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OPTIMIZING THE GLOBAL ENVIRONMENTAL BENEFITS OF TRANSPORT BIOFUELS

Optimizing the Global Environmental Benefits of Transport Biofuels

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Optimizing the Global Environmental Benefits of Transport Biofuels

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DISCLAIMER

The contents of this publication are believed, at the time of publication, to reflect accurately the state of transport biofuels and their impact on the global environment. Nevertheless, the STAP accepts responsibility for any errors. This publication was prepared for the STAP by the authors, serving as independent experts. The views and positions contained herein do not necessarily reflect the views of their affiliated institutions.

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ABOUT STAP

The Scientific and Technical Advisory Panel (STAP) comprises seven expert advisors supported by a Secretariat, who are together responsible for connecting the Global Environment Facility to the most up to date, authoritative and globally representative science.

The Global Environment Facility (GEF) unites 183 countries in partnership with international institutions, civil society organizations (CSOs) and the private sector to address global environmental issues, while supporting national sustainable development initiatives. An independently operating financial organization, the GEF provides grants for projects related to biodiversity, climate change, international waters, land degradation, and chemicals and waste.

http://www.stapgef.org

FOREWORD

"*Bioenergy can play a critical role for [climate change] mitigation, but there are issues to consider, such as the sustainability of practices and the efficiency of bioenergy systems."*

"*Commercially available liquid and gaseous biofuels already provide co-benefits together with mitigation options that can be increased by technology advances."*

These statements, taken from the Summary for Policy Makers of the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report – Mitigation (2014)[1], were approved by member governments at the 12th Session of IPCC Working Group III in Berlin, Germany, 7-11 April 2014.

Many countries encourage the development of biofuels (liquid and gaseous fuels derived from biomass, and the subject of this report) for their co-benefits. Biofuels can also enhance a country's long-term energy security, reduce dependence on imported oil products, promote economic and social development by providing livelihoods for the rural poor, and provide income for the nation as a whole. However, if adequate environmental and social safeguards are not in place, the production and use of biofuels in a given region can have perverse outcomes such as increased greenhouse gas (GHG) emissions and/or adverse impacts on the land, water, food supply or biodiversity. Therefore, when deciding whether to support a biofuels project, policy makers must carefully consider the trade-offs.

In this report, the Scientific and Technical Advisory Panel (STAP) recommends that the GEF and its Implementing Agencies support projects that sustainably produce and use first generation and/or advanced biofuels in place of petroleum derivatives (gasoline, diesel, kerosene). However, these biofuels must meet strict guidelines to ensure that overall benefits outweigh any economic, environmental or social costs. To that end, the STAP provides guidance on evaluating the risks and benefits of proposed biofuel projects.[2]

Where the impact of biofuels is found to be more positive than negative, the GEF can play an important role to overcome barriers to implementation. The STAP recommends a series of strategic entry points for the GEF in this regard, such as support for national mapping schemes and agro-ecological zoning; direct investment in innovative biofuels systems that provide multiple benefits; the creation or improvement of relevant research centers; capacity building programs for farmers, policy makers and other key stakeholders; and support for biofuels policies and programs where appropriate.

The "food versus fuel" debate should recognize that future bioenergy needs and land use must be planned together to help fulfill both environmental and social objectives, and meet the planet's growing demands for food, feed, fuel and fiber. Reducing GHG emissions to achieve the 2°C target for global temperature rise means considering all viable options, including the thoughtful and sustainable production and use of biofuels.

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[1] http://report.mitigation2014.org/spm/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf.

[2] The same principles of sustainable production also apply where biofuels are used for stationary applications such as fuel for small-scale electricity generating systems, lighting or cook stoves.

EXECUTIVE SUMMARY

Liquid biofuel production, using mainly food crops as feedstock, has increased rapidly in recent years. Liquid biofuels now supply around 2-3% of total transport fuels and many countries have developed biofuel blending mandates.[3] "Good" biofuels can enhance the environment, increase farm revenue and boost the security of energy supply. "Bad" biofuels can harm the environment, increase and destabilize food prices, heighten concern over food security and disrupt the lives of small farmers. The Global Environment Facility (GEF) can help overcome barriers to the development and deployment of "good" biofuels.

This report identifies and evaluates necessary conditions for the GEF's support of biofuel projects, and provides recommendations to the GEF Partnership. It outlines a strategic framework for supporting the supply of sustainable biofuels at scales that are significant to the global climate. It reconciles energy and food security challenges with local developmental needs and aspirations. Finally, it evaluates the growing controversy surrounding the sustainable production of biofuels and land-use competition.

Recognizing that biofuels can help stabilize atmospheric greenhouse gas (GHG) emissions, the GEF Council and GEF Secretariat should consider them within the mix of GHG mitigation options when balancing investment effort versus global environmental benefits.

The GEF Implementing Agencies and project proponents should use the GEF/UNEP/FAO/UNIDO biofuel guidelines (Franke *et al.,* 2013)[4] for *ex-ante* screening to assess the sustainability and social benefits of each biofuel project.

The GEF should assess all proposals to support transport biofuel projects to:

- ✓ ensure significant levels of GHG mitigation can be achieved, considering the full life cycle and emissions that result from direct and indirect land-use change
- ✓ minimize the risk of negative environmental impacts such as biodiversity loss, reduced water quality, competition for water supplies and worsened air quality
- ✓ promote positive, economic and social outcomes (including food and energy supply security and local employment).

The GEF should monitor each biofuel project to determine if it achieves the anticipated benefits, using criteria such as:

[3] REN 21 Global Status Report, 2014, lists 33 countries – Table R18 –and several others with targets – Table R15.

[4] Franke *et al.,* 2013. *Global Assessments and Guidelines for Sustainable Liquid Fuel Production in Developing Countries*. This is a joint GEF/UNEP/FAO/UNIDO project.

- ✓ net GHG emission impact
- ✓ ecosystem service impacts, including biodiversity
- ✓ food supply security impacts
- ✓ land-use changes (both direct and indirect), including deforestation
- ✓ negative and positive societal impacts.

The GEF should support:

- projects that sustainably produce and use first generation (conventional) and/or second generation (advanced) biofuels in place of petroleum derivatives (gasoline, diesel, kerosene) where they meet sustainability guidelines (Franke *et al*., 2013)[5]
- cost-competitive and near-market conventional and novel energy crops
- innovative and emerging technologies for new and sustainable[6] production systems
- institutional development that can help deploy biofuels and develop markets for them.

Overall, the GEF could help reduce the risks and costs for biofuel production, promote a faster transition to commercial viability, develop the market and regulatory conditions for promoting sustainable biofuel technologies and enable the positive development of biofuels as a climate mitigation option.

Biofuel projects *should* be supported when:

- net GHG mitigation benefits are anticipated, with minimal negative and potentially positive environmental and socio-economic outcomes
- energy crops, if grown, are located on currently low-yielding crop or pasture lands, or on abandoned, marginal or degraded lands
- energy crop production optimizes the use of fertilizers, pesticides and irrigation in ways that protect or enhance soil quality and minimize negative off-site impacts
- co-benefits are clearly evident, such as the co-production of livestock feed or efficient, low-carbon heat and power generation, or the avoidance of organic waste disposal
- biofuels are used domestically for multiple purposes, such as local transport fuels and rural energy services for powering irrigation pump engines and small-scale electricity generators, crop drying etc., or else exported only where countries support the development of local food and fuel markets

[5] Franke *et al.,* 2013. *Global Assessments and Guidelines for Sustainable Liquid Fuel Production in Developing Countries*. This is a joint GEF/UNEP/FAO/UNIDO project.
http://www.unep.org/bioenergy/Portals/48107/publications/Global%20Assessment%20and%20Guidelines%20for%20Biofuels.pdf.
[6] "Sustainable", in this context, refers to those biofuels that offer economic, environmental and social benefits that outweigh any disbenefits.

- interests of local rural communities are protected.

Biofuel projects *should not* be supported in *any* of the scenarios below where:

- natural forests, wetlands or biodiversity-rich native grasslands are converted for energy crop production
- inefficient energy conversion technologies produce a negative net energy balance
- food crops are used for biofuel, unless the food product is in surplus or the biomass resource is a by-product (such as crop residues)
- smallholder farmers are disadvantaged, for example through unfavorable supply agreements or land acquisition for large-scale commercial biofuel production, especially for export biofuels.

A series of safeguards that avoid adverse environmental and social impacts of biofuel systems should be factored into the GEF project approval decision-making process (Table 12). Any risks associated with biofuel production should be recognized and addressed in the project proposal.

Recommendations for the GEF Council and the GEF Secretariat

1. Support national policy frameworks and feasibility studies

As well as directly supporting sustainable biofuel production and processing facilities, the GEF should support projects that help develop national policy frameworks for the sustainable production of biofuels and conduct feasibility studies coupled with strategic environmental assessments. These projects must result in significant GHG reductions over the full life cycle (Section 4).

2. Promote rigorous monitoring and reporting

The GEF should encourage the use of a rigorous monitoring and reporting protocol with mandatory evaluations of biodiversity, land-use change, water use, local employment, food security, and direct and indirect GHG emissions (noting the complexity and uncertainties involved in estimating net GHG benefits).

3. Encourage innovation

Ideally, GEF projects would encourage innovative approaches that integrate new biofuel crop production into the agricultural landscape. These include introducing energy crops and plantations that provide ecosystem services such as reduced soil erosion, improved micro-climate and crop-nutrient regulation for the benefit of food production, and reclamation of degraded lands (Section 3.4).

4. Support better land-use planning

GEF projects could also support improved land-use planning, including through the use of geospatial technologies and participatory mapping to help identify suitable locations for sustainable biofuel production. This type of "landscape approach" to land management considers multiple factors for biofuel feedstocks. These include the type and location of crop and forest residues; the plant species to be grown; the farm management and harvesting systems used for production; transport of the biomass to refineries, as well as of the biofuel to market; and the type and location of the production facilities (Section 3.3).

5. Build capacity

The GEF should support institutional capacity to provide assurance and accountability, such as through standards and certification (Table 10 and Box 5). Technology transfer and capacity development programs for conventional and advanced biofuels will need to disseminate sustainable land management and agricultural production practices (Section 3.4).

6. Develop and demonstrate flagship projects

"Flagship" sustainable conventional and advanced biofuel production systems should be developed and demonstrated, including field trials to assess water supply and demand, suitable crop rotations, and industrial pilot projects and prototypes (Table 10).

7. *Develop tailor-made approaches for different regions*

The environmental and socio-economic implications of biofuel production are specific to the location and production system. Therefore, the GEF should employ region-specific approaches based on economic status, technological advancement and the appropriate scale of biofuel production. It could support regional centers of excellence (Table 10) for applied research relating to the production of new crop varieties, agricultural stewardship, use of bio-waste products and integration of chemicals production into industrial processes.

Recommendations for GEF Implementing Agencies and project proponents

1. Support projects that provide net GHG benefits and avoid negative impacts

Projects demonstrating biofuel production systems, or their market development, which provide net GHG benefits and avoid adverse environmental and socio-economic impacts, would be worthy of support. Ideal biofuel projects would use agriculture and plantation forest residues or bio-wastes as feedstocks as these have a lower risk of negative direct and indirect effects than purpose-grown crops (Section 4.2).

2. Adopt a life cycle assessment approach

The initial soil and biomass carbon stocks, biomass production methods and processes to produce the biofuels affect GHG emission outcomes (Section 4). For this reason, a life cycle assessment (LCA) is recommended to determine the overall impacts of any proposed biofuel project. Since the accounting system and assumptions in the LCA affect the result, standard methods should be applied, following the ISO Standard 14040:2006[7] and ISO TS 14067 (Section 4). Quantification methodology and assumptions should be clearly stated and justified.

3. Support sustainable production practices

Both small- and large-scale ventures should support sustainable production practices and have no major adverse environmental or socio-economic impacts. Priorities include large-scale biofuel production systems coupled to smallholder co-operatives or farmer associations; small-scale bio-refineries; "drop-in" biofuels production systems[8]; efficient thermochemical conversion systems; and integrated options such as the co-production of biofuels with bio-polymers in a bio-refinery (Table 9). Higher priority should be given to projects using residues or bio-wastes, or with co-products that enhance economic viability; to those that meet local rural energy demands for transport and/or clean cooking fuels; and to those that provide additional co-benefits such as electricity and heat generation that reduce air pollution and thus improve human health.

4. Support other key strategic entry points

Other strategic entry points for the GEF Partnership include:

- national mapping schemes and agro-ecological zoning
- direct investment in innovative biofuel systems that provide multiple benefits
- creation or improvement of relevant research centers
- capacity building programs for farmers, policy makers and other key stakeholders
- biofuel policies and programs, where appropriate (Table 10).

[7] ISO 14040: 2006, "Environmental Management Life cycle assessment: Principles and framework"; ISO 14044: 2006 "Environmental Management Life cycle assessment: Requirements and guidelines"; ISO/TS 14067 "Greenhouse gases - Carbon footprint of products – Requirements and guidelines for quantification and communication".

[8] "Drop-in" biofuels refer to hydrocarbon fuels produced from various biomass feedstocks that are compatible with diesel or gasoline fuels and can be easily blended and stored with existing infrastructure.