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Biofuels – from CDM to NAMAs

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Summary Points:

- This paper reviews the trend of biofuel development and performance of biofuel projects under CDM as well as provides insights on how biofuel projects could transition to NAMAs.
- The author emphasizes that ensuring the sustainability of biofuel production and utilization is the key to overcome the difficulty of biofuels under CDM and facilitate biofuel projects and programmes in the future NAMAs. While there is no concrete guidance yet on NAMAs and MRV, lessons learned from biofuel projects under CDM can help in designing biofuel NAMAs. CDM methodologies can also be the basis on how to MRV supported or credited biofuel NAMAs.

Keywords: biofuels, sustainability criteria, CDM, NAMA, MRV, life cycle analysis (LCA)

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Table of Contents

1. Introduction

Biofuels were initially perceived to be carbon-neutral substitutes to liquid fossil fuels and could contribute in enhancing energy security, economic development and job creation in developing countries thus meeting easily the clean development mechanism's (CDM) dual goals under the Kyoto Protocol to reduce greenhouse gas (GHG) emissions and promote sustainable development. However, risks associated to unsustainable biofuel development (e.g. deforestation, food-fuel conflict, loss of biodiversity, water scarcity, etc) derailed the expected potential for carbon credits of biofuel projects under CDM. CDM biofuel methodologies, to safeguard environmental integrity, took a cautious approach to minimize if not avoid those potential risks.

Amidst the continuing scrutiny surrounding the "green-ness" of biofuels, the industry is growing steadily. Global biofuel production grew from 16 billion liters in 2000 to more than 100 billion liters in 2010 (IEA, 2011). National interests to promote biofuels remain significant both in developed and developing countries with more than 50 countries[2] having blending targets or mandates and biofuel quotas for future years supported by various incentives (IEA, 2011; USAID, 2009; Elder et al, 2008). However, little has been achieved, so far, in the CDM. There is only 1 biofuel project registered to date. While the chance for approval of projects producing biofuels under CDM on a significant scale is deemed unlikely, the interest is shifting towards the potential of biofuels as part of developing countries' nationally appropriate mitigation actions (NAMAs).

In the compiled information on NAMAs[3] submitted to the UNFCCC, 12 out of 48 countries explicitly included promotion and use of biofuels in their NAMAs. NAMAs refer to measures developing countries could implement to reduce greenhouse gas (GHG) emissions supported and enabled by technology, financing and capacity-building in a measurable, reportable and verifiable manner. Many are hopeful that NAMAs could facilitate projects and sectors, such as biofuels, which have difficulty with the CDM rules (Lancaster, 2011).

Will the fate of biofuels differ in NAMAs?

This paper will examine how biofuel projects could transition from CDM to NAMAs by exploring the following guide questions:

- What is the trend of biofuel development in developing countries?
- What is the status, including prospects and challenges and lessons learned, of biofuel projects under CDM?
- How will NAMA be different from CDM?
- What are the lessons from CDM that could help design biofuel NAMAs?

Subsequent sections of the paper will discuss and elaborate relevant issues raised by the guide questions. Finally, recommendations will be made on how biofuel projects can possibly seize opportunities in NAMAs while ensuring that the production and utilization of biofuels will be done in a sustainable manner.

2. Biofuel development trends in developing countries

The recent figures from OECD-FAO Agricultural Outlook 2011-2020 indicate a growing trend on biofuel production and utilization in many developing countries. Brazil, India and China are expected to account for 85% of the 71 billion liters ethanol from developing world in 2020. More than 80% of ethanol produced in 2020 from developing countries is expected to be from sugar cane resulting from the dominance of Brazilian ethanol production. China targets to produce 5 million tons per year of ethanol by 2012 to 12 million tons per year by 2020 from traditional feedstocks like maize, wheat and cassava as well as second-generation biofuels (IEA, 2010). Argentina, Malaysia, Thailand, Indonesia and India will be the leading producers of biodiesel. The

[2] Refer to Appendix to see Table of Overview of Biofuel Blending Targets and Mandates adopted from IEA, 2011

[3] Compilation of information on nationally appropriate mitigation actions to be implemented by Parties not included in Annex I to the Convention. Available for download at http://unfccc.int/resource/docs/2011/awglca14/eng/info1.pdf

main feedstocks for biodiesel production should remain as vegetable oils based on palm oil or soybean oil in 2020. The share of jatropha is expected to only account for 10% of biodiesel produced in 2020 in the developing countries due to slow growth of cultivation capacities (OECD-FAO, 2011).

3. Status of biofuel projects under CDM

Currently there is only 1 biofuel project out of 3,556 registered projects under CDM. The "Plant oil production for usage in vehicles" in Paraguay is a small scale project utilizing combined castor oil, crambe oil and oilseed radish as feedstocks to produce fuel for vehicles by applying methodology AMS-III.T. It was registered on 17 December 2010 expecting to generate 17,188 tons of CO_2 emission reductions per year over a 7-year crediting period. To date, no certified emission reduction (CER) has been issued yet.

There are 7 approved methodologies applicable to biofuels for transport fuel use as well as stationary applications as listed in table 1.

Table 1. CDM methodologies applicable to biofuels

Number	Name of Approved Methodology	Applicability and other conditions
ACM0017	Production of biodiesel for use as fuel	applicable to biodiesel from waste oils/fats or from vegetable oils produced on land that was degraded or degrading prior to cultivation of the oil plants
AM0047	Production of waste cooking oil biodiesel for use as fuel	included in the approved consolidated methodology ACM0017
AM0089	Production of diesel using mixed feedstocks of gasoil and vegetable oil	
AMS-I.G	Plant oil production and use for energy generation in stationary applications	
AMS-I.H	Biodiesel production and use for energy generation in stationary applications	
AMS-III.T	Plant oil production for transportation applications	
AMS-III.AK	Biodiesel production and use for transport applications	plantations should be established in degraded or degrading land; plantations on peat lands not eligible for credits; the project activity does not lead to a shift of pre-project activities

Source: IGES, 2011. CDM in Charts.

In the early days of CDM and at the height of biofuel euphoria, the initial wave of biofuel submissions proposed new methodologies and project activities utilizing different feedstocks such as palm oil (NM0233[4] – Thailand), soybean oil (NM0228[5] – Brazil), oil-bearing seeds (NM108rev[6] – India),

[4] NM0233 "Palm Methyl-Ester Biodiesel Fuel (PME-BDF) production and use for transportation in Thailand"
[5] NM0228 "AGRENCO Biodiesel Project in Alta Araguiai"
[6] NM108rev "Biodiesel production and switching fossil fuels from petro-diesel to biodiesel in transport sector

sugar cane (NM082rev[7] – Thailand) and sunflower oil (NM129 [8] – Thailand). NM0233, NM0228, NM0180[9] and AM0047 became the basis of the approved consolidated methodology ACM0017 while the other submissions were unsuccessful.

The approved methodologies emphasize applicability only to biodiesel from waste oil/fats and vegetable oils produced from dedicated plantations established on degraded or degrading lands prior to the cultivation of oil plants. Clearing of forests and utilization of peat lands for biofuel plantations are not encouraged. Degraded or degrading land is identified using the A/R methodological "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities" to avoid land use shifts due to project activity. To avoid double counting of emission reductions, only the producer of biodiesel is allowed to claim for carbon credits. Exported biodiesel from CDM project activity could not claim for credits so the consumer, i.e. captive fleet, has to be located in the host country to ensure adequate monitoring. There are also provisions to account for emission leakage and rebound effects.

3.1 Prospects of production of biofuel under CDM

The registration of the first biofuel project produced from plant oil for vehicle usage in Paraguay is a good start, to say the least, to set an example that a biofuel project is possible to be registered under CDM. Replication on a wider scale, however, is limited for biofuel projects producing plant oil. Only few vehicles and engines could run on pure plant-oil and captive fleets have to operate near production site constrained by limited refueling sites. Blending with diesel using maximum 10% plant oil is possible but it would require a more complex process that just pressing of oil seeds and filtration needed to produce pure plant oil.

As of 1 November 2011, 11 biofuel projects are at validation stage – 9 using ACM0017, 1 using AM0047 and 1 using AMS-III.AK. All the 9 projects using ACM0017, 7 from China and 2 from India, are using waste oil to produce biodiesel. The project from China using AM0047 uses waste cooking oil to produce biodiesel while the project from Vietnam applying AMS-III.AK uses jatropha as feedstock to produce biodiesel.

It is worth noting that the dominant source of biodiesel is waste oil except for the jatropha project in Vietnam. Utilization of waste oil/fats avoid the complexity of analyzing the processes involved in the production of feedstocks making the application of relevant methodologies straight forward and more appealing to CDM project developers. However, the amount of waste oil/fats is limited compared to the potential amount of producing biofuels from crops.

ACM0017 is yet to be applied to a project producing biodiesel from crops planted in dedicated plantations. The outcome of the jatropha project from Vietnam following the small scale methodology AMS-III.AK could be an indicator of how things could progress.

To facilitate replication of small scale projects with high transaction costs but higher developmental benefits[10], CDM introduced the program of activities (PoA) as a modality of project development. A CDM PoA is considered "a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal (i.e. incentive schemes and voluntary programs), which leads to GHG emissions or increases net GHG removals by sinks are additional to any that would occur in the absence of the PoA via an unlimited number of CDM project activities (CPAs)" (Annex, EB32).

UNEP's Bioenergy Program assisted the conduct of feasibility study for a possible CDM PoA for rural energy generation from jatropha oil in Mali (UNEP, 2009) but the project did not push through. There is no biofuel PoA yet neither registered nor in the CDM pipeline.

[7] NM082rev "Khon Kaen fuel ethanol project"
[8] NM129 "Sunflower Methyl-Ester Biodiesel Project"
[9] NM0180 "BIOLUX Benji Biodiesel Beijing Project"

[10] Biofuel projects, other than reducing GHGs by replacing fossil fuels, are also expected to improve energy security, provide access to energy and job creation in rural areas in many developing countries.

3.2 Challenges and lessons learned from CDM

Many observers and practitioners blame the CDM approval itself, and criticize it for being too strict and complicated. The difficulty is also compounded by lack of available data necessary to measure the baseline and project activity GHG emission reductions. However, the fundamental difficulty for biofuel projects is that actual GHG reduction potential is more difficult than initially expected to establish to demonstrate that it meets the CDM criteria.

3.2.1 Proving sustainability

The revolving debates continue on the sustainability of biofuels produced from crops and its implications – to food security by using crops as alternative fuel instead of food, to water security by using scarce water resources in arid wastelands, to loss of biodiversity by converting huge tracts of land to monocultures dedicated to biofuel production, to overall reduction of GHG emissions if forests would be cleared or dried peat lands would be planted with biofuel feedstocks, and other emerging implications caused by direct and indirect land use change. The cautionary approach in approving methodologies for biofuel projects is justifiable considering that potential damages could be irreversible.

Governments with national biofuel policies and biofuel blending mandates or targets promote sustainable production and use of biofuels, but many do not have concrete guidelines on what constitute as sustainable biofuel production practices and processes. The CDM biofuel methodologies are not enough and do not replace the need for guidance on how to use best environmental practices to produce sustainable biofuels.

There are a number of initiatives aiming to establish sustainability criteria for biofuel projects not only to address environmental aspects of biofuel production but also economic and social implications. The Roundtable on Sustainable Biofuels (RSB), a multi-stakeholder initiative hosted by the Energy Center of Ecole Polytechnique Federale de Lausannae (EPFL), has developed a global sustainability standard and certification system for biofuel production since 2007. RSB's "Version Two" of international standard for biofuel production and processing was released in November 2010 and became a fully operational biofuel certification standard (RSB, 2010). Another endeavor is by the Global Bioenergy Partnership (GBEP) which was established to implement the commitments taken by G8 countries in the 2005 Glenagles Plan of Action to support biomass and biofuels deployment particularly in developing countries. GBEP's Task Force on Sustainability has been working on a set of sustainability criteria and indicators for bioenergy since 2008 and its result was endorsed by the GBEP Steering Committee in May 2011 (GBEP, 2011). There are also similar initiatives in the regional scale such as the Economic Research Institute for ASEAN and East Asia's (ERIA) Working Group on "Sustainability Assessment of Biomass Utilization in East Asia" guidelines to assess biomass utilization in East Asia which was released in 2009 and pilot tested in selected countries in 2010 (ERIA, 2010). These guidelines can be adopted and modified by countries to complement their national biofuel policies and blending mandates. Measures to implement and enforce those guidelines are unfortunately not yet in place.

Conducting life cycle analysis (LCA) of biofuel projects is suggested to ensure environmental sustainability. Results from many LCA studies show that biofuels are not created equal as there are considerable variations in GHG reduction potential depending on feedstocks, location of plantations, production processes and other factors (Elder et al, 2008). Unless LCA become a common practice, the environmental sustainability shroud surrounding biofuels could not be cleared.

3.2.2 Proving project "additionality"

Small scale projects (e.i. Type III projects – for example, biofuel projects applying AMS-III.T and AMS-III.AK) with no more than 20 $ktCO_2e$ per year are deemed additional. Recent developments in CDM to improve regional distribution of CDM projects consider project activities in least developing countries (LDCs) and small island developing states (SIDs) as automatically additional.

For large scale projects, a project activity is additional if it is not financially viable without income from carbon credits. In countries where production costs of biofuels are currently competitive, e.g. Brazil, this provision could not apply but there are other means of additionality demonstration[11]. It should also demonstrate that the project activity is not only in compliance to existing biofuel policy or mandate. This is difficult to demonstrate for project activities that intend to produce biofuel for fuel markets in countries with biofuel blending mandates.

In some cases, demonstrating 'additionality' is not a problem but in spite of potential additional income from carbon credits, the project is still not financially feasible. This has been the experience of many jatropha projects that failed; the yield is too low to be profitable requiring more research prior to wide-scale promotion (Kant and Wu, 2011). Not many farmers can engage in experimenting with jatropha production without expecting any results (Sano et al, 2011).

3.2.3 Many parameters needed – data lacking

Data needed to establish project baseline of biofuel projects are often not available; more so to conduct LCA. Some of the pieces of information and evidence required by CDM biofuel methodologies could use default values (e.g from IPCC or other databases) but many require direct field measurements making the process costly and time consuming. There is a need to generate more default values and establish an open platform to share LCA databases. Usage of biofuel is also complicated to monitor to ensure that biofuels are only used by "captive fleet" identified in the project activity to avoid leakage and double counting. Likewise, capacity building to do data collection and analysis is necessary as awareness of CDM methodologies or LCA is still low.

Designated national authorities (DNA) will lead the initiatives to simplify CDM such as establishing regional or national standardized baselines, bench marks, positive lists and default values. As resources and capacity of DNAs are limited, a pro-active role from the biofuel industry, research organizations and other stakeholders are encouraged to share data and experiences to fast track and facilitate the streamlining of CDM methodologies.

4. Will the problems of biofuels under CDM be lessened under NAMAs?

The prevailing sustainability issues on biofuels will most likely remain while some of the intricacies under CDM rules could be relaxed but there are also possible new challenges under NAMAs.

There are three possible types of NAMAs – unilateral or voluntary, internationally supported and creditable or marketable such as traded certified emission reductions (CERs) or voluntary emission reductions (VERs). In terms of activities, it could be project-based, sector-based, policy-based, intensity target or absolute target. There are a number of initiatives[12] to fast track design of NAMAs but none has been implemented yet.

Table 2 lists the details of actions relating to biofuels included in NAMA submissions. Proposed biofuel NAMAs can be categorized into two types – increase in use of biofuels for countries with existing policies and biofuel promotion for countries without biofuel

[11] see "Tool for demonstration and assessment of additionality"

[12] For example, UNEP implements the USD 6 million Danish fund aimed to facilitate implementation and readiness for mitigation (FIRM) to fast track financing to NAMAs in developing countries. More information at: http://www.unep.org/climatechange/adaptation/InformationMaterials/News/PressRelease/tabid/6710/Default.aspx?DocumentId=653&ArticleId=6865

policy or targets yet. Some developing and less developed countries require international support in terms of funding, technology transfer and capacity-building for their implementation of biofuel NAMAs.

Table 2. Details of biofuel NAMAs submitted

Non-Annex 1 Party	Action/s
Argentina	National Programme on Biofuels and Law No. 26093, which since January 2010 establishes a minimum share of 5 per cent of bioethanol and biodiesel in the gasoline and diesel oil sold in the country, provide a tax exemption and incremental prices for biofuel producers
Brazil	An increase in the use of biofuels (range of estimated reduction: 48 to 60 Mt CO2 eq in 2020)
Chad	Promotion and exploration and use of biofuels.
Colombia	Stimulate the growth of biofuel production, such as ethanol and biodiesel, without endangering the natural forests or the food security of the Colombian people, and by promoting the use of these fuels in the national market with the aim of achieving a 20 per cent share of total national fuel consumption by 2020
Ethiopia	Biofuel development for road transport and household use: • Project to produce 63.36 million litres of ethanol, from 2010 until 2015 • Project to produce 621.6 million litres of biodiesel, from 2010 until 2015
Ghana	Predominant use of gasoline and diesel fuels ('business as usual'): promote the production and use of biofuels as transport fuel On land preparation, mechanized land preparation practised ('business as usual'): promote minimum tillage and incentivize the use of biofuels for mechanized agriculture
Madagascar	Promote the production and use of biofuels
Peru	Modification of the current energy grid, so that renewable energy (nonconventional energy, hydropower and biofuels) represents at least 33 per cent of the total energy use by 2020
Sierra Leone	Development of alternative energy sources, such as biofuels from sugarcane, corn, rice husks, etc.
The former Yugoslav Republic of Macedonia	Harmonization of the national legislation regarding the transport sector, in accordance with European Union directives: • Energy and climate package (biofuels); • The regulation of fuel quality in accordance with the European Union requirements
Togo	The promotion of the use of renewable energies (solar, wind, biogas, biofuel): • Research on the use of biogas and biofuel energies
Tunisia	Tunisia communicated the following NAMAs including the energy valorization of solid and liquid wastes (electricity generation and biofuels)

4.1 Differences between CDM and NAMA

How to carry out international support to NAMAs is not yet clear. As a start, the program of activities (PoA) under CDM is expected to bridge the transition to NAMAs. NAMA is still conceptual with no regulatory guidance in place but its potential modalities can be summarised and compared to CDM as shown in table 3.

Table 3. Differences between CDM and NAMA

CDM	NAMA
Emission reductions used for Annex-1 country Kyoto compliance	Emission reduction account for NAMA country targets Exception for market based NAMA to be decided
Coordination via private or public sector	Coordination most likely by government body
Baseline and monitoring via CDM methodology	Baseline and MRV system not yet defined
Financed through market mechanisms	Market mechanism only an option
Defined by PDD and CDM methodology	Broad, sectoral approaches beyond CDM possible

Source: Adopted from Sekinger, 2011.

4.1.1 Unilateral biofuel NAMAs

If countries develop biofuel projects, programmes or policies as unilateral NAMAs with no intention of seeking international support or selling carbon credits, it would not be subjected to an internationally approved measurement, reporting and monitoring (MRV) process. Decisions to facilitate promotion and implementation of biofuel policies will be handled domestically. In addition, coordination and monitoring procedures might stay the same or if changed, would not entail heavy documentation requiring additional staffs to handle.

4.1.2 Supported or credited biofuel NAMAs

For supported or credited biofuel NAMAs, it is reasonable to assume that the project, programme or policy would be required to demonstrate GHG emission reduction in a measurable, reportable and verifiable manner. There is no guidance yet on how to implement the MRV but it is envisioned that simplified CDM methodologies could serve as basis on how to MRV NAMAs.

Provisions to ensure sustainability would most likely remain the same to ensure environmental integrity but some aspects of implementation and monitoring could be less stringent yet challenging at the same time. On the one hand, the restriction of 'captive fleet' would no longer apply if the biofuel NAMA is national in scope (Lancaster, 2011). On the other hand, coordination will be a challenge if it will be government led especially in LDC and SIDs with few capable human resources. Many designated national authorities (DNA) are already barely able to cope with their current work load.

The scale and coverage of a biofuel NAMA will have significant implications on the ownership of carbon credits. If it will be initiated and coordinated by the private sector such as in the case of CDM, then biofuel producer can claim the carbon credits. If it the coordination will be government led, it is not clear yet what will be the arrangement between the biofuel producers and the government.

5. Summary and way forward

The main challenge for biofuels in CDM is to prove that it can be produced and utilized sustainably. If not addressed properly, the problem will carry over to NAMA with most likely the same dismal results. Ensuring environmental integrity is foremost the main criteria to access international support or climate-related funds[13]. The success of biofuels in NAMA will only be gauged by how fast sustainability measures will be put in place.

Judging from the current status of biofuel development – the industry is growing in spite of minimal support from CDM – it may give an initial impression that producing sustainable biofuels by following stringent sustainability criteria is not necessary to propel the biofuel industry. Currently many domestic markets supporting national blending mandates do not require any proof of GHG emission reduction of biofuels available and sold in the market. Many developing countries are promoting biofuels to achieve economic development and rural poverty reduction. Unfortunately many jatropha projects aimed to provide rural jobs failed. Clearing of forests to expand palm oil plantations or other feedstocks to produce biofuels is still a contentious issue. Thus, it would be really tragic if the subsidies, tariffs and other financial support governments provide to the biofuel industry could not deliver the expected GHG emission reductions and also directly or indirectly support deforestation or worsen the living conditions of the poor.

It is to the benefit of governments to pursue and view the implementation of biofuel sustainability guidelines as investments complementing the financial and other incentives they provide to the biofuel industry. Recognizing the economic and development benefits attracting governments to biofuels, producing sustainable biofuels is the best proof to secure the potential of biofuels as an income generating industry.

There is no need to come up with biofuel sustainability guidelines from scratch. Global and regional biofuel sustainability standards are already available (e.g. sustainability guidelines by RSB, GBEP, ERIA) and some have been pilot tested already in different countries. It could be adopted and modified to reflect local nuances and appropriate local context to promote biofuel development in respective countries complementing existing national biofuel policy and blending mandates.

Finally, the experience of biofuel projects under CDM would be valuable in designing biofuel NAMAs. The CDM methodologies could serve as basis on how to measure, report, and verify (MRV) supported or credited biofuel NAMAs. Some aspects would be easier (e.g. 'captive fleet' will no longer be a hindrance for nationwide or city-wide biofuel NAMAs) while new challenges would likely emerge, e.g. on the ownership of carbon credits if coordination of large-scale NAMAs could be government led. Biofuel projects under CDM had difficulty with the many requirements to ensure environmental integrity of biofuels. If conducting LCA will become a common practice, satisfying CDM or NAMA rules will be less cumbersome.

[13] See the comprehensive lists of "Financing options for bioenergy projects and programmes" at http://www.globalbioenergy.org/toolkit/financing-options-for-bioenergy/en/

References

Global Bioenergy Partnership (GBEP). 2011. *GBEP 24 Sustainability Indicators for Bioenergy*. Available for download at http://www.globalbioenergy.org/programmeofwork/gbep-24-sustainability-indicators/en/

Economic Research Institute for ASEAn and East Asia (ERIA). 2009. Sustainability Assessment of Biomass Energy Utilisation in Selected East Asian Countries. *ERIA Research Project 2009.*No 12. Jakarta.

Elder, M., SVRK Prabhakar, J. Romero and N. Matsumoto. 2008. Prospects and Challenges of Biofuels in Asia: Policy Implications. In *Climate Change Policies in the Asia-Pacific: Re-uniting Climate Change and Sustainable Development.*Hayama. Japan: Institute for Global Environmental Strategies (IGES). 105-131.

Institute for Global Environmental Strategies (IGES). 2011. CDM in Charts. September version 15.

International Energy Agency. 2010. Sustainable Production of Second-Generation Biofuels: Potentials and perspectives in major economies and developing countries. *Information Paper*. February. Paris.

_____. 2011. *Technology Roadmap: Biofuels for Transport*. Paris.

Kant, P. and S. Wu. 2011. The Extraordinary Collapse of Jatropha as a Global Fuel. *Environmental Science and Technology*. 45, 7114-7115.

Lancaster, R. 2010. Can the carbon market unlock the potential for biofuels to reduce emissions or are there too many unanswered questions clouding the sector? *Point Carbon*. September. 18-20.

OECD-FAO. 2011. *OECD-FAO Agricultural Outlook 2011 – 2020.* Paris: OECD. Available for download at www.agri-outlook.org

Roundtable on Sustainable Biofuels (RSB). 2010. *RSB Principles & Criteria for Sustainable Biofuel Production (Version 2)*. Available for download at http://rsb.epfl.ch/files/contents/sites/rsb2/files/Biofuels/Version%201/PCs%20V2/11-03-08%20RSB%20PCs%20Version202.pdf

Sano, D., J. Romero and M. Elder. 2011 (forthcoming). Jatropha Production for Biodiesel in Yunnan, China: Implications for Sustainability at the Village Level. In *Socio-Economic and Environmental Impacts of Biofuels: Evidence from Developing Nations.* Cambridge: Cambridge University Press.

Sekinger, F. 2011. From PoA to NAMA. *Carbon Bazaar 2011*. New Delhi, India. 12-13 May 2011.

Appendix 1. Overview of biofuel blending targets and mandates

Country/Region	Current mandate/target	Future mandate/target	Current status (mandate [M]/target [T]
Argentina	E5, B7	n.a.	M
Australia: New South Wales (NSW), Queensland (QL)	NSW: E4, B2	NSW: E6 (2011), B5 (2012); Ql: E5 (on hold until autumn 2011	M
Bolivia	E10, B2.5	B20 (2015)	T
Brazil	E20-25, B5	n.a.	M
Canada	E5 (up to E8.5 in 4 provinces), B2-B3 (in 3 provinces)	B2 (nationwide) (2012)	M
Chile	E5, B5	n.a.	T
China (9 provinces)	E10 (9 provinces)	n.a.	M
Colombia	E10, B10	B20 (2012)	M
Costa Rica	E7, B20	n.a.	M
Dominican Republic	n.a.	E15, B2 (2015)	n.a.
European Union	5.75% biofuels*	10% renewable energy in transport**	T
India	E5	E20, B20 (2017)	M
Indonesia	E3, B2.5	E5, B5 (2015); E15, B20 (2025)	M
Jamaica	E10	Renewable energy in transport: 11% (2012); 12.5% (2015); 20% (2030)	M
Japan	500 Ml/y (oil equivalent)	800 Ml/y (2018)	T
Kenya	E10 (in Kisumu)	n.a.	M
Malaysia	B5	n.a.	M
Mexico	E2 (in Guadalajara)	E2 (in Monterrey and Mexico City; 2012)	M
Mozambique	n.a.	E10, B5 (2015)	n.a.
Norway	3.5% biofuels	5% proposed for 2011; possible alignment with EU mandate	M
Nigeria	E10	n.a.	T
Paraguay	E24, B1	n.a.	M
Peru	E7.8, B2	B5 (2011)	M

Philippines	E5, B2	B5 (2011), E10 (Feb. 2012)	M
South Africa	n.a.	2% (2013)	n.a.
South Korea	B2	B2.5 (2011); B3 (2012)	M
Taiwan	B2, E3	n.a.	M
Thailand	B3	3 Ml/d ethanol, B5 (2011); 9 Ml/d ethanol (2017)	M
Uruguay	B2	E5 (2015), B5 (2012)	M
United States	48 billion liters, of which 0.02 bln. cellulosic-ethanol	136 billion liters, of which 60 bln. cellulosic-ethanol (2022)	M
Venezuela	E10	n.a.	T
Vietnam	n.a.	50 Ml biodiesel, 500 Ml ethanol (2020)	n.a.
Zambia	n.a.	E5, B10 (2011)	n.a.

B = biodiesel (B2 = 2% biodiesel blend); E = ethanol (E2 = 2% ethanol blend); Ml/d = million liters per day. *Currently, each member state has set up different targets and mandates. **Lignocellulosic-biofuels, as well as biofuels made from wastes and residues, count twice and renewable electricity 2.5 times towards the target.

Source: IEA, 2011 based on IEA analysis on various government sources. For more information, see also http://renewables.iea.org

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