Indirect Impacts of biofuel production and the RSB Standard

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Table of Contents

List of Tables

List of Figures

Peer review

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Executive Summary

This document was drafted by the RSB Secretariat[1], based on a review of recent literature and over a year of discussions on the subject of indirect impacts within the RSB indirect impacts expert group (IIEG).

The paper is divided in two parts. *Part 1* introduces the issue of indirect impacts and presents various options that have been proposed by different actors to address the potential negative indirect impacts of increased biofuel production. *Part 2* presents potential options to address indirect impacts *in the RSB Standard*. The options proposed in Part 2 are based on those listed in Part 1, but have been adapted to be implementable within the RSB Standard. Part 2 also includes an evaluation of each option according to a series of evaluation parameters.

The aim of this paper is to present all possible options to address indirect impacts in the RSB Standard (including the option to *not* address indirect impacts), and their respective evaluation, in a neutral and objective fashion.

Evaluating options according to multiple parameters, as done in this paper, means that it is difficult to reach conclusions on what option is best. Presented below is a summary of the potential options to address indirect impacts in the RSB Standard, their evaluation, and a conclusion on their potential implementation.

Option 0 involves no change. Currently, the RSB Standard does not address indirect impacts, and under this option, indirect impacts would continue not to be addressed in the Standard. Under this option, biofuel that poses risk of indirect impacts can get RSB certified without the requirement to implement any mitigating action, which could be said to effectively lower the sustainability threshold of the RSB Standard, rendering it less ambitious. Proponents of addressing indirect impacts in the RSB Standard are of the opinion that not addressing indirect impacts leaves out a key sustainability consideration in the evaluation of what constitutes a "better" biofuel. On the other hand, proponents of not addressing indirect impacts in the RSB Standard state that the alternative to biofuels, fossil fuels, has negative indirect impacts which can outweigh the potential negative indirect impacts of biofuels, and that any comparison between fossil fuels and biofuels should either take indirect impacts into account for both alternatives, or not at all. Given that several regulatory bodies have, or are expected to enact, legislation addressing indirect impacts, the RSB Standard could be seen as "less ambitious" if it does not address this issue. On the other hand, some argue that addressing indirect impacts is best done at the regulatory level, rather than at the project level.

Option 1 involves incorporating a "low indirect impact risk" optional module in the standard to certify certain projects that can be demonstrated to result in low risk, such as using waste as feedstock, producing on previously unused land, increasing the yield, and increasing the efficiency of the land (through integration models). Version Zero of the LIIB methodology (LIIB, 2012) will be published in the first half of 2012 and can be used (as the basis) for this option. The LIIB methodology addresses the above-mentioned low risk categories, but only addresses integration of sugarcane and cattle within the "integration" category. Including the LIIB methodology in the RSB Standard would benefit those projects

[1] The RSB Secretariat is based at Ecole Polytechnique Fédérale de Lausanne, Switzerland

that are already “low risk” projects, as the operator would be able to make an extra “low risk” claim. It could be that only a limited number of projects can meet LIIB requirements, but this has not been established. If the LIIB certificate gains weight and obtains a good reputation in the market, or is recognized by regulatory bodies, it might be a force for change, i.e., it might result in a preference for low risk feedstocks in the biofuels market. However, without such external incentives, the likely uptake of LIIB certification, and hence the ability to effect change of this option, is uncertain. The RSB Secretariat has the capacity to implement this option, which would be discussed and agreed upon following the RSB multi-stakeholder process.

Option 2 involves the adoption of criteria and associated (minimum and progress) requirements for the implementation of best practices aimed at monitoring and increasing yield and productivity, minimizing waste, better understanding the operations’ potential indirect impacts, preventing infrastructure development near sensitive areas, etc. These requirements, if integrated in the RSB Standard, would apply to all operators, or would apply after an initial screening evaluation. The level of ambitiousness is lower than with Option 1, but since this option would apply to all operations getting certified, the impact would probably be higher (more positive change effected), as long as the requirements are meaningful and ambitious. The RSB Secretariat has the capacity to implement this option; the Criteria and Requirements would be discussed and agreed upon following the RSB multi-stakeholder process.

Option 3 involves the application of an ILUC factor to the lifecycle GHG calculations of the biofuel. This ILUC factor would be different for different feedstocks, given that ILUC factors are feedstock specific (e.g., for corn, soybeans, …) or feedstock type specific (grains, oilseeds, …). By applying an ILUC factor, there is a possibility that an important number of biofuel operations would not attain the 50% GHG reduction threshold of the RSB Standard, given that ILUC factors can be significant (see Annex 1). In the last report on ILUC factors prepared for the European Commission (Laborde, 2011), ILUC factors are estimated at 7-14 g CO_{2eq}/MJ for bioethanol feedstocks (wheat, corn, sugar beet, sugarcane), and 52-54 gCO_{2eq}/MJ for biodiesel feedstocks (palm oil, soybean oil, sunflower seed oil, rapeseed oil). However, it is important to note that all ILUC factors estimated have a significant uncertainty associated with them, and different modeling scenarios can yield very different results. It is also possible to use ILUC factors that can be mitigated (reduced) if the operator implements best practices, such as those highlighted in Option 1 and Option 2. The RSB Secretariat has limited capacity for the calculation of appropriate ILUC factors, and reaching agreement on a set of ILUC factors within the RSB multi-stakeholder process might be a lengthy procedure.

Option 4 involves a regional assessment of potential risk of ILUC. Such a regional assessment could be based on indicators such as those developed by (Ecometrica, 2010). These indicators measure elements such as the trends in exports of commodities, the land use governance in a region, yields trends, and trends in reutilization of previously unused land (e.g., after remediation). Some experts, however, question the validity of employing a regional approach with indicators that do not specifically measure the impact of increased biofuel production, but rather monitor historical agricultural trends. This assessment would probably not be carried out by the operator, nor by the RSB, but rather by an independent expert. Projects in risky regions could then be required to fulfill more requirements to reduce the risk of indirect impacts, e.g., certification restricted to Option 1 projects, or implementation of Option 2 best practices required. In the end, this option is similar to options 1 and 2 above in that the initial risk screening would become a trigger for further requirements. However, the development of a robust set of regional indicators on indirect impacts would take a long time within the RSB multi-stakeholder decision-making process, and *it is not sure that a meaningful set of indicators can be developed*. And finally, the development of such regional indicators, though of interest from a regulatory perspective, would add little value to the RSB standard, since they would only become a trigger for action; it would be easier to require such action (i.e., implementation of one or more options above) from all operators who wish to get certified.

Option 5 is an alternative to Option 2 whereby it allows the operator to help a third party to best management practices. Under this system, an operator contributes with know-how, time or financial resources to a fund, which manages bioenergy projects (or agricultural projects in general) aimed at improving productivity/reducing waste in regions with greater potential, and where lack of capital and/or information/education is the main barrier for implementation of such projects. The rationale is that time and/or money invested in measures to reduce the risk of indirect impacts (e.g., projects to increase yield, or reduce waste, etc.) can effect a much greater positive change if they are invested in regions where there is a greater potential for improvement. This option is very much in the initial stages of exploration. It would require the development of an additional standard or module. The RSB Secretariat has a limited capacity to develop and/or administer such a scheme, which could be in the form of a collaboration between organizations.

It is important to note that a solution might be found in a combination of options, the following of which are possible:

- Option 1 and Option 2
- Option 1 and Option 3
- Option 1 and Option 4 (Screening) and , with the requirement to implement Option 1 (mandatory) or Option 2, depending on the screening outcome

1. Part One: General overview of indirect impacts

1.1 What are indirect impacts of biofuel production?

When land with an existing production of food, feed, fiber, grazing animals, or other harvestable goods (commonly referred to as "provisioning services") is diverted to a new use (such as biofuel production), this creates a short-term reduction in the supply of the original provisioning service in the global commodities markets. This can have the following consequences:

1. Some portion of the prior demand is met through *extensification,* i.e., converting additional land not otherwise used for production; this is termed indirect land use change (ILUC) and it is the main aspect addressed in this paper. If the converted land has high carbon stocks and/or ecosystem values and services, its conversion can release substantial GHG emissions and/or result in the loss of such ecosystem services.
2. Some portion of the prior demand is met through *intensification*, i.e., increasing yield and/or efficiency of the land currently in production through, e.g., additional inputs, denser planting, better seed varieties, etc.;
3. Commodity price hikes: In the short term, commodity prices can rise due to decreased supply, which can result in an increased level of food insecurity of vulnerable populations; this is an *indirect impact on food security*, also addressed in this paper; and
4. Price-induced reduction in consumption, i.e., higher commodity prices may force people to consume less food, or food lower in the food chain (less meat), resulting in lower global demand for commodities.

In other words, the magnitude of indirect land use change is reduced to the extent to which yields increase (European Commission , 2011, Draft) and demand is reduced in response to increased market prices for agricultural commodities.

Indirect land use change and indirect impact on food security are just two aspects of potential indirect impacts caused by increased biofuel production from agricultural commodities. They are the most cited ones. Other indirect impacts of increased biofuel production could include, for example, additional fertilizer, water, or other inputs required for intensification of non-biofuel crop production, as well as the "rebound effect" whereby increased biofuel production lowers the price of fuels, resulting in an overall higher consumption of fuels. This paper focuses on ILUC and indirect impacts on food security only, while recognizing the importance of keeping a close watch on other potential indirect impacts of biofuels, *both positive and negative*.

1.2 Broader causes for (Indirect) Land Use Change

While direct land use change may be monitored, iLUC is a global, market-driven phenomenon that by definition is not observable directly and is thus difficult to attribute to a particular driver. Therefore, while it is possible to detect land cover changes in multiple locations, assigning *causation* for global land use changes to a single *driver* (such as expanding biofuel production) with a high degree of confidence is unlikely (Winrock International, 2011).

It is important to note that indirect land use change is *direct* land use change in the part of the world where it takes place. There are many drivers for *direct* land use change, including, but not limited to[2]:

- Poor land governance, linked to poorly enforced land use policies and uncertain land tenure regimes;
- Economic and/or policy incentives to deforest ("manage") the land in order to claim ownership of the land;
- Increased demand for agricultural products, including livestock;
- Increased demand for biofuel;
- Urban development.

Land use change is an important contributor to human-made GHG emissions globally; deforestation, forest degradation, and peatland conversion contribute to about 17% of such emissions (IPCC, 2007). Ineffective governance in the form of poorly enforced land use policies and uncertain land tenure regimes is "the most important" underlying cause of deforestation (European Commission , 2011, Draft), and by extension DLUC. Any measure to address ILUC should also take the broader causes of DLUC into consideration.

1.3 Broader causes for indirect impacts on food security

As stated above, an increased demand of agricultural commodities for biofuel production is one of the drivers of global price increases for such commodities, which can undermine the food security and nutritional status of poor and vulnerable populations (HLPE, 2011). These impacts on food security are indirect because an accumulation of operator-level changes in the use of agricultural commodities (switching from food/feed to biofuel) can cause a global impact on food prices, i.e., an impact that cannot be directly controlled or addressed by the operator. However, higher commodity prices can also, in the mid to long term, spur agricultural development and ultimately increase agricultural output. In addition, it has also been pointed out that in the long term, higher commodity prices and increased demand can benefit farmers in the developing world by opening new markets and providing additional revenue.

It must be kept in mind that there are numerous and interrelated reasons that may individually or in combination lead to commodity price hikes, including (but not limited to)[3]:

- Increased petroleum prices
- Poor harvests
- Population growth
- Increased global demand for food (especially meat) and feed caused by rising incomes
- Diverting agricultural land to biofuel production
- Market speculation and market reactions to low projections of grain stocks and crop size
- Export and trade restrictions
- Fluctuations in currency markets

[2] Based on (European Commission , 2011, Draft)
[3] (Defra, 2009); (Trostle, 2008); (Gilbert, 2010); (Headey & Fan, 2010)

Given these interactions, any measure addressing indirect impacts of biofuel should take the bigger picture of commodity markets into account.

1.4 Options for addressing indirect impacts – General

Various options have been proposed by different actors to address the potential negative indirect impacts of increased biofuel production. They vary in scale and scope from regional to project-based, and based on incentives, mandatory requirements, or ILUC accounting approaches. Some of these proposed approaches are discussed below.

1.4.1 Regulatory approaches

In an Impact Assessment document on indirect land use change related to biofuels, the European Commission (European Commission , 2011, Draft) proposes a broad range of options on how to address indirect impacts in the EU Renewable Energy Directive (RED), which includes GHG accounting measures and the use of an ILUC factor, regional level requirements, project-level requirements, or the option to take no action:

A. Take no action
B. Increase the minimum GHG threshold of the biofuel
C. Introduce additional sustainability requirements on certain categories of biofuels, including:
    1. Country level (or regional) actions, such as:
        - Implementing measures to reduce the (direct) loss of high-carbon stock land
        - Promote the use of unused land by zoning lands, including "unused lands" and thus defining areas where land use change is permitted; or
    2. Project-level actions, such as
        - Production on unused land
        - Increasing yields / productivity
D. Use an ILUC factor calculated through modeling
    - Use a factor of zero where there is no displacement of agricultural commodities (non-agricultural land or no land required for feedstock production; waste as feedstock; no land required for production)
    - ILUC factor can be crop-specific or averaged by crop families (oil seeds, grains, etc.)

The EU has not yet made a decision on how to address indirect impacts in the EU RED.

The U.S. Renewable Fuel Standard (RFS) and the California Low Carbon Fuel Standard (LCFS) address indirect impacts (ILUC) by introducing ILUC factors in the biofuel lifecycle GHG emissions accounting (see below, ILUC factor). Concretely, the RFS doesn't calculate ILUC factors as such, but rather uses consequential LCA to estimate each biofuel's contribution to total GHG changes caused by the policy; it also includes more indirect effects than just ILUC, such as methane emissions from changes in rice and livestock production, and changes in fertilizer and energy use from crop shifting.

1.4.2 Regional approach

(Ecometrica, 2010) identified *regional*-level actions to avoid ILUC, some of which overlap with those presented above:

- Increasing yields and/or agricultural intensification
- Cultivating degraded or marginal land
- Protecting high carbon stock land
- Reducing waste[4] (in the agricultural sector) and increasing resource efficiency
- Reducing consumption, especially of highly land-intensive commodities such as meat

(Ecometrica, 2010) proposed several regional-level indicators for ILUC. A region may be sub-national, a country, or a supra-national bloc (e.g., the EU, the Asian trading block, etc.)

The indicators cited are as follows:

- *High-level outcome indicators*, providing an indication of the risk that ILUC is occurring in the region and/or whether ILUC pressures are being transmitted to other regions. Examples:
    - Natural area of high-carbon stock/high biodiversity land maintained or increasing in the region
    - Agricultural (non-energy) exports from the region maintained or increasing
    - Agricultural imports in the region maintained or decreasing
- *Supplementary outcome indicators*, indicating the likely outcomes of the above. Examples:
    - Increasing yields in a region, water scarcity, instances of land grabs, etc.
- *Action-based indicators*, which show the extent to which ILUC mitigation actions are being implemented within a region. Examples:
    - Expenditure on agricultural R&D, which may help to increase yields

(Ecometrica, 2010) propose a series of concrete regional-level indicators; a somewhat modified and shorter version is included here in Table 7 (see Option 4, below) for illustrative purposes.

The (Ecometrica, 2010) report thus suggests that *ILUC risk* can be monitored at the regional level using the above-cited indicators. For example, a regional approach may require that the "region as a whole maintain or increase its non-energy agricultural production in addition to producing bioenergy feedstocks". However, Ecometrica also note (p. 15) that "a hypothetical reference scenario (i.e. a 'without bioenergy' scenario) may have even higher carbon stocks, and a better balance of trade."

The document provides examples of *regional actions to reduce the risk of ILUC*; these are closely related to the cited indicators. Below is an abbreviated and somewhat modified list of such actions:

1. Increasing yields
    a. Investment in agricultural infrastructure
    b. Investment in agricultural R&D
    c. Skills & training/technical support in the agricultural sector
    d. Land use zoning
    e. Facilitation of improved agricultural management (integrated systems, etc.)
    f. Water resources / pest management

[4] In developing countries, there is large potential for reducing wastage at the farm level or post-harvest, while in developed countries there is greater potential for reducing post-consumer waste (Ecometrica, 2010).

2. Cultivating degraded/marginal/abandoned land
    a. Policy incentives for the use of such zones
    b. Land use zoning of such zones
    c. Investment in irrigation / remediation
    d. Technical support
3. Protecting high-carbon stock (and biodiversity) land
    a. Land use zoning (and define protected areas), enforcement of land tenure rights, minimize land evictions
    b. Managing land prices and land speculation
    c. Implementing and enforcing conservation legislation; minimizing infrastructure development near protected areas
    d. Monitoring LUC
    e. Create employment (to reduce the driver for resource-poor people to clear land)
    f. Managing price volatility and food security
4. Reduce waste / increase resource use efficiency
    a. Investment in infrastructure
    b. Skills & training
5. Decrease consumption of land intensive commodities

Source: based on (Ecometrica, 2010)

The regional approach has been criticized because the proposed indicators (e.g., maintained outputs, increasing yields, etc.) are measured in absolute (historical) terms, and do not provide a measure of the potential impacts of increased biofuel production, since a "biofuel" scenario is not measured against a "no biofuel" baseline. Ecometrica recognize (p. 14) that "undertaking an action only indicates likelihood, and does not entail certainty, that ILUC will be reduced."

1.4.3 Project-level approach: Certification of low-indirect impacts biofuels (LIIB)

WWF International, the consulting firm Ecofys, EPFL (hosting the RSB Secretariat) and other partners[5] have collaborated on a project to develop a certification module for low-indirect impacts biofuels (LIIB, 2012). The project, funded by the Dutch development and implementation agency NL Agency[6], ran from January 2011 through end of March of 2012. The methodology lists certain categories of biofuels & biofuel feedstocks with a certifiably low risk of causing indirect impacts:

1. Feedstock produced from *yield increases,* where the producer must demonstrate yield increases above the trendline; this trendline is calculated based on own data for the last five years or data based on similar producers in the last 10 years.
2. Feedstock produced by *increasing the overall system efficiency through integration of sugarcane and cattle* (other integration models will be added to the LIIB methodology in the future).

[5] Other project partners include the University of Sao Paulo, Waggeningen University (the Netherlands), WWF Indonesia & Mozambique, BioGreen (a South African company making biofuel from waste vegetable oil), and the Certification Body DNV.

[6] An agency of the Dutch Ministry of Economic Affairs implementing government policy for sustainability & cooperation.

3. Feedstock produced on *unused land* with low carbon stocks and low biodiversity values, in countries with an excess or growing amount of unused arable land – this project category requires carrying out a Responsible Cultivation Area (RCA) assessment according to the RCA methodology[7] (RCA, 2010) among other requirements.
4. Biofuel produced from *waste*, which would normally be disposed of and which is not used for alternative purposes in the region. The certification scheme adopting the LIIB must define a list of waste-regions, i.e., a list of feedstocks that are considered a waste in a particular region (but may not be a waste in a different region of the world); the LIIB methodology does not specify this list of waste-regions.

The LIIB methodology has been developed to be relatively user-friendly and cost-effective, avoiding the need for the operator to prove the "additionality" of the implemented best practices.

An important difference between the LIIB methodology and the regional approach is that the LIIB compares outcomes to the "no increased biofuel" baseline, i.e., the intent of the LIIB methodology is to certify only those projects that would not have been implemented in the absence of increased biofuels demand.

The LIIB methodology is in the initial stage of development. It has been tested on four pilot projects. The final methodology has not yet been subjected to peer review as of April 2012, although a draft version has been reviewed by several members of the RSB Indirect Impacts Expert Group. Version 0 of the methodology will be subjected to peer review and presented in a public workshop in 2012. In addition, the LIIB report also lists another two categories as having potential low negative indirect impacts (but does not, at this point, propose a methodology for these categories), namely:

(5) *bioenergy production from aquatic biomass such as algae* (grown in water bodies/wastewater treatment plants) *currently not used for other purposes, and taking into account sustainability aspects* (CIIB, 2011); however, this category is not being pilot-tested in the CIIB project.

(6) *bioenergy feedstock obtained from waste reduction projects*, notably post-harvest and post-consumer waste.

The latest draft of the CIIB methodology can be found on the *RSB IIEG webpage* (http://rsb.epfl.ch/lang/en/iieg). Version 0 will be posted in May 2012.

1.4.4 Integrating ILUC in lifecycle GHG calculations

An "ILUC Factor" is a measure of the global greenhouse gas emissions resulting from land use change (LUC) caused by increased biofuel activity. It is generally measured in grams of CO_2-equivalent per unit of biofuel and it is typically attributed to individual biofuel feedstock types based on assumptions on the types of biofuel pathways that will meet this additional demand.

ILUC is a global, market-driven phenomenon that by definition is not observable directly. While it is possible to detect land cover changes in multiple locations, determining causation for global land use

[7] The RCA methodology was developed in collaboration between Ecofys, WWF, and Conservation International, and was commissioned by BP, Neste Oil, and Shell Global Solutions.

changes to a single driver, such as expanding biofuel production, with a high degree of confidence is unlikely (Winrock International, 2011).

Nevertheless, models have been developed that attempt to quantify ILUC. They simulate variables associated with land use changes and attempt to isolate impacts that may be associated with biofuel demand increases (Winrock International, 2011). Modeling ILUC is a consequential exercise, i.e., it models the consequences of increased biofuel production.

The models generally compare a "baseline scenario" with a "future scenario" of increased biofuel demand (e.g., due to a particular biofuels policy, such as the U.S. RFS or the EU RED). The models' outcome is the predicted amount of additional land use change that will be caused in the future scenario owing to increased biofuel production; the models also predict where the land use change will take place, and with this information the emissions of carbon due to the LUC can be approximated. Thus, the models' outcomes can be translated into "ILUC factors".

ILUC modeling has a high degree of uncertainty associated with it given the large number of parameters that are included in the models, each parameter with its own associated uncertainty (see Annex 2). (Plevin, O'Hare, Jones, Torn, & Gibbs, 2011) have done a detailed assessment of uncertainty associated with ILUC modeling. They estimate an uncertainty range for corn ethanol of between about 20 and 140 g CO_2e per MJ. However, they suggest that although the magnitude is uncertain, ignoring ILUC underestimates, perhaps substantially, the GHG emissions from increasing biofuel production.

The U.S. Renewable Fuel Standard and the California Low carbon fuel standard both include the use of ILUC factors in biofuel regulations. In the European Union, the European Commission is assessing different options to address ILUC in the EU Renewable Energy Directive (RED). The most definitive study currently available that models the ILUC impacts of the EU RED is the study conducted by (Laborde, 2011), which looks at the impact of the additional biofuel production and consumption in the EU as a result of the RED [some of the results are listed in Annex 1 and cited as IFPRI(2011)].

Selected results from this study, as well as from other ILUC modeling and calculation efforts, are included in the figure in Annex 1. The figure shows that different studies have attained different ILUC emission values for the same feedstock. The differences can be mainly attributed to the fact that:

- Different modeling exercises simulate different future scenarios (i.e., different amounts of additional biofuel demand);
- Numerous parameters are addressed in each model, and each modeling exercise can make slightly, or widely different, assumptions on each parameter;
- The models use different base data, include different sets of markets, operate at different sectorial and regional resolution, and amortize ILUC emissions over different periods (20 years in the EU, 30 years in the US.)

The figure in Annex 1 shows that, generally speaking, oilseeds have a higher ILUC factor than grains. This is because oilseeds are replaced in the market largely by palm oil, which comes primarily from East and South Asia, an area with very high deforestation rates, as compared with other parts of the world

(European Commission , 2011, Draft), and where a substantial portion of the deforestation occurs on forest land and especially peatland, resulting in very high carbon emissions.

Some experts criticize the validity of adding ILUC factors to biofuel lifecycle emissions calculated using an "attributional" approach (as is the case with the RSB GHG methodology). An attributional life cycle analysis (LCA) calculates lifecycle emissions of biofuel productions based on the chemical and energy usage, as well as emissions, taking place in each production step through the lifecycle of the biofuel (feedstock production, feedstock processing, etc.) An attributional LCA includes the direct LUC emissions associated with converting one land use to another within the boundary of the biofuel operation. However, an attributional LCA does not include GHG emissions associated with ILUC.

Alternatively, all LUC emissions (direct and indirect) caused by increased biofuel production can be assessed using a consequential life cycle assessment. A consequential approach to biofuel LCA aims to model all impacts caused by increased biofuel production, and includes market reactions and feedback loops. For example, the U.S. RFS models aspects such as methane emissions from changes in rice and livestock production, and changes in fertilizer and energy use from crop shifting due to increased biofuel production.

1.4.4.1 Incentives for best practices ("ILUC bonus") approach

In a document aimed at EU policymakers on the issue of ILUC, (Ernst & Young, 2011)[8] argue that the best way to address ILUC in the EU RED regulation is to create incentives for operators to implement best practices that lower the risk of ILUC. (Ernst & Young, 2011) recommend the implementation of a "carbon credit that could be awarded to biofuels that meet defined ILUC mitigation criteria". A list of measures could be developed that are considered to reduce ILUC risk; producers who can demonstrate compliance with one or more of these measures would be awarded a carbon credit.

Such a credit "could be based on the existing mechanism in RED for a 29gCO_{2eq}/MJ credit for biofuels from severely degraded or heavily contaminated land." An ILUC factor "penalty" could be applied to producers who do not adopt verifiable ILUC mitigation measures.

The report states that given the uncertainties in estimating ILUC emissions, the measurement of carbon emission reductions from ILUC mitigation practices is "problematic", but affirms that "shortcomings in the ability to measure ILUC emissions should not prevent the adoption of activities that can proactively reduce ILUC risks."

[8] Ernst & Young were commissioned to produce the report by a consortium of the following organizations: ePURE (European Renewable Ethanol Association); IUCN (International Union for Conservation of Nature); Neste Oil; PANGEA (Partners for Euro-African Green Energy); Riverstone Holdings; and Shell.

2 Part Two: Indirect impacts in the RSB Standard

2.1 Background

The Roundtable on Sustainable Biofuels (RSB) has discussed the issue of indirect impacts of biofuel production since 2007. On several occasions, the RSB Steering Board has evaluated the pertinence of integrating requirements to address indirect impacts in the RSB Standard. In its June 2010 in-person meeting, the RSB Steering Board acknowledged that the risk of indirect impacts is an "important issue", but requested that, prior to making a decision on the subject, further work be conducted by the RSB Secretariat at EPFL to better understand the link between biofuels and indirect impacts, to better establish how indirect impact risks may be mitigated at the project level, and to further research how the concept of "additionality" may be addressed in practice. To that effect, the Steering Board encouraged progressing on the development of the LIIB methodology, as well as continued collaboration with the RSB Indirect Impacts Expert Group.

This paper, together with Version 0 of the LIIB methodology, is the result of this work and collaboration, and constitutes the background to the discussion on indirect impacts within the RSB membership. RSB Members and the RSB Steering Board will be invited to decide on a way forward in May-June 2012. This decision will be informed, in part, by the results of a public consultation on this issue, to take place during April-May 2012.

2.2 Objectives

Prior to designing any strategy to address indirect impacts in the RSB Standard, the objectives of such strategy must be clear. The objectives of any measure addressing indirect impacts in the RSB Standard are to: (i) effect change by "uplifting" operators with medium or low sustainability practices into better sustainability practices; and (ii) differentiate sustainable from unsustainable operations.

Category	High level objective	Translation of high-level objectives into objectives that are concretized in the RSB Standard
Effect change	Minimize LUC and negative impacts on food security caused by biofuels on a global level ⇧ Minimize displacement	Encourage as many operators as possible to implement measures that reduce risk of displacement and, therefore, of ILUC.
Accurately reflect sustainability	Differentiate "sustainable" (certified) from "unsustainable" (not eligible for certification) operations	Certify "better" operations: Aim for best 30% (rough estimate) and aim to "uplift" those below

Although they point in the same direction, these objectives are in fact different, and their translation into RSB Standard requirements may result in contradicting requirements.

In recent RSB Steering Board meetings, it was agreed that the main objective of RSB certification is to effect change, that is, to "embrace" an important portion of the spectrum of biofuel operations, and encourage their continuous improvement; the objective of the RSB Standard is not to become a "boutique certification" for perfectly sustainable operations, but rather to "uplift" sustainability performance. This is also reflected in the Mission Statement of the RSB (5 November 2010):

- To provide and promote the global standard for socially, environmentally and economically sustainable production and conversion of biomass.
- To provide a global platform for multi-stakeholder dialogue and consensus building.
- To ensure that users and producers have access to credible, practical and affordable certification.
- To support continuous improvement through application of the standard

RSB Mission Statement

The two objectives listed above have been included as part of the evaluation parameters for the different options to address indirect impacts. All of the evaluation parameters reflect, to a degree, one or both objectives listed above.

2.3 Evaluation parameters

The options to address indirect impacts in the RSB Standard have been evaluated according to the following parameters:

Table 1: List of parameters to evaluate potential options addressing indirect impacts in the RSB Standard

Category	Evaluation parameter
RSB Standard	Impacts on ease of RSB certification
	Coherence with RSB Standard; compatibility between options
	Accurately reflects sustainability: differentiates high vs. low risk biofuels
	Capacity for implementation
	Reputation
Effectiveness	Scale of impact (number of operators affected/incentivized)
	Effect change (minimize displacement)
Environmental	Impacts on GHG emissions
	Impacts on High –C/high biodiversity LUC; water, soil, air
Social	Other impacts on food commodity prices; economic & rural development
Economic (operator's perspective)	Cost of implementation
	Mid-long term stability
Coherence	Coherence with existing regulations
	Trade issues

2.4 Options to address indirect impacts in the RSB Standard & Evaluation of options

This section presents potential options to address indirect impacts in the RSB Standard, including the option *not* to address indirect impacts.

It is important to note that some of these options could be combined; i.e., combinations are possible between Options 1, 2, 3, and 4.

Each option is evaluated according to the evaluation parameters presented above.

2.4.1 Option 0: Do nothing

Continue with the RSB Standard as-is. This is the *status quo*, and the baseline condition against which all other options are compared.

Under this option, biofuel that poses risk of indirect impacts can get RSB certified without the requirement to implement any mitigating action. It could be said that this effectively lowers the “level of ambition” of the RSB Standard.

Since the RSB Standard was developed to certify, and incentivize the production of, “better” biofuels, the aspiration is that global biofuel production can be incentivized, through certification, to become more sustainable, and that certification can help differentiate the better biofuels.

Therefore, proponents of addressing indirect impacts in the RSB Standard are of the opinion that *not* addressing indirect impacts leaves out a key sustainability consideration in the evaluation of what constitutes a “better” biofuel.

On the other hand, proponents of not addressing indirect impacts in the RSB Standard state that the alternative to biofuels, fossil fuels, has negative indirect impacts that can outweigh the potential negative indirect impacts of biofuels, and that any fair comparison between fossil fuels and biofuels should either take indirect impacts into account for both alternatives, or not at all.

Finally, proponents of not addressing indirect impacts in the RSB Standard state that such a complex and global phenomenon should be addressed in policy rather than in a certification scheme for operators.

Table 2: Evaluation – Option 0: Do nothing

Category	*Evaluation parameter*	Evaluation
RSB Standard	*Impacts on ease of RSB certification*	No impact
	Coherence with RSB Standard; compatibility between options	No incoherence; Incompatible with other options
	Accurately reflect sustainability (differentiate high risk from low risk)	Since a major potential impact is not addressed in the Standard, sustainability is less accurately reflected.
	Capacity for implementation	No effort required
	Reputation	Could be seen as an option that lowers the "level of ambition" of the RSB Standard.
Effectiveness	*Scale of impact (number of operators affected/incentivized)*	No impact
	Effect change (minimize displacement)	No change effected
Environmental	*Impacts on GHG emissions*	No impact
	Impacts on High –C/high biodiversity LUC; water, soil, air	No impact
Social	*Other impacts on food commodity prices; economic & rural development*	No impact
Economic (operator's perspective)	*Cost of implementation*	No impact
	Mid-long term stability	Depends on whether the issue of indirect impacts is "closed" or remains an open discussion. Difficult to evaluate.
Coherence	*Coherence with existing regulations*	No incoherence
	Trade issues	No trade issues

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable

2.4.2 Option 1: Add-on LIIB certification of low-risk biofuels (optional)

A “low indirect impacts risk” module is added to the RSB Standard to certify low-risk feedstock production. The LIIB methodology can be used or adapted to develop this new “low risk standard”. This standard is optional, i.e., RSB participating operators have the opportunity to select it, or not. If the standard is selected and complied with, the operator can then make an *extra claim*, such as “low indirect impact risk”.

Certification would be *at the level of feedstock production*. The extra claim (“low indirect impacts risk”) would be carried down the production chain all the way to the end product.

The current LIIB methodology only addresses a limited number of project types (waste; unused land; increased yield; and one integration model) and has relatively strict qualifying requirements (for example, records of past five-year yields, etc.)

This option therefore aims to differentiate biofuels that have a lower risk of negative indirect impacts from other biofuels (with a higher risk). This option does not provide an incentive for non-LIIB biofuel operations to implement practices that lower the risk of ILUC. However, if there are incentives for LIIB certification (e.g., if LIIB biofuels are recognized by policymakers as better biofuels), this could create additional demand for such biofuels in the market and result in a shift towards more production of LIIB-biofuels and less production of biofuels with higher risk of negative indirect impacts.

Table 3: Evaluation – Option 1: Optional low-indirect impacts risk module (LIIB)

Category	*Evaluation parameter*	Evaluation	
RSB Standard	*Impacts on ease of RSB certification*	No effect on the number of RSB certificates since the module is optional	
	Coherence with RSB Standard; compatibility between options	No incoherence; Compatible with options 2, 3, and 4	
	Accurately reflect sustainability (differentiate high risk from low risk)	If well-designed, the LIIB will provide an accurate representation and certification of low-risk operations/projects.	
	Capacity for implementation	Relative ease of implementation; some effort required to adapt LIIB methodology if/where needed; submit methodology to multi-stakeholder evaluation; develop standard	
	Reputation	Expected to be seen as ambitious measure	
Effectiveness	*Scale of impact (number of operators affected/incentivized)*	Small number of operators expected to fulfill requirements; extra claim may carry enough weight to encourage change on a wider scale.	
	Effect change (minimize displacement)	Expected limited number of participating operators who meet the project qualifying requirements; however, might provide an incentive for more operators to seek to become LIIB certified, esp. if recognized in regulation.	
Environmental	*Impacts on GHG emissions*	GHG accounting remains the same; option encourages yield/productivity increase and use of waste, which reduce GHG emissions of feedstock production; option encourages production on unused land – depending on land use type (e.g., grassland), some GHG emissions possible. Since rest of P&C must be met (notably P3), 50% GHG reduction threshold is still in place.	
	Impacts on High –C/high biodiversity LUC; water, soil, air	Prevents negative indirect impacts, so only potential negative direct impacts. Yield/efficiency increase measures, as well as conversion of unused land, could negatively impact environment, but since rest of P&C must be met (notably P, impacts are not expected to be negative.	
Social	*Other impacts on food commodity prices; economic & rural development*	Conversion of unused land might negatively impact local populations using the land to a minor degree, but since rest of P&C must be met (notably P12), impacts are not expected to be negative.	
Economic (operator's perspective)	*Cost of implementation*	Slight additional cost of certification; additional effort for data gathering &recording	
	Mid-long term stability	Predictable option with no foreseeable changes (except expansion of methodology to include more categories); therefore no negative impact on stability	
Coherence	*Coherence with existing regulations*	No incoherence with regulations identified	
	Trade issues	No trade issues identified	

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable/ not determined

2.4.3 Option 2: Criteria to minimize risk of indirect impacts

Develop RSB criteria & requirements that aim to reduce the risk of ILUC posed by an operation. The criteria, minimum requirements, and progress requirements would be integrated in the RSB Principles & Criteria (P&C) and would touch the themes presented in the table below; note that the Criteria and requirements presented in the table are examples only, non-exhaustive, and presented for illustrative purposes only. Any criteria and requirements developed under such an option would be developed as part of the RSB multi-stakeholder process. Such criteria and (minimum and progress) requirements can be either integrated in a new Principle or in one or more existing Principle(s).

Table 4: Examples of criteria / requirements aimed at minimizing risk of negative indirect impacts (non-exhaustive; for illustrative purposes only)

Theme / Criterion	Example (minimum/progress) requirement in RSB Standard
Operator *monitors* yields, productivity, efficiency and waste	Operator measures annual yield, total productivity of land, input usage per unit output, waste per unit output
Operator raises yields and productivity of the land	Operator implements verifiable actions such as: - Improved agricultural practices - Investment in training - Investment in infrastructure, better machinery, better storage, more efficient irrigation - Better/best use of co-products - Reuse of byproducts - Implementation of integration models (different crops/cattle-crops/food & bioenergy/etc.) - Integrated pest management
Operator reduces waste with respect to business as usual	Operator implements verifiable actions such as: - Implementation of best practices - Investment in infrastructure (storage, etc.)
Operation does not result in infrastructure development near sensitive/protected areas	
Operator assesses potential indirect impacts	Operator conducts a "displacement" evaluation and develops a plan to minimize displacement where the best management practices are identified.

2.4.3.1 *Differences between Option 1 and Option 2*

Option 2 is similar to Option 1 above, but less strict on the project-level requirement. Option 1 requires that the operator meet strict project requirements in order to qualify, and thus in order to be able to make the claim "low indirect impacts risk". For instance, operators must show quantitative proof that they have increased yields by more than 20% with respect to the previous 5-year trendline.

Under Option 2, the requirements are less results (outcome) oriented and more action (practice) oriented; they are also less quantitative and more qualitative. For instance, the minimum requirement to implement yield-enhancing measures and to measure yield (option 2) is a practice-based requirement, but the quantitative demonstration of yield increases (Option 1) is an outcome-based requirement. While Option 1 is an optional add-on module (with the right to make an additional claim), Option 2 would be part of the P&C, and therefore mandatory, or it could be triggered after initial screening (similar to Principles 5 and 6). Option 2 does not result in any additional "low indirect impact risk" claim.

Table 5: Evaluation – Option 2: Criteria and requirements addressing indirect impacts in the P&C

Category	*Evaluation parameter*	Evaluation	
RSB Standard	*Impacts on ease of RSB certification*	Increases the difficulty of certification of each operator; but not expected to turn operators away	
	Coherence with RSB Standard; compatibility between options	Coherence with RSB standard would be ensured when designing the criteria & requirements; Compatible with options 1, 3, and 4	
	Accurately reflect sustainability (differentiate high risk from low risk)	Greatly depends on what requirements are implemented; more ambitious requirements would raise the bar.	
	Capacity for implementation	Criteria & requirements would be developed using multi-stakeholder approach, which requires a level of effort (stakeholders & RSB Secretariat), but there is capacity to carry out activities	
	Reputation	Could be seen as relatively ambitious (less so than option 1, but applicable to all operators certified); but this greatly depends on the types of measures required	
Effectiveness	*Scale of impact (number of operators affected/incentivized)*	Applies to all operators certified, who must implement best measures.	
	Effect change (minimize displacement)	This option affects all operators and therefore has the highest potential for impact; the positive change effected depends on the level of ambition of the requirements. Another positive of this option is that it educates operators on indirect impacts and mitigation measures.	
Environmental	*Impacts on GHG emissions*	No identified impact on GHG emissions	
	Impacts on High –C/high biodiversity LUC; water, soil, air	Measures would reduce the impact of negative indirect impacts (albeit with less effectiveness than option 1). Direct impacts addressed in other P&C	
Social	*Other impacts on food commodity prices; economic & rural development*	No impact expected	
Economic (operator's perspective)	*Cost of implementation*	Increases slightly cost of complying with RSB Standard; less so in increased costs of verification, but rather internal cost of compliance	
	Mid-long term stability	Predictable option with no foreseeable changes (once the criteria and requirements are agreed upon in the multi-stakeholder process); therefore no negative impact on sstability	
Coherence	*Coherence with existing regulations*	No incoherence with regulations identified	
	Trade issues	No trade issues identified	

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable/ not determined

2.4.4 Option 3: Implement a (project-specific) ILUC factor in lifecycle GHG calculations

The RSB calculates, or selects from literature, ILUC factors for biofuel production. The ILUC factor is added to the lifecycle GHG emissions of the biofuel. Within the RSB Standard all operators have to calculate the GHG emissions associated with their operations; the ILUC factor could be added *at the level of the feedstock producer,* with units of g-CO_{2eq}/kg-product; best management practices implemented by the feedstock producer could result in a mitigation of the ILUC factor (see below). However, the difficulty of adding ILUC factors at the feedstock producer level is that ILUC factors are generally calculated taking into account the full life cycle of the biofuel and potential use of its co-products, so *adjustments might be required at the biofuel production level*. This is something that should be assessed.

As explained in Part One, some experts question the use of (consequential) ILUC factors in attributional LCA accounting (which is the type of LCA accounting used in the RSB GHG methodology).

The ILUC factor can be feedstock-specific (e.g., different for corn, soybeans, etc.) *or* specific to different feedstock *groups* (e.g., oilseeds, grains, etc.). (European Commission , 2011, Draft) offers an example of how crop-specific ILUC factors can be averaged by feedstock groups.

2.4.4.1 Option 3a: ILUC factor with mitigation possibility

The ILUC factor can reflect “attenuating” best practices, i.e. the ILUC factor can be reduced if best practices are implemented by the operator, such as those included in Table 4 under Option 2 (e.g., monitoring yields and implementing yield-enhancing measures above business as usual, etc.)

In addition, the ILUC factor can be zero for feedstocks with recognized low risk of indirect impacts, such as those meeting Option 1 requirements.

2.4.4.2 Option 3b: ILUC factor with no mitigation possibility

Under this option, a given ILUC factor is applied according to feedstock (or feedstock group) type, with no possibility for ILUC factor mitigation through the implementation of best practices.

Table 6: Evaluation – Option 3: Implement a project-specific ILUC factor in GHG calculation

Category	*Evaluation parameter*	Evaluation	a	b
RSB Standard	*Impacts on ease of RSB certification*	Depending on the factors utilized, an important number of operations might not meet the 50% GHG threshold; however, depending on the best practices required, and the amount of reduction in ILUC factor obtained when implementing best practices the number of operations that do not meet the reduction threshold could be less significant.		
	Coherence with RSB Standard; compatibility between options	No incoherence; Compatible with options 1/2/4		
	Accurately reflect sustainability (differentiate high risk from low risk)	ILUC factors reflect the GHG emissions associated with an operation in a more complete fashion. However, it is difficult to choose "accurate" ILUC factors due to their inherent uncertainty.		
	Capacity for implementation	The RSB Secretariat has limited capacity for calculation of ILUC factors; it might be difficult to agree on a set of ILUC factors under the RSB multi-stakeholder process.		
	Reputation	It is a measure that addresses indirect impacts so it would have positive impacts; since the RSB Standard aims to encourage best practices and continuous improvement, an ILUC factor that provides incentives for best management practices would be better.		
Effectiveness	*Scale of impact (number of operators affected/incentivized)*	All operators would be affected; the number of operators that would be incentivized (as opposed to being "eliminated" from the standard for not meeting 50% threshold) depends on how the option is designed.		
	Effect change (minimize displacement)	Depending on the best practices required, and the amount of reduction in ILUC factor obtained when implementing best practices (Option 2), this could be similar to Option 2. However, for those operators who already meet the GHG threshold with a full ILUC factor in place, there will be no incentive for improvement.		
Environmental	*Impacts on GHG emissions*	This option would impact the reported lifecycle GHG emissions. If an ILUC factor is applied, reported GHG emissions will be higher. The implementation of this option will more accurately reflect GHG emissions associated with the project. (This said, if the option is in the form of a "bonus", then reported GHG emissions will be lower than what they are in reality.) Since this option will discourage projects that result in high risk of ILUC without mitigating such risk, the option is expected to have positive outcome in terms of actual GHG emissions.		
	Impacts on High –C/high biodiversity LUC; water, soil, air	Depending on the best practices required, and the amount of reduction in ILUC factor obtained when implementing best practices (Option 2), this could be similar to Option 2.		
Social	*Other impacts on food commodity prices; economic & rural development*	No impacts expected		
Economic (operator's perspective)	*Cost of implementation*	Low cost to implement an ILUC factor; however, if the ILUC factor is subject to reduction if best practices are implemented, this could be similar to Option 2.		
	Mid-long term stability	This can results in low stability. ILUC factors should be periodically recalculated to reflect changing global economic realities. This can potentially result in very different ILUC factors 5 years from now		
Coherence	*Coherence with existing regulations*	No incoherence with regulations identified/existing to date.		
	Trade issues	Some feedstock types would be worse affected than others; there would be a bias against oilseeds		

a=ILUC factor and requirements for attenuating indirect impacts risk, which in turn reduce the ILUC factor; b=ILUC factor only

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable/ not determined

2.4.5 Option 4: Regional/National-level assessment of indirect impacts risk (risk assessment)

Starting from the work done by (Ecometrica, 2010), assess the "potential regional indirect impacts risk", at a national, sub-national, or supra-national bloc level (e.g., U.S.; E.U.; Eastern Europe; ECOWAS region; etc.) based on regional indicators of ILUC risk (see Table 7). For a given region that has undergone this assessment, determine whether the region receives a "green" light, "yellow light", or "red light", reflecting the potential risk of bioenergy projects within that region of causing negative indirect impacts inside and outside the region. This regional evaluation could be part of the RSB Screening process.

Table 7: Regional indicators of ILUC risk. Source: based on (Ecometrica, 2010)[9] – EXCERPT

Type	Indicator	Units
H	Area of high-carbon stock land maintained or increasing in the region	Ha
H	Maintained or increasing key non-energy agricultural exports and/or maintained or decreasing all agricultural (energy and non-energy) imports as bioenergy production expands	Tons/yr
S	(low/no) conversion of high-carbon stock (high biodiversity) land to agricultural use	Ha/yr
S	Area of regenerated marginal / degraded land increasing	Ha/yr
S	(low) incidence of land evictions or people displaced without due process & consent	Number of cases /yr
S	Production yields for agricultural (bioenergy and non-bioenergy) commodities increasing	% yield change
S	Reduced waste/increasing resource efficiency	% waste as proportion of total ag output
S	Maintained or increasing production of key staple crops used as food, feed, and fiber; or maintained or decreasing imports of key staple crops	Tons/yr
A	Policy incentives for the use of degraded/marginal land	Yes/No; Type
A	LUC monitoring program	Yes/No; Area covered
A	Land Use Zoning	Yes/No; Area covered
A	Protection of high-carbon stock (high biodiversity) land	Yes/No; ha; % of total
A	(low/no) investment in infrastructure (roads) in high-carbon stock (high biodiversity) land	Km new roads
A	Investment or policy to support (sustainable) agricultural intensification / efficiency improvement	Yes/No; type; $/yr

H=High level outcome indicator; S=Supplementary outcome indicator; A=Action indicator

Based on the outcome of the assessment, establish the consequences with respect to RSB certification. For example, for projects in a red/yellow light region:

- Project cannot be certified (extreme)
- Project must meet Option 1 requirements (strict)
- Project must implement Option 2 requirements
- Other

[9] Note: this table is an extract of the original, and some modifications have been introduced.

As noted in Part One, the regional approach has been criticized because the proposed indicators (e.g., maintained outputs, increasing yields, etc.) are measured in absolute (historical) terms, and do not provide a measure of the potential impacts of increased biofuel production. Further expert consultation should take place before proceeding with such an approach.

The RSB Secretariat has a limited capacity to develop this option, which would likely need to be developed in conjunction with an expert group. It is also expected that it might be a lengthy process to come to an agreement on the indicators and the thresholds between “red”, “yellow”, and “green” level of risk and the requirements for each category, under the RSB multi-stakeholder process.

Table 8: Evaluation – Option 4: Regional approach

Category	Evaluation parameter	Evaluation	
RSB Standard	*Impacts on ease of RSB certification*	The regional assessments would be conducted by an external organization, i.e., not by the operator. The impact on the ease of certification depends on what the requirements would be for operators in (high-)risk areas. However, operators would not be able to proceed until an assessment has been carried out for their region, hence complicating certification. In addition, important volumes of data are needed in order to conduct assessments, and these data might not be easily available for all regions/countries.	
	Coherence with RSB Standard; compatibility between options	Slight "incoherence" in that it is required to do a broader regional assessment before the implications for the operator are established.	
	Accurately reflect sustainability (differentiate high risk from low risk)	The indicators included in Table 7 have a limited accuracy in predicting the potential risk of indirect impacts caused by operations in a given region so the strength of this option rests on the level of ambition of the required measures for those operators in high risk areas.	
	Capacity for implementation	RSB secretariat has limited capacity to conduct or coordinate regional assessments. A multi-stakeholder process to come to an agreement on the indicators and the thresholds between "red", "yellow", and "green" level of risk could result in a lengthy process.	
	Reputation	Depends on the level of buy-in of indirect impacts experts; expected to have positive effects over "do nothing"; difficult to evaluate.	
Effectiveness	*Scale of impact (number of operators affected/incentivized)*	Operators in areas considered to be at risk would be affected; difficult to say which areas these would be. Regions of poor governance are considered "high risk", as well as regions with decreasing natural forests, and regions with increasing imports of agricultural commodities. This covers a large part of the world. Without conducting an assessment, this parameter is difficult to evaluate.	
	Effect change (minimize displacement)	This depends on what the requirements would be for operators in high and medium risk areas; expected to have positive effects over "do nothing". Difficult to evaluate	
Environmental	*Impacts on GHG emissions*	See above / Other options	
	Impacts on High –C/high biodiversity LUC; water, soil, air	See above / Other options	
Social	*Other impacts on food commodity prices; economic & rural development*	See above / Other options	
Economic (operator's perspective)	*Cost of implementation*	See above / Other options	
	Mid-long term stability	See above / Other options	
Coherence	*Coherence with existing regulations*	See above / Other options	
	Trade issues	See above / Other options	

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable/ not determined

2.4.6 Option 5: "Indirect impacts fund" / indirect impacts mitigation outside the project boundaries

Under this system, an operator contributes with know-how, time or financial resources to a fund, which manages projects aimed at improving productivity in regions with greater potential, and where lack of capital and/or information/education is the main barrier for implementation of such projects. Alternatively, operators can identify and directly fund an external operation.

The rationale is that time and/or money invested in measures to reduce the risk of indirect impacts (e.g., projects to increase yield, or reduce waste, etc.) can effect a much greater positive change if they are invested in regions where there is a greater potential for improvement.

This option is very much in the initial stages of exploration. The RSB Secretariat has limited capacity for its development and implementation, which would need to be done in collaboration with other organizations.

Table 9: Evaluation – Option 5: "ILUC Fund"

Category	Evaluation parameter	Evaluation	
RSB Standard	*Impacts on ease of RSB certification*	If this option were mandatory, it would create an additional burden towards certification.	
	Coherence with RSB Standard; compatibility between options	This option is not incoherent with the RSB Standard, although it does not go along the traditional lines of the standard and it would require substantial additional work . It would be implemented as an alternative to the requirement to comply with Option 2.	
	Accurately reflect sustainability (differentiate high risk from low risk)	Since the operator does not implement best practices within their operations, and the mechanism for the implementation of "offset projects" has not been worked out in a methodological document, it is difficult to evaluate this aspect.	
	Capacity for implementation	The RSB has a limited capacity for implementation of such a scheme. It would need to be a collaborative approach.	
	Reputation	Since mechanism has not been worked out in a methodological document, it is difficult to evaluate this aspect.	
Effectiveness	*Scale of impact (number of operators affected/incentivized)*	If this option were mandatory, it would be applicable to all operators seeking certification.	
	Effect change (minimize displacement)	Difficult to evaluate, since the concrete mechanism (qualifying project types, extent of subsidy, etc.) for the implementation of this option does not yet exist. If successfully and efficiently implemented, however, it would bring about positive change. The extent of this change depends on the methodological details.	
Environmental	*Impacts on GHG emissions*	There could be impacts on GHG emissions depending on the projects implemented, but these cannot be evaluated in a general way.	
	Impacts on High –C/high biodiversity LUC; water, soil, air	No significant impacts expected.	
Social	*Other impacts on food commodity prices; economic & rural development*	Difficult to evaluate. If successfully and efficiently implemented, it would bring about positive change in terms of economic and social development.	
Economic (operator's perspective)	*Cost of implementation*	Given that the option is based on the operator investing time/money on a third party, the implementation of this option would result in a cost to the operator – the magnitude of it is tbd.	
	Mid-long term stability	If the option is well elaborated, it should have no negative impact on mid-long term stability, as the requirements will be clear and will not change (unless the standard is revised).	
Coherence	*Coherence with existing regulations*	This option is not incoherent with existing regulations, although it does not go along the traditional lines of any existing regulation or scheme.	
	Trade issues	No issues identified.	

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable/ not determined

Table 10: SUMMARY TABLE

Category	*Evaluation parameter*	*Option 0*	*Option 1*	*Option 2*	*Option 3*	*Option 4*	*Option 5*
RSB Standard	*Impacts on ease of RSB certification*						
	Coherence with RSB Standard; compatibility between options						
	Accurately reflect sustainability (differentiate high risk from low risk)						
	Capacity for implementation						
	Reputation						
Effectiveness	*Scale of impact (number of operators affected/incentivized)*						
	Affect change (minimize displacement)						
Environmental	*Impacts on GHG emissions*						
	Impacts on High –C/high biodiversity LUC; water, soil, air						
Social	*Other impacts on food commodity prices; economic & rural development*						
Economic (operator's persp.)	*Cost of implementation*						
	Mid-long term stability						
Coherence	*Coherence with existing regulations*						
	Trade issues						

Optimal	Better	Neutral/No impact	Slightly worse	Negative	Not applicable/ not determined

Annex 1: Summary of ILUC factor estimates

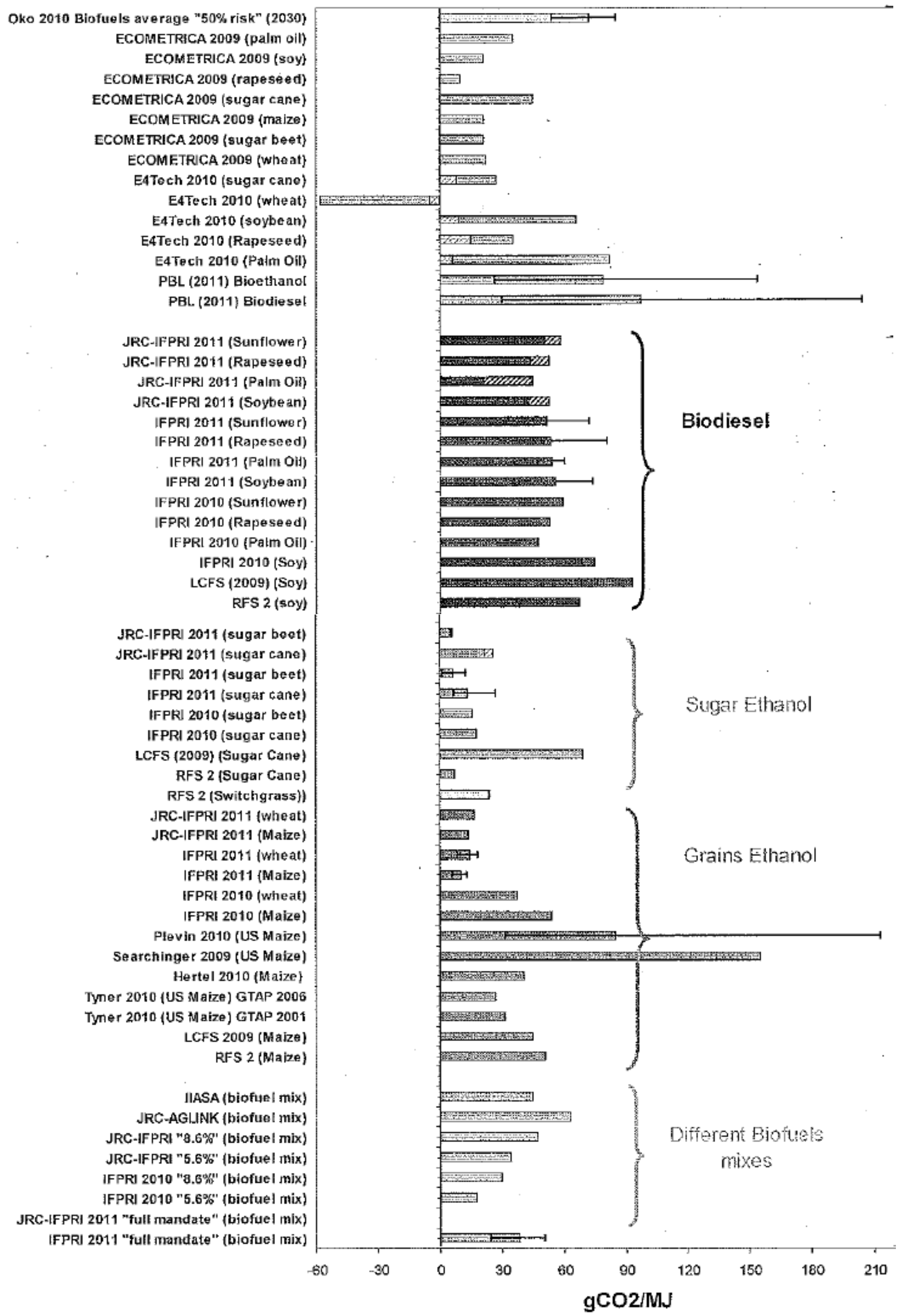

Figure 1: Summary of estimated (indirect) land use change emissions. Source: (European Commission , 2011, Draft)

The figure in Annex 1 includes a summary of estimates of LUC attributable to increased biofuel production (European Commission , 2011, Draft).

Note that values from the US have been multiplied by 1.5 to convert 30-year amortization of ILUC emissions to 20-year amortization used in the EU (Richard Plevin, personal communication).

Some ILUC factors include estimates of associated uncertainty. the differences in uncertainty between the IFPRI (2011) study [cited in this paper as (Laborde, 2011)] and other studies with higher estimated uncertainty ranges could stem from the fact that in the study by (Laborde, 2011), "sensitivity analysis does not cover the entire range of potential parameter values and does not investigate more extreme situations", and the study "does not investigate the uncertainty related to data […] such as carbon stock per Ha or proportion of land type converted from pristine environment."

Annex 2: Sources of uncertainty in ILUC models

Table 11: Sources of uncertainty in ILUC models.

Table S3. Uncertainties in modeling ILUC emissions. V = Variability, P = Parameter uncertainty, M = Model uncertainty, D = Decision uncertainty.

Component	Category	Description
Economic modeling	V	- Elasticities - Crop yields
	M	- Type of model (partial or general equilibrium; other) - Model resolution (number of regions and industrial sectors) - Functional forms and choice of closure - Choice of land classes to include
	D	- Baseline year and analysis year
	P	- Values of exogenous parameters (e.g., oil price)
Mapping to land cover classes	V	- Accuracy of land cover classification by remote sensing - Reliability of land cover change detection
	M	- Number and regional specificity of land cover classes - Predictive power of historical patterns of LUC - Reliability of land cover change detection
Estimating emissions for land cover conversion	V	- Above- and below-ground carbon stocks - Fraction of carbon emitted upon conversion - Annual foregone sequestration - Fraction of conversion through burning - Non-CO_2 emissions from burning - Global warming potentials
	M	- Use of average carbon stocks values as proxy for affected areas - Global warming potentials
	D	- Years of foregone sequestration assumed - Which climate-affecting phenomena to include, (e.g., black carbon, albedo, evapotranspiration) - Method of aggregating climate effects, e.g., combining regional and global phenomena
Estimating total fuel production	V	- Temporal and spatial variability in biofuel feedstock yields - Feedstock conversion yield
	M	- Projected changes in crop yield over the production horizon - Projected changes in biorefining yields - Affects of climate change on crop productivity

Source: (Plevin, O'Hare, Jones, Torn, & Gibbs, 2011)

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