CONSULTATION ON INDIRECT LAND USE CHANGE

Submission by ExxonMobil — October 29, 2010
Register of Interest Representatives ID number 0745650927-75

ExxonMobil appreciates the opportunity to comment on indirect land use change (iLUC) and the possible elements of an EU policy approach. With a rapidly growing global biofuels market, it is important that biofuels policy development assess all potential consequences, consider cost-effectiveness, and evaluate net environmental impact. Including iLUC in the assessment of greenhouse gas (GHG) emissions from biofuels is critical if GHG reduction goals are to be achieved.

The EU cited documents demonstrate that the projected magnitude of iLUC emissions is large relative to the direct emissions values set forth in, and calculable from, the Renewable Energy Directive (RED), and therefore iLUC should be included in biofuel GHG emissions calculations. To that end, ExxonMobil supports:

- Assessment of global iLUC emissions using the best available science, with continued refinement as the science progresses, agricultural practices improve, and new biofuels become viable.
- Inclusion of an iLUC factor, based on marginal incremental production, in
  - Determining the net GHG benefits of specific biofuel production pathways, and
  - Assessing their ability to meet the reduction targets as specified in the RED.
- Approaches taken by:
  - The Joint Research Center (JRC) [1,2] to address model differences.
  - The International Food Policy Institute (IFPRI) [3], with modifications discussed below.
  - The California Air Resources Board (CARB) [4], and the US Environmental Protection Agency (US EPA) [5], applying an iLUC factor to major biofuel pathways.
- Continued efforts to improve agricultural efficiencies to reduce the need for additional land. Current iLUC models already anticipate such improvements, resulting in lower land needs for biomass growth. Future assessments should consider demonstrated efficiency improvements.
- Research that may enable economic biofuel production from non crop-based biomass, such as algae.
- Use of biomass to produce power or heat, because such use is significantly more GHG efficient than using biomass to produce liquid fuels.

The magnitude of iLUC is shown clearly (Figure 1) in a review of previous iLUC studies presented by Ecofys [6]. This review included the EU referenced studies, as well as other noteworthy studies, and is consistent with the JRC analyses [1,2].

The Ecofys presentation demonstrates that the magnitude of iLUC, as calculated by IFPRI [3], is comparable to the direct GHG emissions in the RED for many first generation biofuels (Figure 2). Note that the relatively low value for iLUC in the IFPRI study in Figure 1 is based on a scenario where sugar cane ethanol provides a high percentage of the marginal biofuel demand, which is not realistic for European biofuel needs.

Higher iLUC values were estimated for other biofuels as shown in Figure 2. This underscores the need to consider iLUC on a biofuel-specific basis as opposed to employing a more general iLUC factor. Taken together, the IFPRI study finds that very few first generation biofuel pathways come close to meeting the 50% GHG reduction threshold specified in the RED when iLUC is considered, the notable exceptions being sugar cane and sugar beet derived ethanol. Not including biofuel-specific iLUC fails to advantage biofuels pathways with low iLUC.

The JRC study [1] compares the GHG impacts from six modeling methodologies for marginal increases in biofuel use, using defined ethanol and biodiesel production increases in the EU and the US. A summation of the results (Figure 3) illustrates that, while calculated factors vary with the model used, the incremental GHG for iLUC (in g CO_2/MJ) for most biofuels is at least comparable to the direct GHG emissions as presented in the RED, and in many cases, significantly higher. The JRC study also suggests that GHG emissions associated with iLUC could be higher than shown in Figure 3 and predicted by various agro-economic models. This is due to several reasons – for example, the models that are used usually assume optimistic yield improvements and typically do not include GHG emissions associated with intensification (e.g., increased fertilizer use to realize improved crop yields).

The iLUC results from both studies, JRC and IFPRI, are similar to the conclusions reached by CARB [4] and EPA [5] analyses (Figure 4). Note that the European, CARB, and EPA analyses all used different modeling approaches yet arrived at similar results.

Considering key elements of iLUC model constructs (Figure 5) can help in determining a path forward. The driver for increased biofuel demand, such as a mandate, generates a market response, displacing existing agricultural production. Agriculture responds with increased yield, reduced feed demand, and production shifts. However, additional land is converted at the margin to help meet this need, requiring conversion of existing vegetation. An estimate is made of the short term carbon flux from that displacement, which is then amortized against longer term GHG credits from using biofuels.

The choice of market-based scenarios to meet mandates requires the use of an appropriate biofuel mix, source, and amount. The IFPRI ICCT consultation [7] (Figure 6) shows that using a more realistic biofuel mix for the EU (ethanol/diesel of 25/75 instead of 45/55) results in > 2X higher iLUC emissions. This is consistent with marginal expansion in vegetable oil crops, which are less land efficient than the Brazilian sugarcane ethanol assumed for the high marginal ethanol case in the IFPRI study. The 25/75 ethanol/diesel mix is consistent with an industry and European Commission JRC study, the JEC biofuels study [12], which shows a 25% mogas and 75% diesel in 2020. The IFPRI analysis assumes a 5.6% biofuels target, below the 10% mandate specified in the RED, which would correspondingly result in a lower calculated iLUC.

At least qualitatively similar considerations are addressed by the JRC study [1]. Their analysis was designed to test the model response to geographic and fuel specific limitations (of which six were examined); they find that models can erroneously exaggerate incremental crops and their locations. Additional price-induced yield shifts can have large effects in iLUC in areas beyond where demand increases. The conclusion is that defining growth geography and fuel demand are essential elements of iLUC modeling.

Efforts to improve agricultural and land management practices will likely continue. Each iLUC model comprehends reductions in land required to produce a unit biomass in the base case. Incorporating an additional factor for improved agricultural practices is therefore not needed.

iLUC is caused by global social and economic factors. It will occur primarily outside the EU. GHG emission quantification from cropland expansion requires an assessment of the type of incremental land used to grow the biomass and its carbon stock. Both the IFPRI and JRC studies incorporate analyses for each land type, by biodiversity prior to land use change. An analysis by Gibbs [8] (Figure 7) illustrates the importance of utilizing appropriate carbon stock values when considering emissions from crop expansion.

The time horizon over which carbon emissions from LUC are amortized can lead to large differences in the carbon intensity applied to the fuel, as can the use of a discount factor. A time period of 30 years or less, and simple averaging, is a pragmatic approach that can be applied now. This practice has been adopted by the analyses presented – most utilize a 20 or 30 year time horizon with no discounting.

Society has other alternatives for reducing GHGs than using transportation fuels generated from biomass. Direct use of biomass for power generation and heat is more efficient than using biomass to produce transportation fuel [9] (Figure 8). Among alternatives for reducing GHG emissions, biofuels are costly [10]. On a comparative basis, vehicular efficiency improvements offer substantial GHG savings at a relatively low cost per metric ton CO_2 avoided. Allowing market forces to select the lowest cost options will reduce the total cost to society for GHG reduction.

ExxonMobil offers the following comments on the specific questions posed by the EU.

1. *Do you consider that the analytical work provides a good basis for determining how significant iLUC from biofuels production is?*

   Yes. There is overall agreement that emissions due to iLUC are large compared to other factors, sufficiently large that if ignored policies may actually lead to increased rather than decreased global GHG emissions.

2. *On the basis of the available evidence, do you think EU action is needed to address iLUC?*

   Yes. The collected evidence demonstrates iLUC is numerically significant, and in most cases, equal to or higher than the direct effects as calculable from RED. It must be included if a representative accounting of GHG emissions is desired.

3. *If action is to be taken, and if it is to have the effect of encouraging greater use of some categories of biofuel and/or less use of other categories of biofuel, it would be necessary to identify these categories of biofuel. As such, do you think it is possible to draw sufficiently reliable conclusions on whether iLUC impacts of biofuels vary according to: Feedstock type? Geographic location? Land management?*

   Yes. Analyses of the data from multiple sources referenced above and elsewhere shows that some feedstocks deliver more than 50% GHG reduction including iLUC – including sugar cane and sugar beet ethanol; the use of waste, tallow, and related feeds; and if they are commercialized as envisioned, some second and later generation feedstocks and conversion pathways such as cellulosic ethanol.

   These studies also consistently conclude that maize- and wheat-derived ethanol and sunflower, palm and soy biodiesel have a GHG reduction factor less than 50% when iLUC is included. The calculations include sufficient geographic detail to assess the respective carbon stock change associated with the use of the particular biofuel. Changes in land management practices can have a beneficial or detrimental effect and are included in the iLUC calculation methodology.

4. *Based on your responses to the above questions, what course of action do you think appropriate? (a) Take no action now; monitor with potentially changing in the future; (b) Encourage greater use of*

some categories of biofuel; (c) Discourage some categories of biofuel; (d) Take some other form of action

(d) Take some other form of action, namely, develop iLUC factors for several categories of biofuels, with the categories recognizing the most important iLUC considerations, such as biofuel type, method of manufacture, and country of origin. The US EPA and the California Air Resources Board have developed such factors specific to their circumstances. The EC could develop similar factors by extending existing modeling work, for example by the Joint Research Centre and IFPRI. Realistic inputs, such as biofuel type and volume, econometric data, and carbon stock changes associated with specific land type conversion, are needed to achieve higher quality results. This can be accomplished with modest additional effort. The review clauses in the RED and the Fuels Quality Directive (FQD) should be used to re-examine targets.

<u>References</u>

1. JRC, "Indirect Land Use Change from Increased Biofuels Demand," Final Report of the contract 070307/2008/517067/C3, Edwards, R., Mulligan, D., and Marelli, L., 2010
2. JRC, "Impacts of the EU Biofuel Target on Agricultural Markets and Land Use: A Comparative Modeling Assessment," Final Report, Fonseca, M. B., Burrell, A., Gat, H., Henseler, M., Kavallari, A., M.Barek, R., Dominguez, I. P., Tonini, A., June, 2010.
3. IFPRI, "Global Trade and Environmental Impact Study," Final Report, Al-Riffai, P., Dimaranan, B., Labourde, D., Final Report, March, 2010.
4. CARB, "Staff Report Initial Statement of Reasons Proposed Regulation to Implement the Low Carbon Fuel Standard", Date of release March 5, 2009, Board Hearing April 23, 2009. http://www.arb.ca.gov/fuels/lcfs/030409lcfs_isor_vol1.pdf
5. "Regulations of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Final Rule" US Federal Register, vol. 75, No. 58, 14670-14904, March 26, 2010; and
   "Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Proposed Rule," US Federal Register, vol. 74, No. 99, 24904-25143.
6. Ecofys presentation at the International Council on Clean Transportation European Indirect Land Use Change Consultation Workshop, "Indirect Effects of Biofuel Production: Understanding the Numbers," , Dehue, B., September 20, 2010.
   http://www.theicct.org/workshops/iluc_sep10/ICCT_ILUC_workshop_Ecofys_Sep2010.pdf,
7. IFPRI presentation at the International Council on Clean Transportation European Indirect Land Use Change Consultation Workshop, "Global Trade and Environmental Impact Study of the EU Biofuels Mandate,"
   http://www.theicct.org/workshops/iluc_sep10/ICCT_ILUC_workshop_IFPRI_Sep2010.pdf, Al-Riffai, P., Dimaranan, B., Labourde, D.
8. Gibbs et al., "Carbon Payback Times for Crop-Based Biofuel Expansion in the Tropics: the Effects of Changing Yield and Technology," Environmental Research Letters, 3, 034001, 2008.
9. JRC, "Well-to-Wheels Analysis of Future Automotive Fuels and Powertrains in the European Context", Version 2c, March 2007, http://ies.jrc.ec.europa.eu/jec-research-collaboration/downloads-jec.html
10. ExxonMobil Energy Outlook, 2009.
11. Graphic based on O'Hare, UC Berkeley, US EPA LCA Workshop, 2009.
12. JEC biofuels Study (EU Joint Research Center, EUCAR, CONCAWE), http://ies.jrc.ec.europa.eu/jec-research-collaboration/downloads-jec.html

Figure 1

iLUC factors calculated from EU references, and from other models, from Ecofys presentation to the ICCT [6]. The magnitude of iLUC from these comparisons is significant.

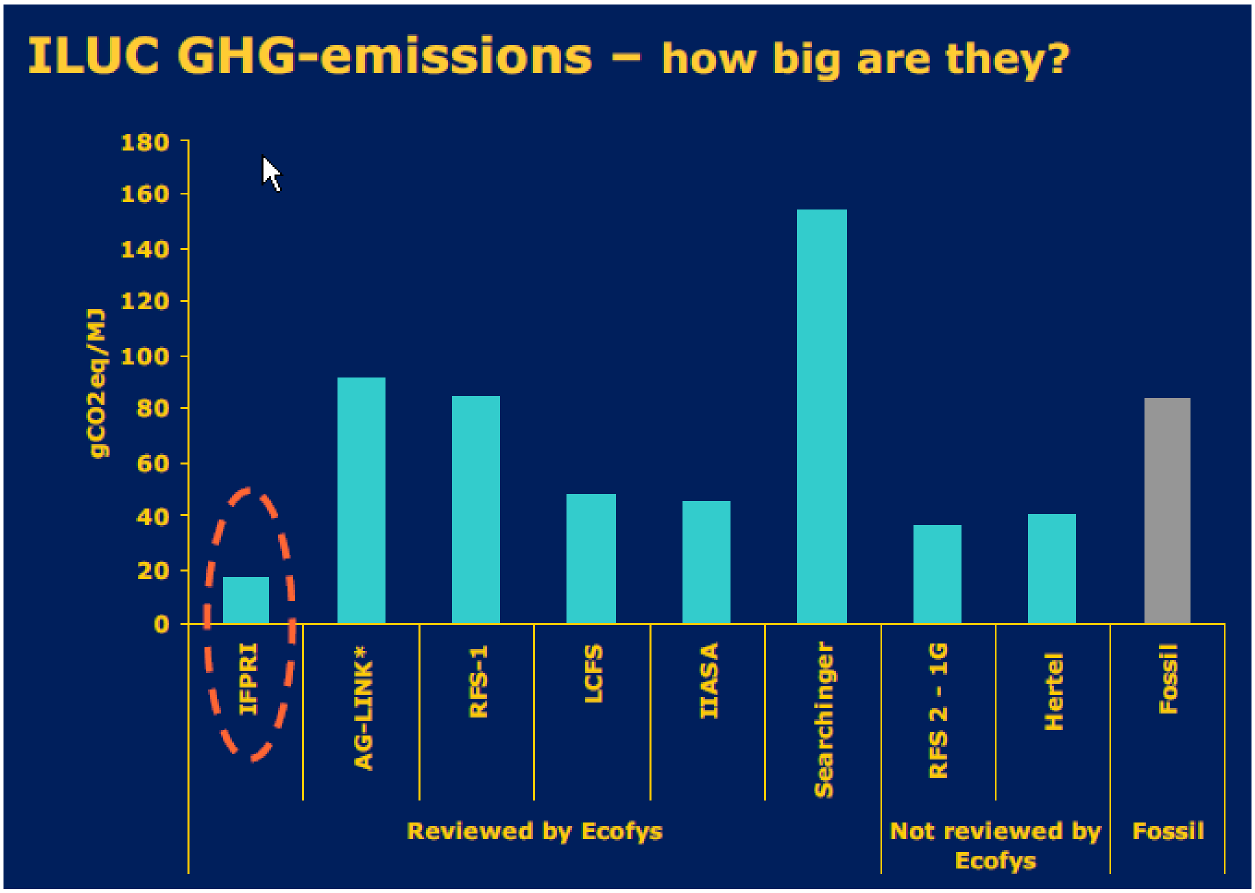

Figure 2

Crop specific direct effects, as calculated from the Renewable Energy Directive (RED) (shown in red), and iLUC factors, as calculated by the IFPRI analysis [3] (shown in blue). Note that the magnitude of iLUC is comparable to the direct GHG emissions in RED for many first generation biofuels. This underscores the need to consider iLUC on a biofuel-specific basis as opposed to employing a more general iLUC factor. Very few first generation biofuel pathways meet the 50% GHG reduction threshold specified in the RED, the notable exceptions being sugar cane and sugar beet derived ethanol.

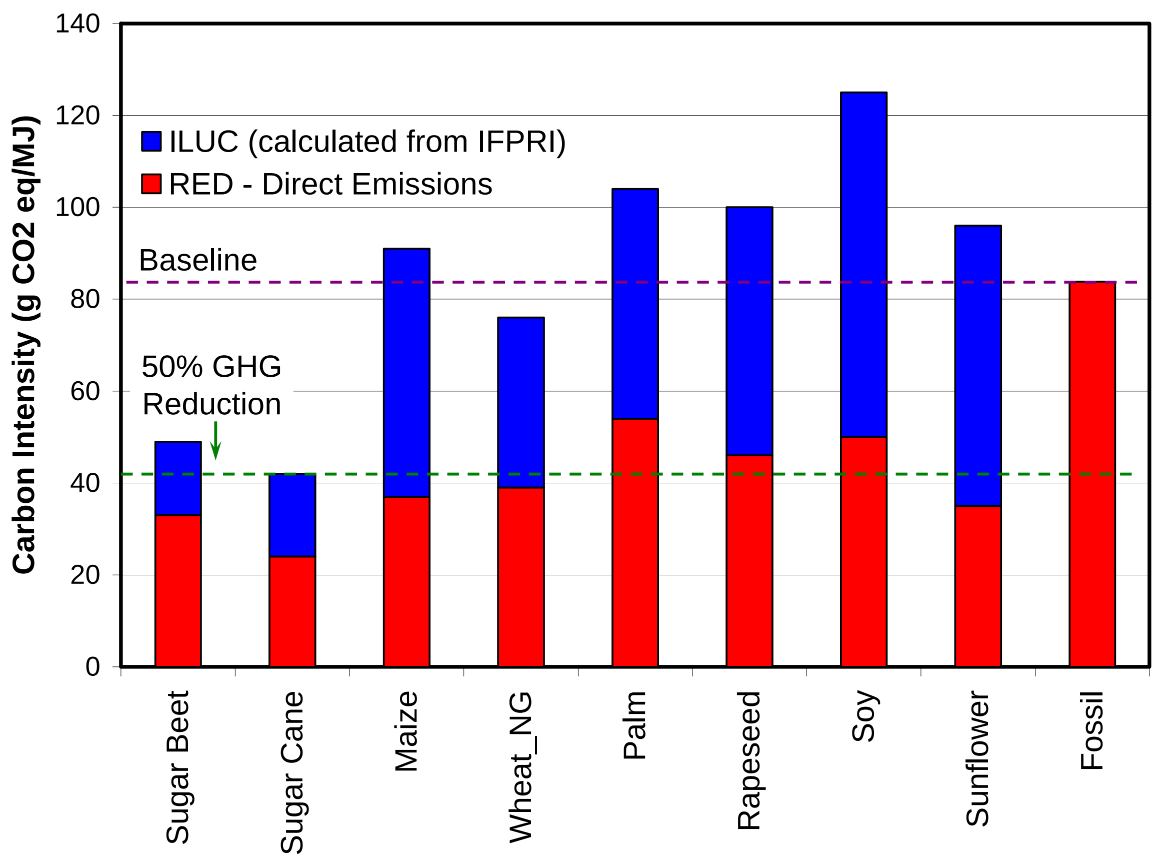

Figure 3

Summary of iLUC calculated by models, as reported in the JRC analysis [2]. For comparison, the direct emissions for the production of many biofuels, as calculated from the RED, is in the range of 20 – 50 g CO_2/MJ. The red bars at the bottom show the results of the IFPRI analysis.

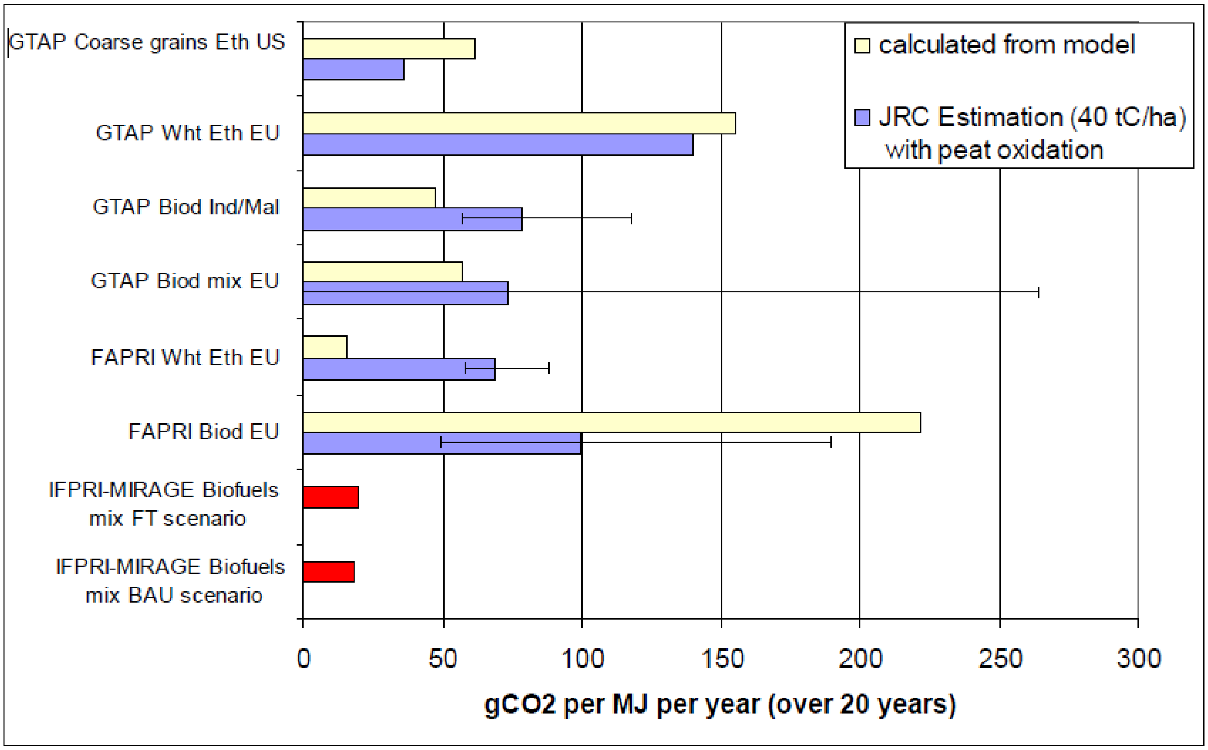

Figure 4

CARB [4] and EPA [5] life cycle analysis of crop specific biofuels.

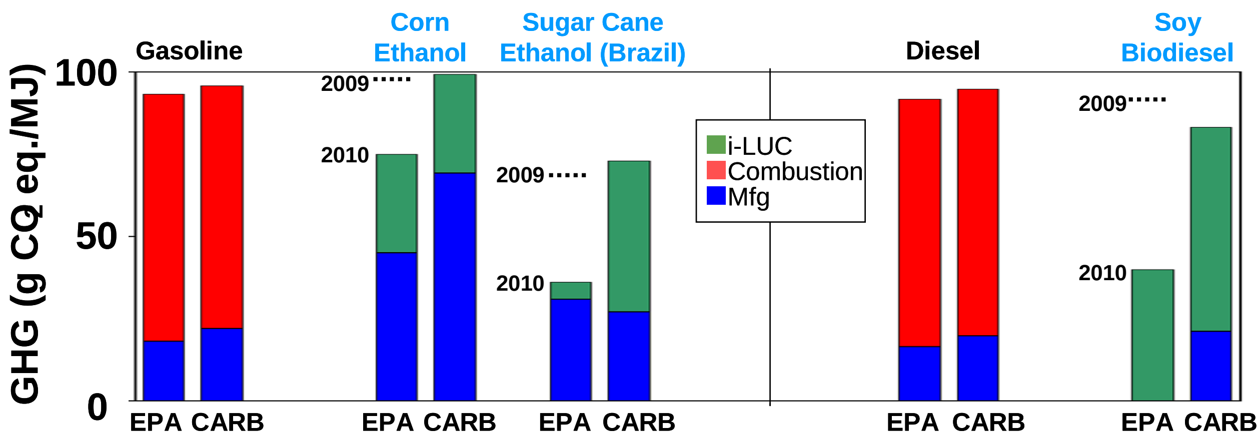

Figure 5.

Schematic representation of iLUC modeling methodology [11].

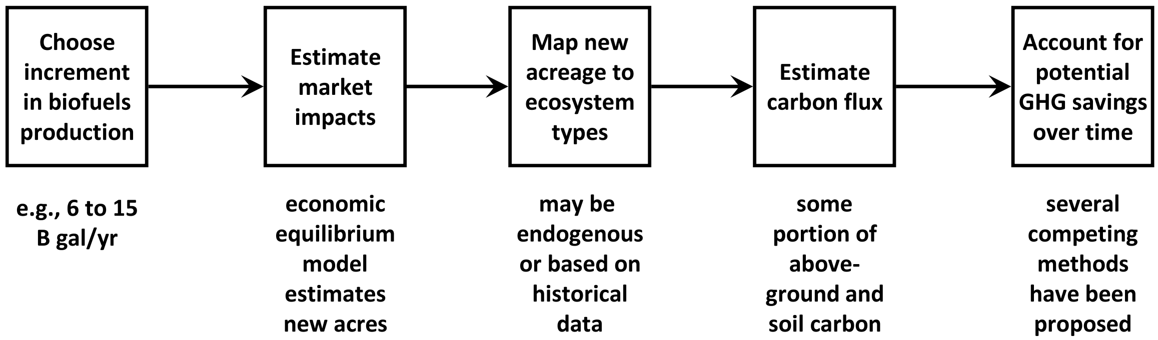

Figure 6.

Slide 34 from the IFPRI Presentation at the ICCT Meeting, September 20, 2010 [7]. Note the significant shift in calculated Land Use Emissions as biofuel targets closer to those in the EU are applied, resulting in > 2X higher iLUC emissions. This is consistent with marginal expansion in vegetable oil crops, which are less land efficient than the Brazilian sugarcane ethanol assumed for the high marginal ethanol case.

This underscores the importance of ensuring accurate market scenarios are used in iLUC calculations.

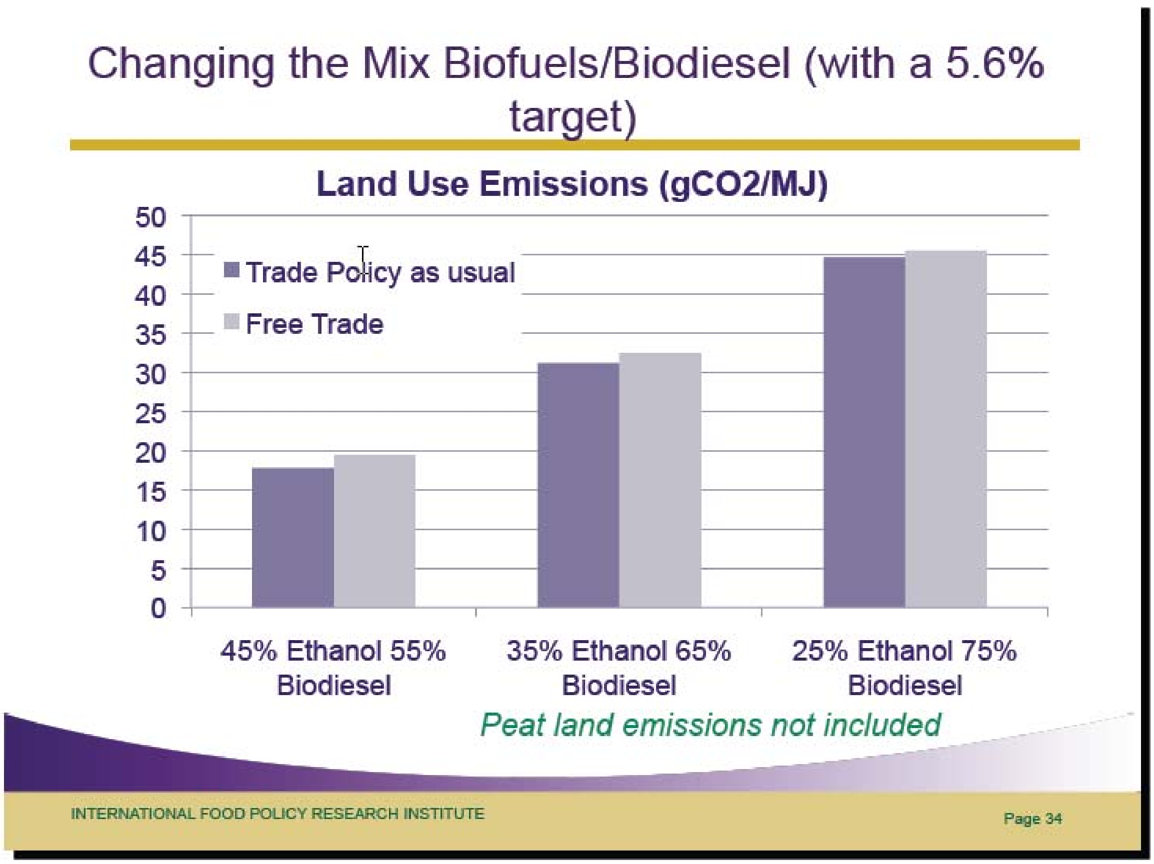

Figure 7.

Comparison of payback times for different land types, demonstrating that payback time for Carbon Debt from land displacement can be large (figure based on [8]). iLUC modeling methodology needs to model land type displaced, use accurate values of carbon stock for that particular land type, and discriminate based on the biomass being grown. Current iLUC models have the capability to address these considerations.

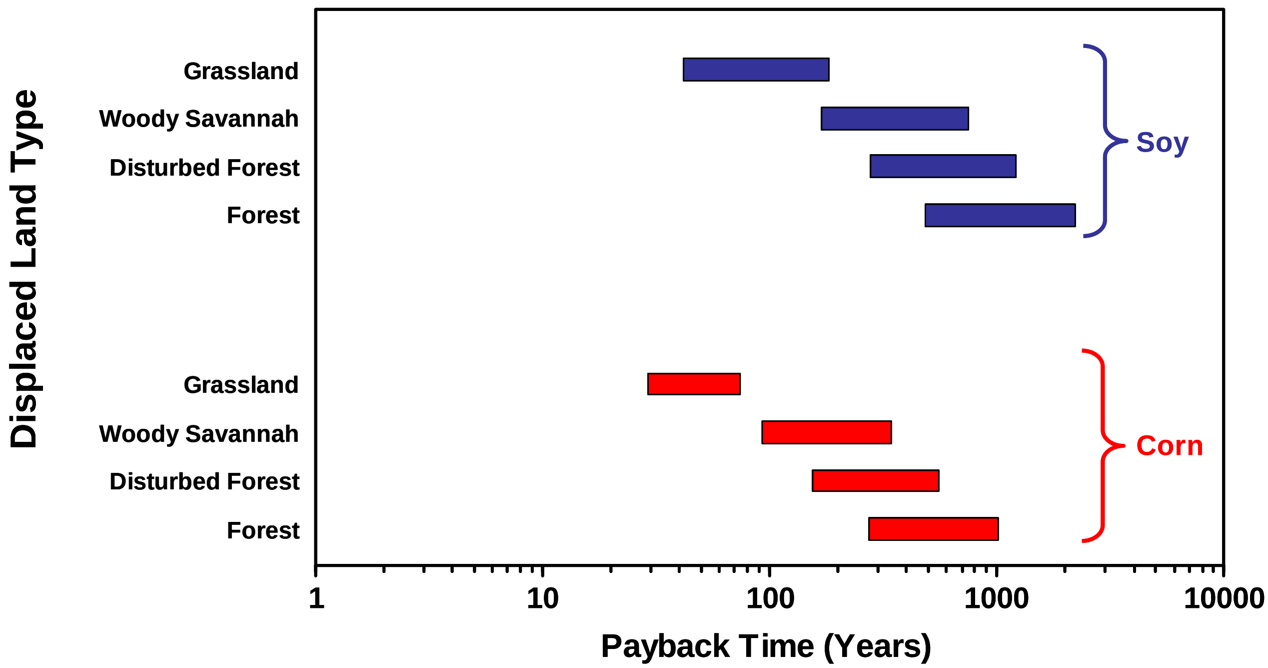

Figure 8.

Direct biomass use offers the best GHG savings and has an inherently lower land use impact than the use of specific types of land for biofuel growth [9]. The use of biomass for stationary power generation and heat offers better GHG avoidance than use producing transportation fuel. This calculation does not include land use change effects.