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The Future of Biofuels in the Future Climate Regime

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KEY MESSAGES

The future climate regime should:

- Create incentives to promote only those biofuel projects and programs that provide net positive energy, environment, and developmental benefits.
- Institute necessary safeguards including mandatory Life Cycle Assessments (LCA) for sustainability impact of biofuels from production to consumption with the boundary extended to include impacts on water, forests, and biodiversity.
- Develop additional methodologies for promoting future biomass programs under Clean Development Mechanism (CDM) and Reducing Emissions from Deforestation and Degradation (REDD) schemes.
- Mobilize financial and technological resources for the production and consumption of second generation biofuels.
- Establish a mechanism for coordinated energy policies that brings together the developed and developing countries.

Biofuels have gained much attention as a solution for becoming energy independent, reducing the greenhouse gas (GHG) emissions, and promoting livelihoods in the Asia Pacific region and elsewhere. To this effect, the Asia Pacific region has already claimed 25% of the world's bioethanol production with China being the largest producer followed by India. Moreover, Asia uses 50% of world fuel wood mostly owing to its socioeconomic conditions characterized by limited access to commercial forms of primary energy such as electricity, coal, and diesel. 75% of households in India, China and nearby countries still use solid fuels, which include dung, wood, agricultural residues or coal (WHO 2005). A simplistic argument that modernization of life requires abandoning of natural energy sources may lead to larger emission of anthropogenic GHGs caused from greater use of fossil fuels. On the other hand, there is a massive amount of unused biomass that could be converted to energy if a relatively small amount of funding and technology transfer could be allocated along with appropriate quality control measures, which could significantly contribute not only to the improvement of quality of life but also to climate mitigation. This signifies the importance of biofuels in the energy security of the region and in promotion of livelihoods.

Energy security, environment, and development are three important driving forces of biofuels. Asia currently obtains 68% of its oil from imports (estimated from British Petroleum 2008) and its dependency is expected to reach 85% by 2030 under a business-as-usual scenario (IEA 2007). Without homegrown energy alternatives such as biofuels, these fast growing Asian economies are vulnerable to shocks in the global energy mar-

**This brief reflects the views of participants at the IGES consultations on the post - 2012 climate regime.*

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kets. On environment front, Asia ranks first in CO_2 emissions with its emissions accounting to 26.5% of global emissions. Transportation sector is one of the biggest polluters in Asia region and the sector is expected to grow rapidly in the future (Rogers and Trafalgar, 2006).

The unemployment rate in Asian region is about 4.9% (ILO 2008). Nearly one third of the population in Asia Pacific is poor (The World Bank 2007). The World Bank suggests that bringing down income poverty to single digits in South Asia requires a constant economic growth of 8% per year in the next two decades which would have further implications for the GHG emissions.

Looking at the current rush to promote biofuels and its driving forces and impacts, in this Briefing Note, which is based on consultations carried out by the Institute for Global Environmental Strategies (IGES) in Bangkok in 2008 and literature review, we explored the possibility of promoting the sustainable production and consumption of biofuels in the future climate regime.

A future climate regime with higher mitigation targets could change the way the energy is produced and consumed and hence could make a difference for biofuels too (Figure 1). Since biofuels are increasingly becoming an important source of energy and have potential to contribute to the GHG emissions if not produced sustainably, it is a challenge to find those synergies in the climate regime that could help promote sustainable production and consumption of biofuels so that the energy security is not undermined.

1.Issues and Challenges

Sustainability: Biofuels are widely advocated by various policymakers and industries for their potential to significantly decrease dependence on imported fossil fuels and reduce the GHG emissions. However, positive reductions in life cycle GHG emissions are possible only when the impact assessment doesn't account for land use changes (LUC) (Nguyen et al. 2007, Zutephen 2007, and Hooda and Rawat 2006). Some reports suggest that biofuels can result in a 'net carbon debt' by releasing 17 to 420 times more CO_2, when the LUC are accounted for, than the annual GHG reductions these biofuels provide by displacing fossil fuels (Fargione et al. 2008, Searchinger et al. 2008).

The net energy and GHG emissions from biofuels depend on the use of fossil fuels in its production and transportation. The increasing farm mechanization in Asia with expanded use of direct and indirect on-farm energy use could further undermine the prospects of producing positive net energy from growing dedicated biofuel feedstock. This suggests that the positive net energy production can-

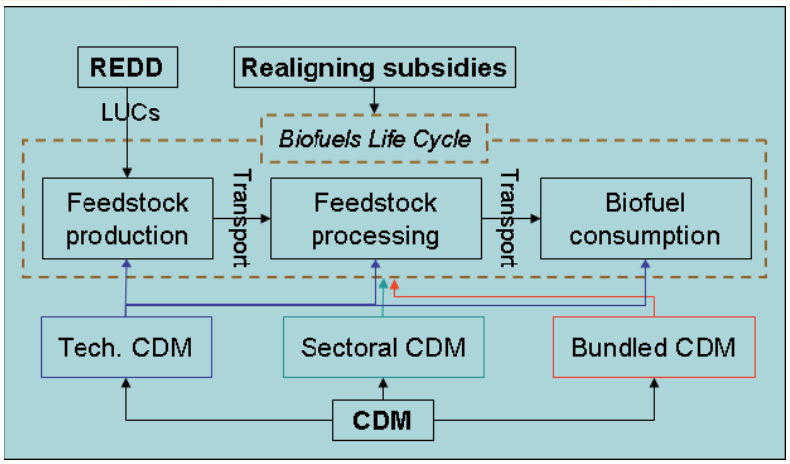

Figure 1: Impact pathways of future climate regime on biofuels production and use

not be automatically obtained but rather there is a greater need for strict control on use of fossil fuel based inputs and LUC at various stages of biofuel production.

Governments in Asia have also been promoting biofuels on wastelands (e.g. India and Indonesia). However, there is an uncertainty about the availability of such areas, their productivity, possible costs, environmental consequences of converting these lands, and other opportunity costs (Elder et al. 2008).

In addition to energy security and GHG emissions, little is known on how biofuels affect other environmental factors and development. Some concerns include the amount of water used in the production of biofuels, the extent that biofuels support the local economy, and secondary factors such as the depletion of water tables, loss of biodiversity, and impacts on ecosystem services.

One major issue with global ramifications is the food-fuel conflict that arises from the conversion of agriculture to biofuel crops and the willingness of the private sector in engaging labor-intensive production techniques. By reducing the area under food crops, food prices and poverty around the world could go up.

Vast literature suggests that the second generation biofuels (biofuels derived from cellulosic and other organic waste) are more sustainable than first generation biofuels. However, second generation biofuels are costly and are not viable under current conditions.

Market and REDD Mechanisms: Some of the ways by which biofuels could be promoted in a future climate regime is through mechanisms like CDM and to certain extent the Reducing Emissions through REDD for forest based feedstocks. It is possible that there will be a range of new market mechanisms, which include modified versions of CDM that overcome its current limitations, in the future climate regime. The Table 1 lists the issues for promoting biofuels under current CDM programs. The question marks in the table indicate the uncertain nature of proving them to meet the current CDM guidelines. Some of the current barriers to promote biofuels under CDM include the lack of suitable methodologies and difficulty in proving the additionality of GHG reduction.[1] The part of the difficulty is due to the fact that most of the first generation feedstock production is geographically widespread, which makes it difficult to monitor for the input use (most importantly the direct and indirect energy use) that has bearing on the GHG emission reductions and net energy generation (Bakker 2006).

Table 1: Applicability of CDM to biofuels

Issue	Concerns with Biofuels
GHG reduction	Life cycle based GHG reduction (?)
Additionality is to be proved	Additionality (?)
Sustainable development (e.g. Employment generation)	Employment generation
Clean technology transfer (not in all projects)	Can be a clean technology (Disputable for first generation and more probably for 2nd generation technologies) (?)
Current major sellers of C credits are China and India and major buyers are EU and Japan	Countries with highest biofuel production in Asia are China and India. India and China also have more land than EU and Japan to spare for BF

Currently two types of REDD mechanisms are being considered: national mechanisms and project-based mechanisms. While national mechanisms have less leakage effects, the project based ones could considerably shift the pressure from project areas to non-project areas. Though discussions under current REDD doesn't differentiate between different forest stocks to be grown, it also doesn't provide sufficient methodologies to assess impacts on a life cycle basis since biofuel produced from feedstocks in aforestation programs have emissions beyond the usual REDD project boundary. In addition, the lack of dependable data sets for carbon accounting, poor governance mechanisms to avoid leakages need to be addressed in order for biofuels to be sustainably promoted through REDD schemes.

2.Stakeholder Perspectives

Sustainability: There are a range of perspectives both in for and against use of biofuels. The first generation biofuels are known to have more environmental impacts than the second generation biofuels. First generation biofuels are being attributed to causing deforestation in Southeast Asia (Butler 2008). Friends of the Earth (2008) argued that first generation biofuels produce more GHGs than they save and threatens the food supply and livelihoods of millions of people. Similar fears were also raised by

Greenpeace and other environmental non-governmental organisations worldwide.

On the contrary, oil palm producers claim that the amount of land converted to oil palm constitute only a fraction of what is converted from forests to agricultural purposes with some estimates suggesting only 0.005% of total LUC being accounted for palm oil (Yusof Basiron the Chairman of Malaysian Oil Palm Council). Others also support this argument stating that only very small amounts of palm oil used for energy purposes comes from peat land clearances in Indonesia while the bulk of it is being used for food purposes (John Seymour, UK consortium North East Biofuels to New Energy Focus).

The uncertainties in the impact on LUC have also affected how they should be treated and used for creating a standard for biofuels. One prominent group of researchers feel that there is not enough confidence to support making policy recommendations based on what is known so far as to the potential effects of indirect LUC associated with biofuel production (Blake et al. 2008). They cite that the conventional tools used to determine the indirect impacts of biofuel production are based on assumptions that are not readily backed by empirical validation. As a result, they recommend that fuel standards should be implemented with the assumption that indirect land use changes are negligible for the GHG emissions.

In contrast, another group of scientists feels that calculations for the life cycle environmental and socioeconomic impacts are improving and that life cycle based approaches should be considered in policy making (Delucchi et al. 2008). This group generally believes that policies today should reflect the most likely assessments of current data sets and models that are generally accepted by the scientific community. Moreover, policies should be designed with enough flexibility to reflect changes in these models as they evolve.

At the policy making level, a wide range of proposals have been made. An European Union (EU) moratorium on biofuels has been suggested because EU is not able to address the key issue of "leakage" or the displacement of agricultural activities elsewhere (Friends of the Earth in response to EU Climate Energy Package 2008).

Stipulating particular amount of the GHG reduction as criteria for a particular feedstock/production process to be eligible for renewable energy is also an important means of promoting sustainable biofuels. The EU has already started discussions along these lines and stipulates that biofuels and biomass be produced according to a 'Sustainability Scheme'. It includes GHG emissions from biofuel use as well. The European Parliament has also emphasized that developing and implementing biofuel strategies should fully account for and safeguard against any associated negative environmental, social and economic impact (European Parliament 2008). United States says there is a need to limit the amount of biofuels coming from corn and to put a threshold of GHG emissions for biofuels to be qualified as renewable energy (20% reduction for corn based biofuels and 60% reduction for second generation biofuels) (US Department of State 2008).

There are suggestions to include total emissions of the life cycle of biofuels in the mandatory accounting. Wetlands International (2008) proposed to include total emissions for accounting the emissions while producing and consuming biofuels .

The California government has proposed using a low carbon fuel standard (LCFS) to promote fuels with reduced GHG emissions. The tool is not intended to pick a particular source of fuel but to offer a way to compare the GHG impact for a wide variety of fuels, including electricity (Farrell et al. 2006).

Other proposals to measure and verify the sustainability of biofuels include the Roundtable on Sustainable Biofuels (RSB), which has been developing principles and criteria for these fuels (Roundtable on Sustainable Biofuels 2008). The Dutch government is also among the first to implement a tracking system to better characterize biofuel products from the field to power plant. Using a framework that is similarly used for combating Bovine Spongiform Encephalopathy in the cattle industry, this system is intended to ensure compliance to sustainability standards (Green Building News 2007).

Market and REDD Mechanisms: There have been proposals for sectoral CDM (including policy CDM) and clustered approach. The sectoral CDM expands the CDM bound-

ary from a project based one to overall sector (namely, Sectoral CDM. e.g. energy, cement production, clean coal fired power plants) or to a policy (namely, Policy CDM. e.g. renewable energy policies have significant GHG mitigation potential). By bundling projects together, small projects could become viable and result in quicker administrative procedures. In all these forms of CDM, there is a potential for biofuels to be expanded (Bakker 2006). Sectoral CDM has the potential to divert major resources to single or multiple sectors as against spread of efforts across different sectors, sectoral CDM would provide more impetus to expansion of research and deployment efforts in both first generation and second generation biofuels.

The EU was hesitant to use forestry credits in its Emission Trading System (EU-ETS) and has halted the inclusion of EU-ETS forestry credits until 2020. This was to protect carbon markets from getting flooded with the cheap carbon credits from afforestation programs. Instead, the EU proposed to establish a forest preservation fund to promote forestry. In a similar initiative, Brazil has established an international fund for protecting the Amazon forests. Developing countries are asking for including forestry credits. New Zealand has designed emission trading that includes credits from forestry.

3.The Way Forward

Sustainability: With wide disagreement among experts as to the actual impacts of first-generation biofuels on overall emissions, a consensus on a methodology for life cycle assessment seems unlikely in the near future. In spite of these uncertainties, the biofuel economy continues to grow worldwide and is likely to provide large amounts of fuel in the Asian region. Therefore, current policies should be designed with the flexibility to incorporate new understanding on how biofuels affect emissions, environmental sustainability, the economy, and jobs.

Our estimates suggest that there is a theoretical potential for biofuels to play a substantial role in the future climate change mitigation (Figure 2, refer to endnote for details on estimation). One of the means to realize this potential is to establish feedstock production and fuel standards. The standards should allow new competitors to enter the market, providing a level playing field for new technologies. The standards should also send a powerful market signal to slow down and eventually stop the development of and investment in conventional fossil fuels.

The current plans to measure the GHG impacts of biofuels do not extend to the consumer or retail levels. Labeling systems (e.g. green fuel standards) are needed in order for consumers to make a conscientious choice toward low carbon fuels.

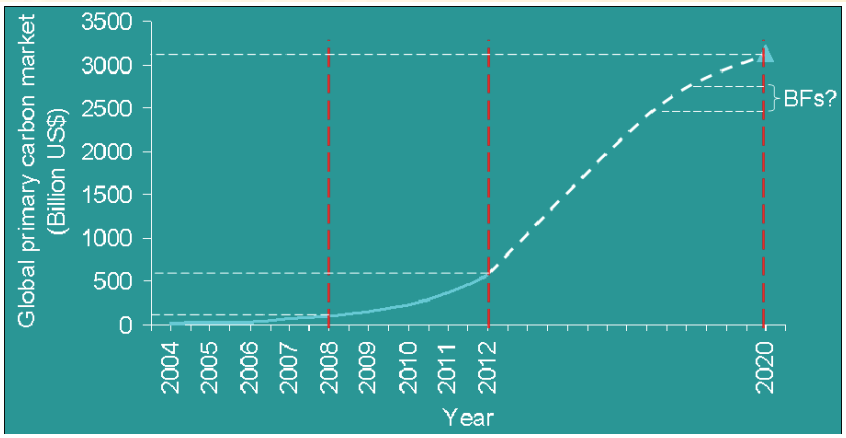

Figure 2: Possible share of biofuels in global primary carbon market until 2020 (preliminary estimates). [2]

Ultimately, various environmental and socio-economic factors besides the GHG emissions and energy dependence must be addressed in order to properly see the big picture on what impact the emerging biofuel economy will have and how the negative aspects could be reduced or avoided. In order to understand the overall sustainability of biofuels, a concerted research effort that go across countries, socio-economic segments, and industries that are directly and indirectly involved with the cultivation, processing, distribution, and consumption of biofuels is necessary.

Metrics and standards (e.g. Round Table on Sustainable Biofuels, RSB) must be identified, standardized, and promoted so that biofuels produced from different sources can be fairly compared. In order for a tracking system to work consistently, a global framework will be needed to regulate a sustainability standard for biofuels.

The following overarching policies could further help in sustainable production of biofuels:

- Both North-South and South-South technology transfer should be explored since developing countries such as India and China have already made substantial progress on R&D on biofuel processing technologies that could be transferred to other developing countries at least overhead costs. Landscaping of different technologies employed in biofuels production and consumption could help in identifying where these technologies are and what their costs are for effective technology transfer (Kamal 2008).
- Sustainability of biofules could be improved by coordinated policy making at global level such that policy decisions taken in the West doesn't unduly impact the environment in the South. The biggest division is the North-South divide in which the developed countries are the primary producers and the developing ones are sources of feedstock. The Organisation for Economic Co-operation and Development (OECD) is arguably the best mechanism to create a global market for biofuels while meeting the multiple goals in environment, energy security, and socioeconomic development (Matthews 2007).
- There is a need to develop an institutional mechanism where the South is guaranteed open markets and access to better technology for biofuel production while the North (OECD) is guaranteed normal supplies of biofuels that are produced in a sustainable way. Under this framework, the OECD countries would first need to establish among themselves a market that is in need of responsibly produced biofuels and as an institution seeking a stable future supply. The South would then be invited to join in this Biopact, which aids them in making the financing necessary to expand biofuel feedstock production but at the same time be compelled to avoid environmentally deleterious activities including forest clearance, water wastage, and illegal runoff. Since the global energy markets are increasingly interconnected, there is a need for coordinated policies, where the ambitious biofuel targets of the global North doesn't lead to unsustainable production in the global South.

Market and REDD Mechanisms: In all forms of CDM, setting the baseline for emission reduction would determine the further expansion potential of biofuels. Both market mechanisms and REDD have potential to enforce sustainable means of biofuel production since the objective is to reduce the GHG emissions. How they can do it effectively depends on how these mechanisms are designed and implemented by taking forward the experiences from the ongoing mechanisms under the Kyoto Protocol.

The afforestation and reforestation (AR) CDM could be another instrument to promote biofuels in forest programs. However, in order to enable the AR-CDM to support biofuels, there is a need for clear methodologies that estimate the GHG reduction on a life cycle basis.

The difference between the price of C (currently USD 2/t CO_2 at voluntary CCX and 10 USD/t CO_2 on compliance based ECX) and CO_2 abatement costs through biofuels, which vary from country to country and the choice of technology (For example, the costs could be as high as 1400 USD/tC, UK Department of Transport 2005), are wide enough that carbon abatement through biofuels production is not feasible. Any mitigation mechanism under the United Nations Framework Convention on Climate Change (UNFCCC) requires that the gap be narrowed down. This could be achieved either by reducing the abatement cost, for example by facilitating transfer of second generation biomass gasification technologies at lower costs or by increasing the carbon price, namely by increasing the demand for carbon through higher mitigation targets.

Though we foresee a possible increase in overall carbon prices in the future climate regime with higher mitigation targets, albeit with some uncertainty, there is a likelihood of biofuels related Certified Emission Reductions (CER) will be relatively poorly priced due to the quality related concerns (the same reason for which the EU halted the forest-based CERs in EU-ETS). Many of these obstacles could be overcome by establishing appropriate methodologies for assessing carbon mitigation benefits from first generation biofuels and by moving to second generation biofuels where production of feedstock is either not needed or strictly controlled (e.g. production of Algae).

If sectoral targets are agreed as a way forward, countries with considerable amount of biofuel production may want to agree for targets assigned to energy intensive sectors such as transportation which is fast growing. This would further generate potential for biofuels production and consumption.

Since no clear global mechanism is available on REDD, how it would affect biofuels production is still speculative. However, it is clear that the future REDD mechanism should establish suitable methodologies and provisions, which include the possibility of growing biofuel feedstock (e.g. Pongamia) in afforestation programs. The REDD mechanism should also help assess emission reduction benefits on life cycle basis.

The effect of REDD on future biofuel production depends on two scenarios. If future biofuels are dominated by second generation technologies, for example, from household, timber and agricultural wastes, REDD may not significantly impact the biofuel production since second generation biofuels do not result in land use changes. However, if first generation feedstocks remain dominant, REDD could considerably restrict the spread of biofuels by limiting land use changes. Experiences from countries such as India where local governments are promoting planting of pongamia under forest programs show that expansion of biofuel feedstock under forestry programs could be promoted by REDD. Since perennial biofuel plantations sequester more carbon than first generation field crops based biofuels (e.g. corn etc), there is a very high potential for these plantations be promoted under REDD schemes.

Second generation biofuels are still in developmental stages and will require substantial investments for commercialization. In order for the technology to be viable, they must be replicated and scaled-up to quantities that are affordable. Second generation biofuels could be promoted through technology CDM.

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Endnotes:

1 **To date, most of the methodologies are biomass based and only one on liquid fuels which include AM47, ver. 2 on Biodiesel from Waste Oils and Biomass; AM 7 on Cogeneration; AM 36 on Boiler for Heat Generation; AM 42 on Grid Electricity; ACM 6 on Grid Electricity**

2 **Preliminary estimates from data on future carbon markets, estimated share of biofuels in future energy mix, and GHG reduction potential.**

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