do not plan to look at this effect in the current project.

3. Stakeholder input

- Ecofys: we welcome all info from the stakeholders that they think can be of relevance to this project. Signing NDAs for confidential data is an option. Suggestions for changes to GLOBIOM and for baseline and policy scenario's are most useful when submitted by the end of this month. Information on processing and production chains, prices etc. can be submitted a bit later, before the end of this year/early next year.

The consortium is interested in getting information and data from the stakeholders to support the model, especially on the following:

  - o Refineries
    - ▪ Current pathways / future pathways
    - ▪ Coefficient of conversion of feedstocks
    - ▪ Input requirements
    - ▪ Processing costs
    - ▪ Output and co-products
  - o Feedstocks availability constraints
  - o Downstream market bottlenecks
  - o Competition from foreign markets and pathways
  - o Any information on current developments deemed of interest
    - ▪ Market information
    - ▪ Literature
- Stakeholder: if you're going to use confidential data then you cannot disclose that, making it impossible to discuss the assumptions taken with other stakeholders.

- - Ecofys: that indeed is a trade-off. Stakeholder: can be solved by anonymising or aggregating data.
  - Stakeholder: appreciate your approach, it's different to the approach taken by IFPRI.

The consortium welcomes all information and suggestions from the stakeholders that could be relevant to the project. Please send your input preferably by the end of November to: ILUC@ecofys.com

These minutes will be published on: www.globiom-iluc.eu