Biofuels and Bioenergy for an International Market: Perspectives and Priorities

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Biomass 2011 Conference
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U.S. Department of State

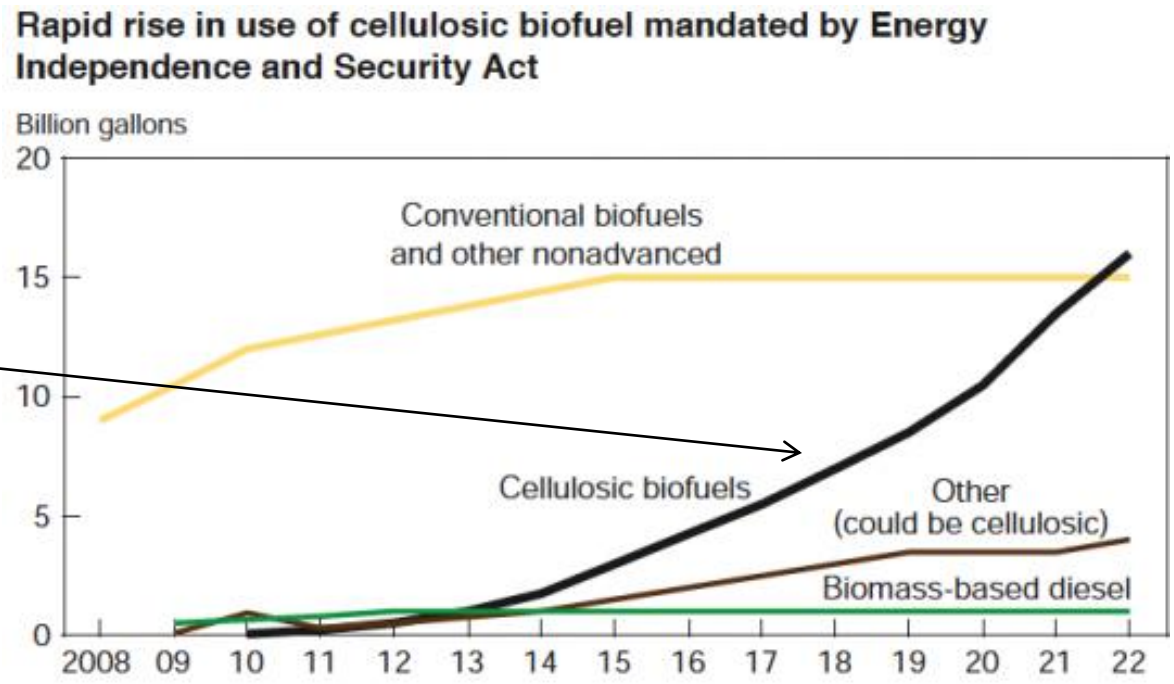
Overview

- A Well-Rounded View
- Key International Considerations
- U.S. Cooperation on Biofuels
  - Why? How? Where? with Whom?
- Technical Assistance Overview & Case Studies
- Multilateral Mechanisms

U.S. Policy Drivers

- USG updates to Renewable Fuel Standards with GHG emissions reduction definitions and volume objectives for advanced biofuels.

Our proposed plan requires rapid growth in advanced biofuels



Source: U.S. Environmental Protection Agency. *Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program: Final Rule*. February 2010.

EPA Sets Renewable Fuel Standard (RFS2) for 2010 Issues Report Card

- **2010 Standards**
- For 2010, EISA set a total renewable fuel standard of 12.95 billion gallons.
- This total volume, presented as a fraction of a refiner's or importer's gasoline and diesel volume, must be renewable fuel. The final 2010 standards are shown in below.

Fuel Category	% of Fuel Req'd to be Renewable	Vol Renewable Fuel (in billion gal)
Cellulosic biofuel	0.004%	0.007
Biomass-based diesel	*1.10%	*1.15
Total Advanced biofuel	0.61%	0.95
Renewable fuel	8.25%	12.95

http://www.epa.gov/oms/renewablefuels/420f10007.htm#5

Biofuel & Feedstock	Energy Balance	GHG reduction
Ethanol from Corn	1.4	20%
Ethanol from Sugarcane	8.0	60%
Cellulosic Ethanol	*6 - *14	*70-*90%
Biodiesel from Rapeseed	2.5	40%
Biodiesel from Soy	3.2	40%

Average Values from Published Literature, *Cellulosic Ethanol Figures are estimates

Benefits of Cooperation

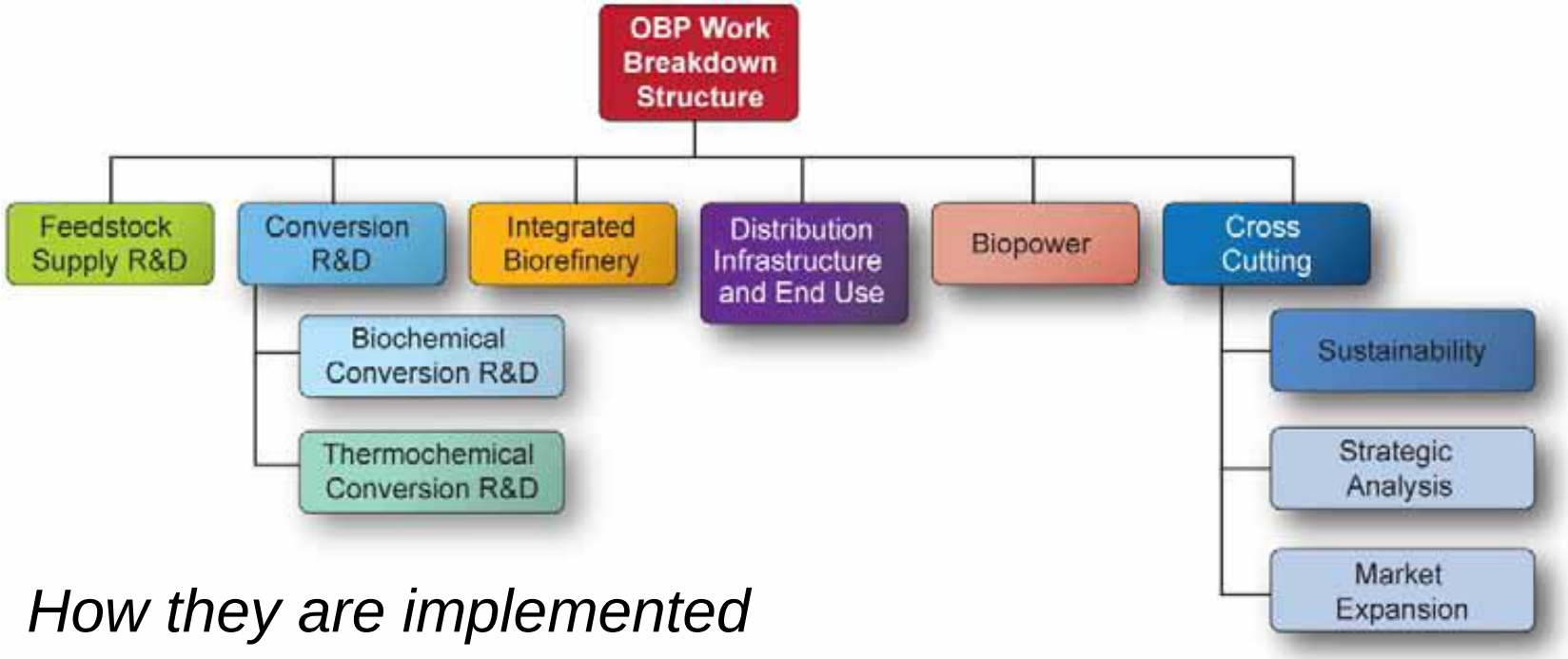
Why is the U.S. engaged in <u>sustainable</u> biofuels cooperation?

- **Relieve Stress on Global Fossil Fuel Demand**
- **Reduce Global GHG Emissions**
- **Encourage Economic Development**

- **Promote Agricultural Productivity**
- **Advance Scientific Dialogues**
- **Facilitate the Sharing of Best Practices**
- **Develop Advanced Solutions that use Non-Food Feedstocks**
- **Advance Alternatives for Aviation**

Deployment Methodology

- *The Priorities for Biofuels and Bioenergy are the same for domestic and international efforts*



- *How they are implemented may be significantly different*

DOE Biomass Program- Multiyear Program Plan, April 2011
http://www1.eere.energy.gov/biomass/pdfs/mypp_april_2011.pdf

Key Drivers for Bioenergy at the National Level

A healthy industry relies on critical priorities

- Economic Viability
- Market Demand
- National Policies & Regulatory Framework
- Domestic Context & Sensitivities
- Sustainability

Key Economic & Trade Considerations for Global Bioenergy

Bioenergy and Biofuels in an international market are subject to important, yet complicated variables:

- Variability of Foreign Exchange Rates
- Weather Impacts on Agricultural Output
- Volatility of Inputs (oil, energy, fertilizer)
- Harmonized Measurement Standards & Codes
- Supply and Demand Trends
- Regional Priorities (food, water, electricity, fuel)
- Sustainability Framework and/or Requirements
- Trade Policy

Key International Collaborations

U.S. Bilateral

- **Brazil**
- **Canada**
- **China**
- **European Union**
- **India**
- **Israel**
- **Japan**
- **Mexico**
- **Many Others**

Trilateral & Development Outreach

Multilateral

- **GBEP – Global Bioenergy Partnership** – Sustainability Task Force
- **UN IBF – International Biofuels Forum** – Biofuels Standards
- **APEC – Asia-Pacific Economic Cooperation** – Energy Working Group: Biofuels Task Force
- **MEF – Major Economies Forum** on Energy and Climate – Technology Action Plans (TAP), Bioenergy
- **ECPA – Energy and Climate Partnership of the Americas**
- **IEA- International Energy Agency** – Work Groups, Implement'g Agreements
- **Others**

U.S. Brazil MOU to Advance Cooperation on Biofuels

- **US-Brazil MOU to Advance Cooperation on Biofuels**
  - **Bilaterally**
    - **Joint Development on Sustainability Analyses of Biofuels Production**
    - **Joint Development on R&D of Next Generation Biofuels**
    - **Joint collaboration with advanced biofuels private sector**
    - **Partnership for the Development of Aviation Biofuels**
  - **Multilaterally**
    - **Harmonize Standards to permit expansion of Global Biofuel Market**
    - **Advance the Global Dialogue on Biofuels Sustainability**
  - **Trilaterally**
    - **Assisting 3rd countries in Central America, the Caribbean & Africa**
    - **Policy Development & Assistance**
    - **Technical Assistance to Encourage Development of Domestic Production Capacity for Domestic Consumption**

US-Brazil Joint Study on GHG Emissions

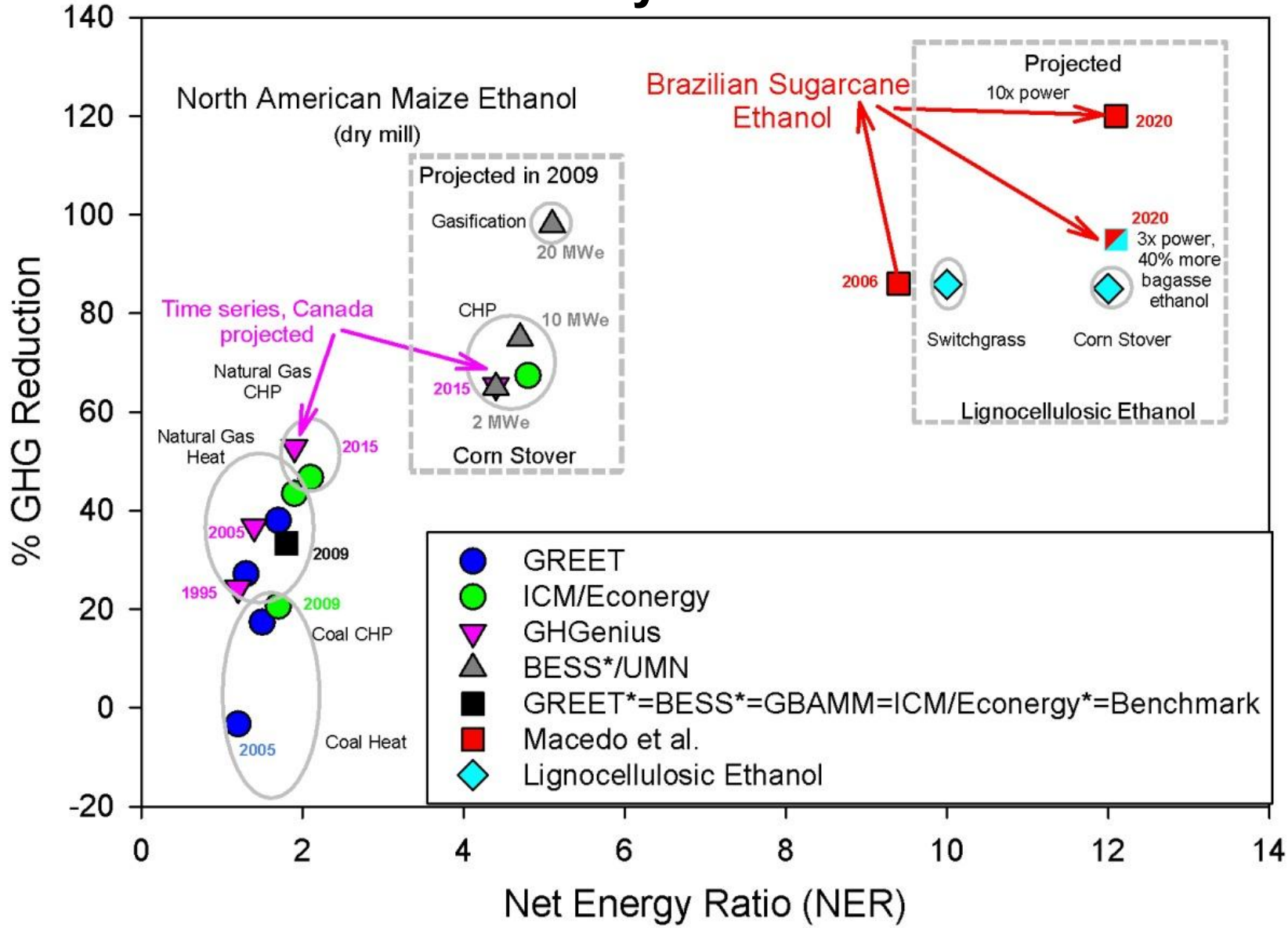


Figure1: GHG reductions from gasoline emissions for ethanol production as a function of the net energy ratio (absent land use change) in the Brazil,[a] Canada,[b] and U.S.[c] using system expansion methodology for coproducts and indicating methodological results' agreement for maize ethanol[d] and projected values for lignocellulosic ethanol.

US-Brazil MOU for Biofuels Cooperation

U.S.A.

Brazil

Participating Partners:

- **International Organizations**
  - **Organization of American States (OAS)**
  - **InterAmerican Development Bank (IDB)**
  - **UN Foundation (UNF)**

- **Third Country Partners**
  - **Dominican Republic**
  - **El Salvador**
  - **Guatemala**
  - **Haiti**
  - **Jamaica**
  - **Honduras**
  - **St. Kitts & Nevis**
  - **Senegal**
  - **Guinea-Bissau**

Outreach Examples
Select technical support from recent efforts

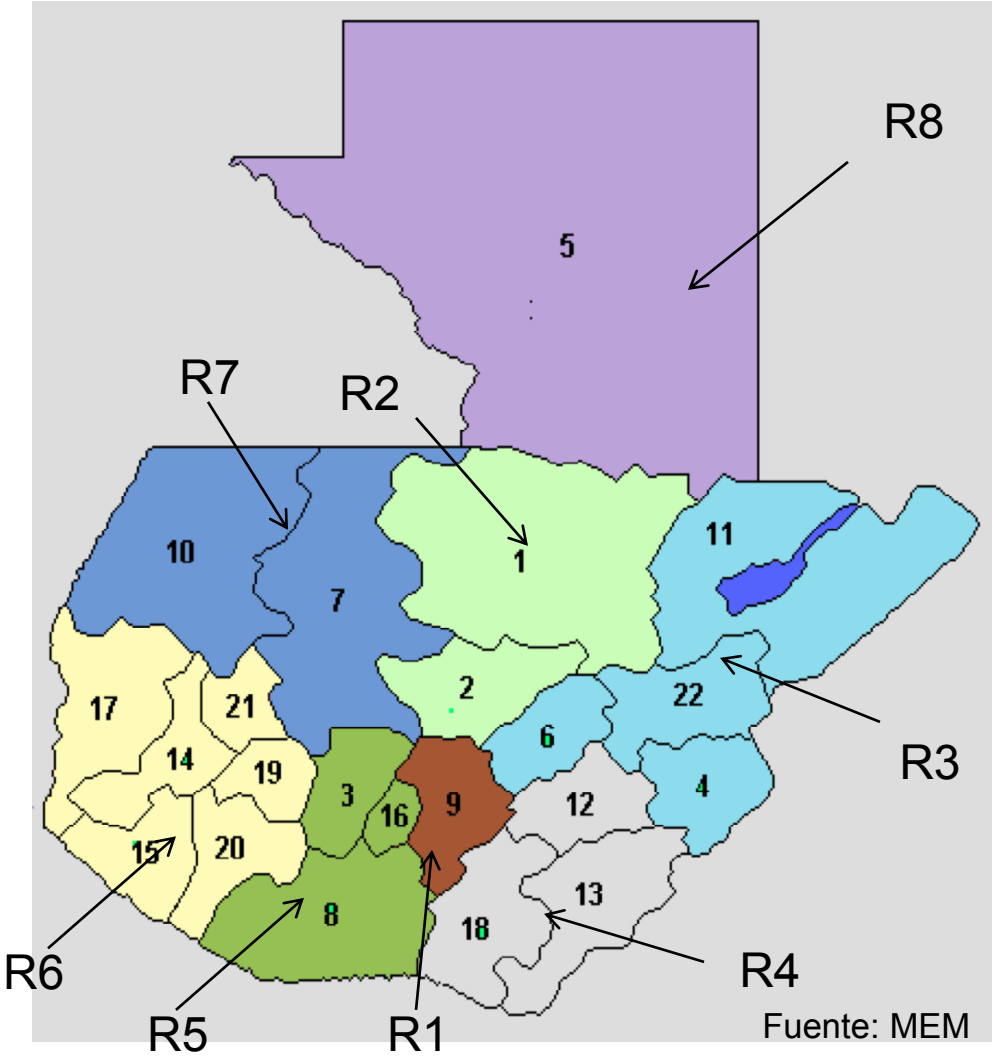
- ***Guatemala*** *(OAS, Hart Energy, Getulio Vargas Foundation- FGV)*
  - Assess biofuels policy development, encourage implementation
  - Address infrastructure requirements

- ***El Salvador*** *(OAS, Winrock, ESG, Arkel/Delta, FGV)*
  - Support drafting of biofuels legislation, implementation strategy
  - Demonstrate economic benefits to small farmers
  - Allay concerns over environment and food impact

- ***Senegal*** *(UN Foundation, ESG, UEMOA, FGV, ECOWAS)*
  - Assess biofuels feedstock potential in regional context
  - Perform Agroeconomic and policy analysis
  - Evaluate best use of biomass (biopower vs. biofuels)
  - Develop phase II strategy for future support

Mercado de destilados en Guatemala

Análisis regional



Región	% consumo	Estac. Servicio
I	24.7%	310
V	11.9%	150
VI	24.8%	311
VII	10.4%	131
III	10.5%	132
IV	9.4%	118
II	4.2%	53
VIII	4.1%	51
Total	100%	1256

36.6% Guate-Mala y Escuintla

35.2% Occidente

19.9% Oriente

8.3% Norte (Petén y Verapaz)

- Número alto de estaciones de servicio per cápita
- Casi el 72% de las estaciones de servicio y el consumo se encuentran en las partes central y occidental del país, cerca a los puertos y zonas cañeras
- En esta zona se encuentra la mayoría de las estaciones de marca
- Esto permitiría una introducción de biocombustibles en forma regional

Ley actual de Biocombustibles en Guatemala
Comparación con las de otro países

Objetivos	Argentina	Brazil	Colombia	Costa Rica	Guatemala
	Ley 26.093	Decreto 76953	Ley 693	Decreto 31807	Ley 17-85
	Mayo-06	Dic-75	Sept-01	Feb-03	Feb-85
Meta	Estimular economías regionales, reducir importación de combustibles	Aumentar la independencia energética, estimular el sector de agricultura	Reducir la contaminación, estimular creación de empleos, desarrollar el sector agrícola	Proteger sector agrícola y proteger medio ambiente	Fomentar inversión en la agroindustria, crear nuevos empleos
Organizaciones involucradas en la implementación de la ley	Comisión Nacional (Ministerios de Energía, agricultura, Comercio, otros)	Comisión Nacional de Alcohol (Ministerios de Finazas, Agricultura, Industria y Comercio, Minas y Energía y del Interior)	Programa coordinado por ministerios de Energía y Minas, y Medio Ambiente	Comision Tecnica (Ministerios Agricultura y Ganaderia, Ambiente y Energia, RECOPE, LAICA (cañeros))	Comisión Técnica (Ministerios Energía y Minas, Finanzas) Nueva Dirección General de Fuentes Renovables de Energía en MEM
Establece mandato (nivel de mezcla)	Si (mezcla minima de 5 vol%)	Si (se establece en función de producción esperada)	Si (MEM lo determinará en el futuro)	Si (el Poder Ejecutivo lo establecera en el futuro)	Si (mezcla mínima de 5 vol%)
Implementación nacional	Si	No	No	Si	Si
Control del mercado	Cuotas de producción, precios fijos	Competencia abierta	Competencia abierta	RECOPE responsable de suministro	Cuotas anuales de producción y precios fijos
Establece precios, impuestos, incentivos y sanciones	Si	Si (precios , programas de financiamiento)	No (rigen leyes normales de commercio)	No	Si (mecanismo para fijar precios, tasa de producción)

Guatemala Study Key Findings: Biofuels Production

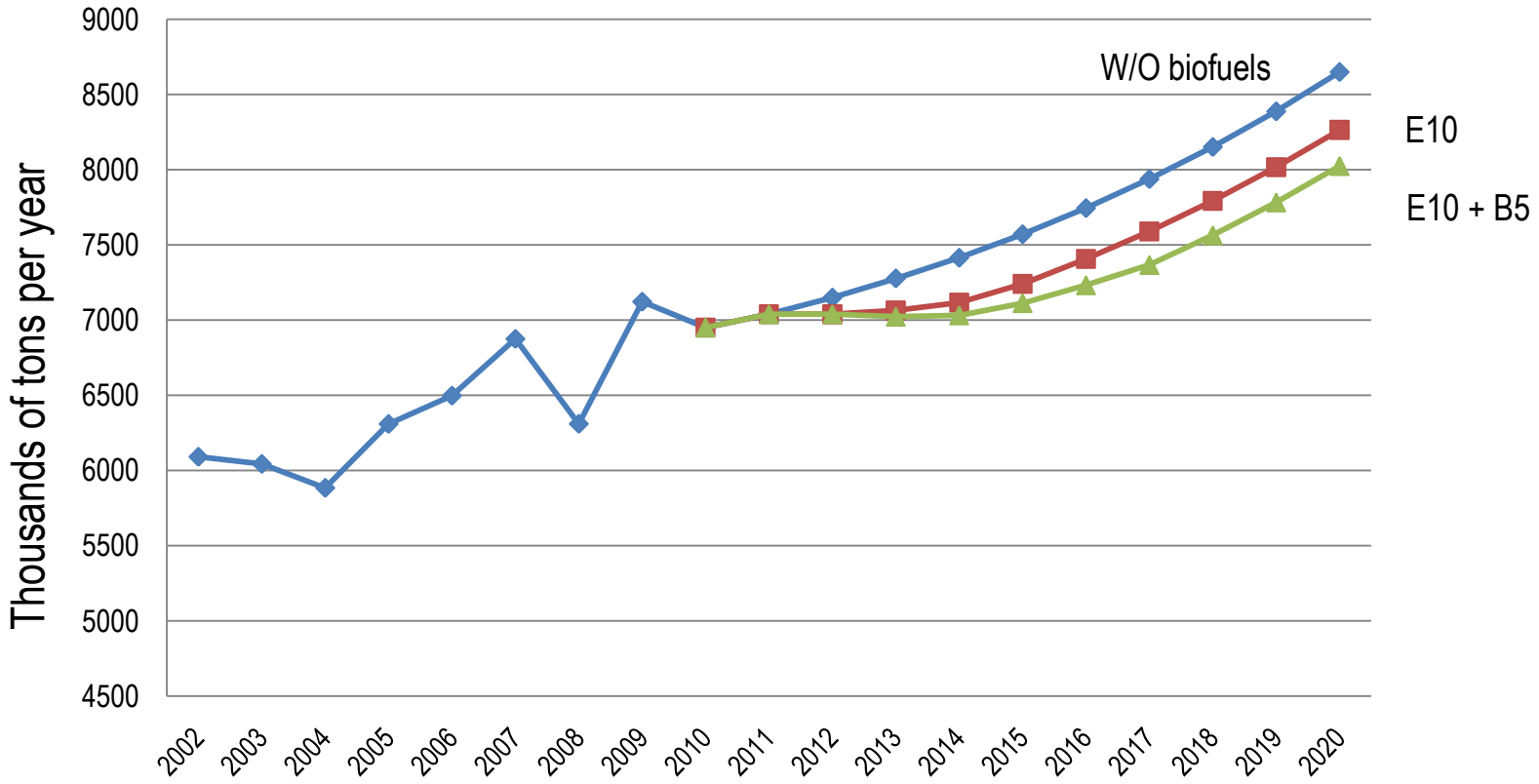
Biofuels Production Required (million liters)

	E10	B5
2010	125.08	73.70
2015	138.24	79.39
2020	161.50	89.13

Source: Hart Energy

- Biofuels could replace fuel imports of 250 million liters per year.
- Current ethanol production around 200 million liters per year; will increase by 69 million liters in 2011.
- Current biodiesel production around 2.84 million liters (for use in private fleets)

Guatemala Study Key Findings: Reduction in Greenhouse Gas Emissions



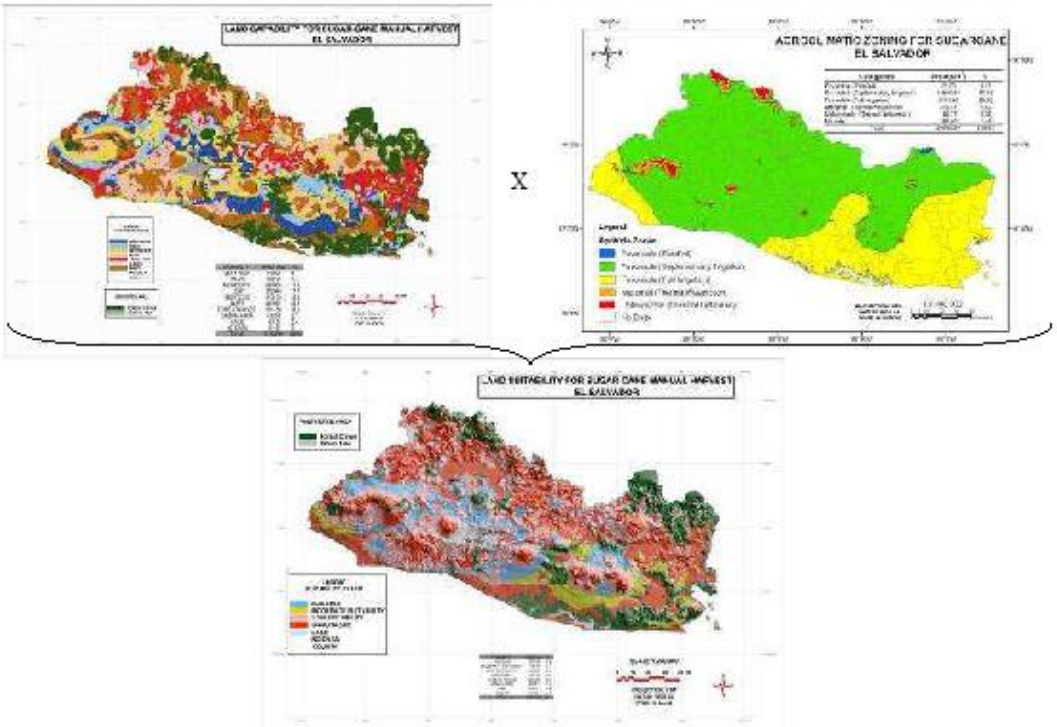
Source: Hart Energy

- Implementation of E10 could reduce GHG emissions by 380,000 tons of CO_2 per year.
- Implementation of B5 could reduce GHG emissions by 240,000 tons of CO_2 per year.

Technical Assistance Study: EL SALVADOR

Land Capability & Agroclimatic Zoning for Sugarcane

Proceso de combinación de mapas para generación del mapa de aptitud de la tierra - El Salvador



Ejemplo: Aptitud de tierras para caña de azúcar recolectada manualmente en El Salvador

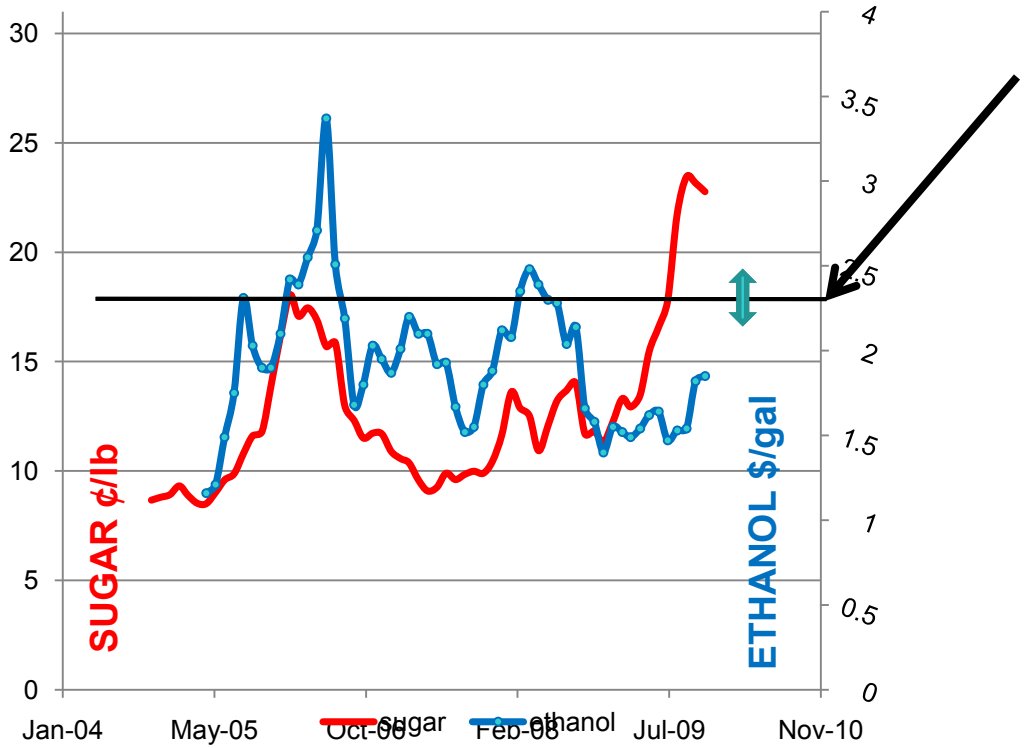
Studies Assess

- Water
- Soil
- Climate
- Feedstock
- Ecological Impact
- Economic Viability
- Logistics
- Infrastructure
- Policy Context

This study showed a GHG reduction of 82,000 tons/yr or 4.7% by implementing an E10 blend from domestically produced sugarcane ethanol

Room enough for Both

Sugar and Ethanol



- ***A horizontal break-point line concept helps identify when conditions are economically favorable for a given end-use***

- ***Market conditions will change constantly, but both sugar and fuel ethanol will maintain strong support***

Technical Assistance Study: SENEGAL

SENEGAL AT A GLANCE:

Population: 12,853,259 (2008)

Urban population: 51%

Rural population: 49%

Human Development Index: 0.499 (2005)

Electricity Access: 42%

GDP per capita: $1,700 (2007)

Major Agricultural Crops: peanuts, millet, maize, sorghum, rice, cotton, tomatoes, green vegetables; cattle, poultry, pigs; fish

% of Land under Cultivation: 0.24% (2005)

Oil production: 0 bbl/day (2005)

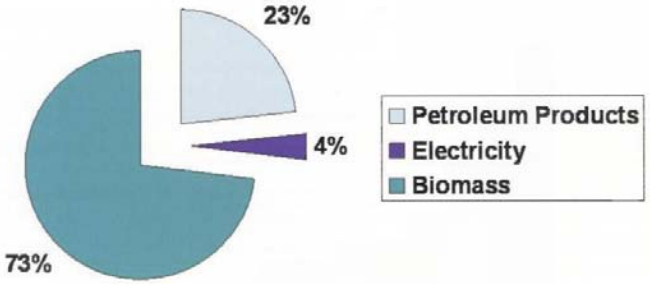
Oil consumption: 35,000 bbl/day (2005)

Oil imports: 37,180 bbl/day (2004)

Analysis of Key Country & Regional Metrics, Potential for Renewable Biomass

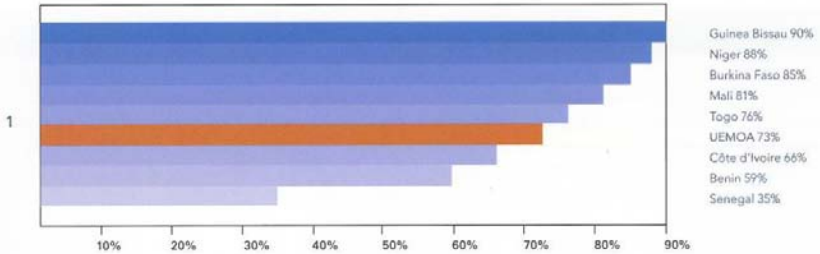
Biomass Share of Energy Matrix

Figure 4-1: Distribution of End-Use Energy Consumption in the UEMOA Zone



Source: IEA, 2005 and SIE, 2005 (Senegal, Niger, Togo).

Figure 4-2: Biomass in Energy Consumption, 2005



Source: IEA, 2005 and SIE, 2005 (Senegal, Niger and Togo).

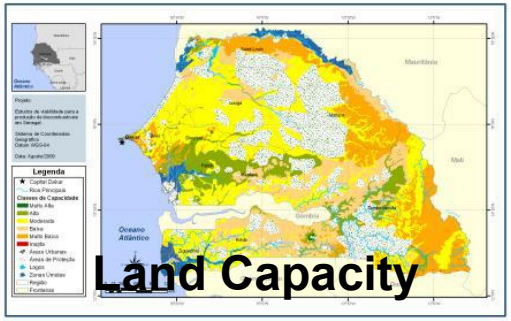
A key issue confronting the UEMOA countries is deforestation. The combination of poverty and population growth is taking a toll on the forests in the region, as deforestation is primarily due to human settlement, agricultural expansion, and the use of wood for cooking. Overall, the average deforestation rate[3] was 1.25% per year for all UEMOA member countries over the period 2000 to 2005. This is in sharp contrast to the annual deforestation rate for Africa as a whole of 0.62% per year. However, Togo had a much higher annual deforestation rate of 4.5%. At the other extreme is Côte d'Ivoire, which had a 0.1% reforestation rate.

Study citesDeforestation as a key issue in the region. Sustainable biofuels can help alleviate some of this concern, provided trees are not removed to cultivate.

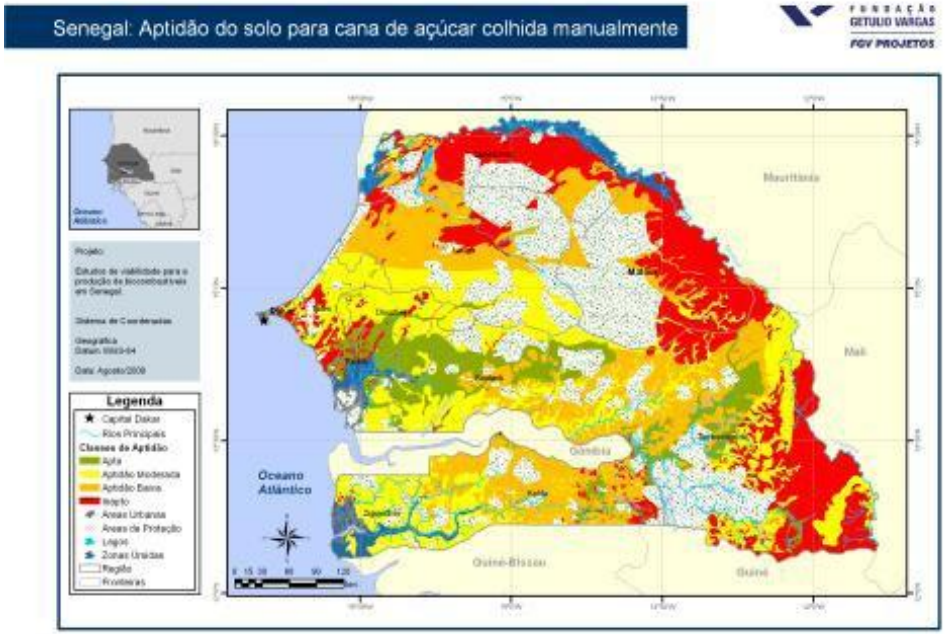
2.5.4 Agricultural Suitability

Agricultural suitability is defined as the combination of **land capacity combination with agroclimatic zoning** of each crop chosen for biofuel production. Outputs are ranked in color coded preference.

Among key crops considered in Senegal were:
Sugarcane, elephant grass, sunflower, eucalyptus, cotton, African palm and Jatropha. Electricity may be a more pressing need than fuel.



Overall Suitability, for a given crop



Business Model & Economic Feasibility

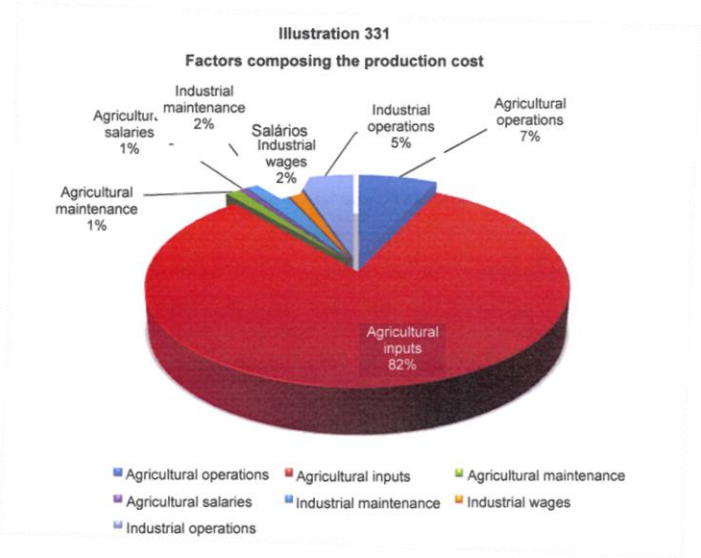
Manual Harvest Sugarcane Ethanol, Senegal

Table 108

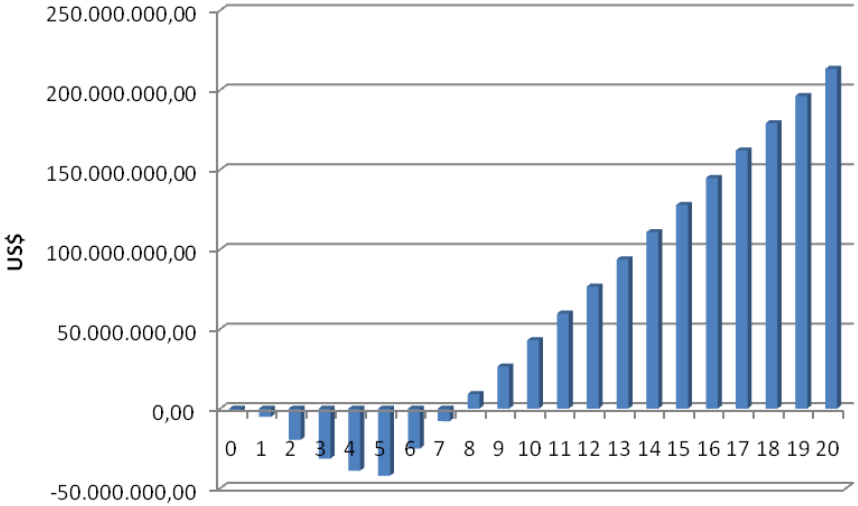
Annual cost of each type of worker of the agriculture part

Position	Minimum Wages	Sum	Months	Total
Field Helper	2	244.64	12	2,935.71
Field Helper Harvest	1	122.32	5	611.61
Head of Topography	4	489.28	3	1,467.85
Agricultural Technician	3	366.96	12	4,403.56
Machine Operators	3	366.96	12	4,403.56
Agronomist	9	1,100.89	12	13,210.68
Agriculture Manager	12	1,467.85	12	17,614.24
General Director	15	1,834.82	12	22,017.80
HR Manager	12	1,467.85	12	17,614.24
Adm. Assistant	6	733.93	12	8,807.12
Secretary	3	366.96	12	4,403.56

Source: FGV Projetos, 2010.



Total Accumulated Results



Experience-Sharing Site Visits

South Florida: August, 2010

Concentrated Solar Power, Florida Power & Light

Sugarcane Research, USDA Field Office

Sugarcane to Ethanol Processing w/ cogeneration Florida Crystals & FIU

U.S.-Brazil Joint Outreach

Bioenergy Site Visits

Brazil: February, 2011

Soy Diesel Production Plant

Brazilian Bioenergy Policy Discussions

E100 & E25 At the Pump

Bioenergy
Site Visits in Brazil

February 7-12, 2011

Sugarcane Processing

Standards Testing & Metrology

Agriculture Field Visit, Cooperative Model

Selected Multilateral Mechanisms in Biofuels

International collaboration is improving the way stakeholders advanced sustainable bioenergy:

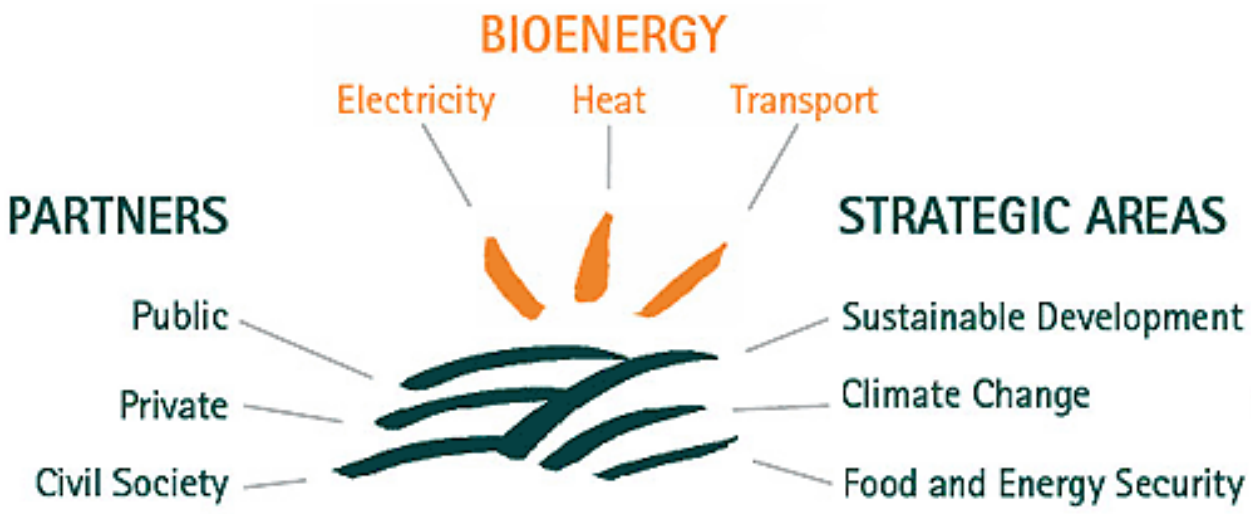
- ***Global Bioenergy Partnership (GBEP)***
  - Sustainability, Methodologies & Capacity Building
- ***International Biofuels Forum (IBF)***
  - Harmonization of Testing & Measurement Standards & Codes
- ***Asia Pacific Economic Cooperation (APEC)***
  - Energy Working Group, Biofuels Task Force
- ***International Energy Agency (IEA)***
  - Renewable Fuels & Second Generation Biofuels Analysis

Global Bioenergy Partnership (GBEP)

GBEP brings together public, private and civil society stakeholders in a joint commitment to promote bioenergy for sustainable development.

The Partnership focuses its activities in three strategic areas:

- **Sustainable Development**
- **Climate Change**
- **Food and Energy Security**

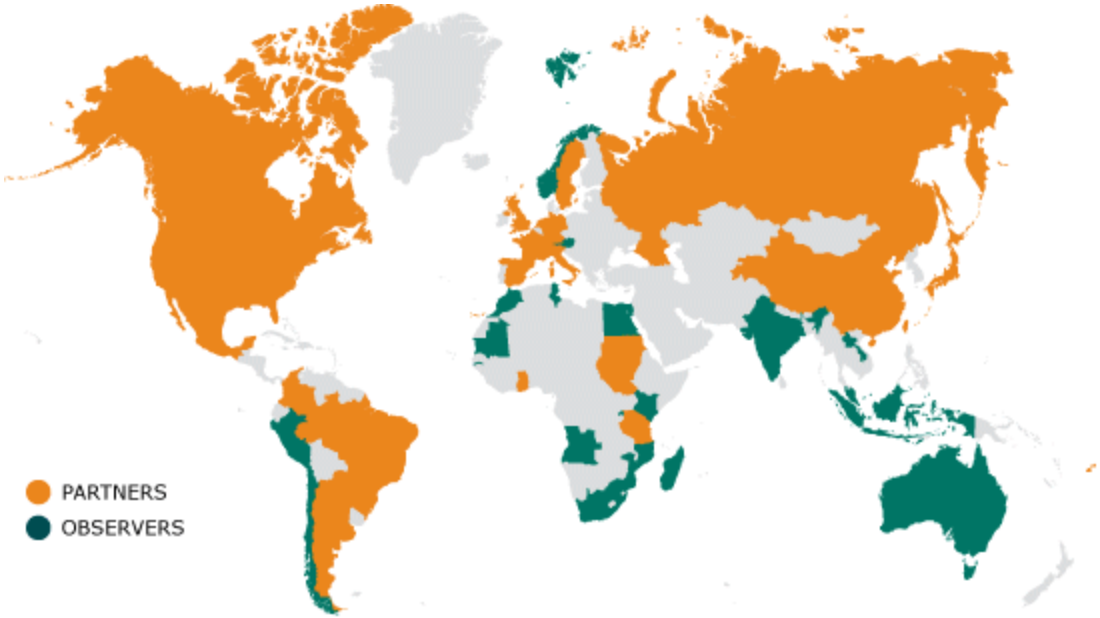


GBEP Partners & Membership

GBEP includes
32 Partners
(21 national governments and
11 organizations) and

29 Observers (21 national governments and 8 organizations):

Argentina
Brazil
Canada
China
Colombia
France
Fiji Islands
Germany
Ghana
Italy
Japan
Mexico
Netherlands
Paraguay
Russian Federation
Spain
Sudan
Sweden
Switzerland
Tanzania
United Kingdom
United States of America



The Partnership brings together public decision-makers, representatives of the private sector, civil society and international agencies with expertise in bioenergy:

Inter-American Development Bank (IDB)
International Energy Agency (IEA)
United Nations Food and Agriculture Organization (FAO)
United Nations Conference on Trade and Development (UNCTAD), Geneva (Switzerland)
United Nations Department of Economic and Social Affairs (UN/DESA), New York (USA)
United Nations Development Programme (UNDP), New York (USA)
United Nations Environment Programme (UNEP), Paris (France)
United Nations Industrial Development Organization (UNIDO), Vienna (Austria)
United Nations Foundation (UNF), Washington D.C. (USA)
World Council for Renewable Energy (WCRE), Brussels (Belgium)
European Biomass Industry Association (EUBIA), Brussels (Belgium)

Global Bioenergy Partnership (GBEP)

GBEP partners are pursuing the following priority areas:

Formulated a common methodological framework for Life Cycle Analysis (LCA) of GHG Emissions from the production of bioenergy

The GBEP Task Force on GHG Methodologies completed the LCA GHG work in 2010. The report may become a useful tool for domestic measurement, reporting and verification set out in the Copenhagen Accord, for bioenergy projects. (initiated 2007, U.S. UN Foundations, numerous others)

Formulate sustainability indicators on the development and production of bioenergy in the developing world

The GBEP Task Force on Sustainability has reached consensus on a set of relevant, practical, science-based, voluntary criteria and indicators as well as examples of best practice regarding the sustainability of bioenergy. (initiated 2008, UK, Italy, Brazil, 20+ others)

Capacity building for sustainable bioenergy

Launched in May, GBEP members are defining future work in promoting capacity-building for sustainable bioenergy.

Asia Pacific Economic Cooperation (APEC)

APEC Energy Working Group: Biofuels Task Force

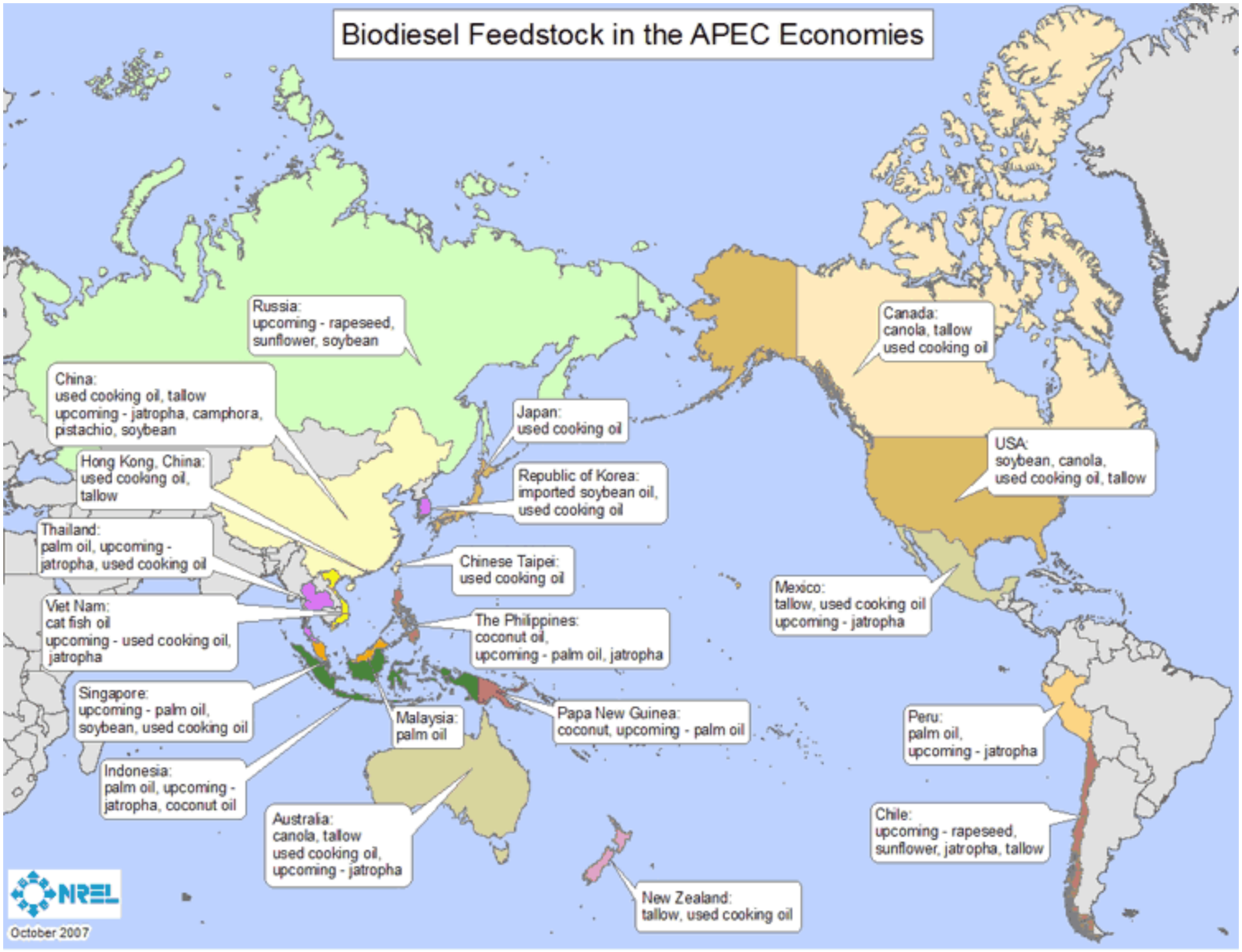
The Biofuels Task Force helps Asia-Pacific Economic Cooperation (APEC) member economies better understand the potential for biofuels to displace oil in transport. It focuses on **joint analysis** of key issues affecting the development of biofuels, such as:

- resources,
- economics,
- infrastructure,
- vehicles, and
- trade opportunities.

The Task force was launched in May 2006.

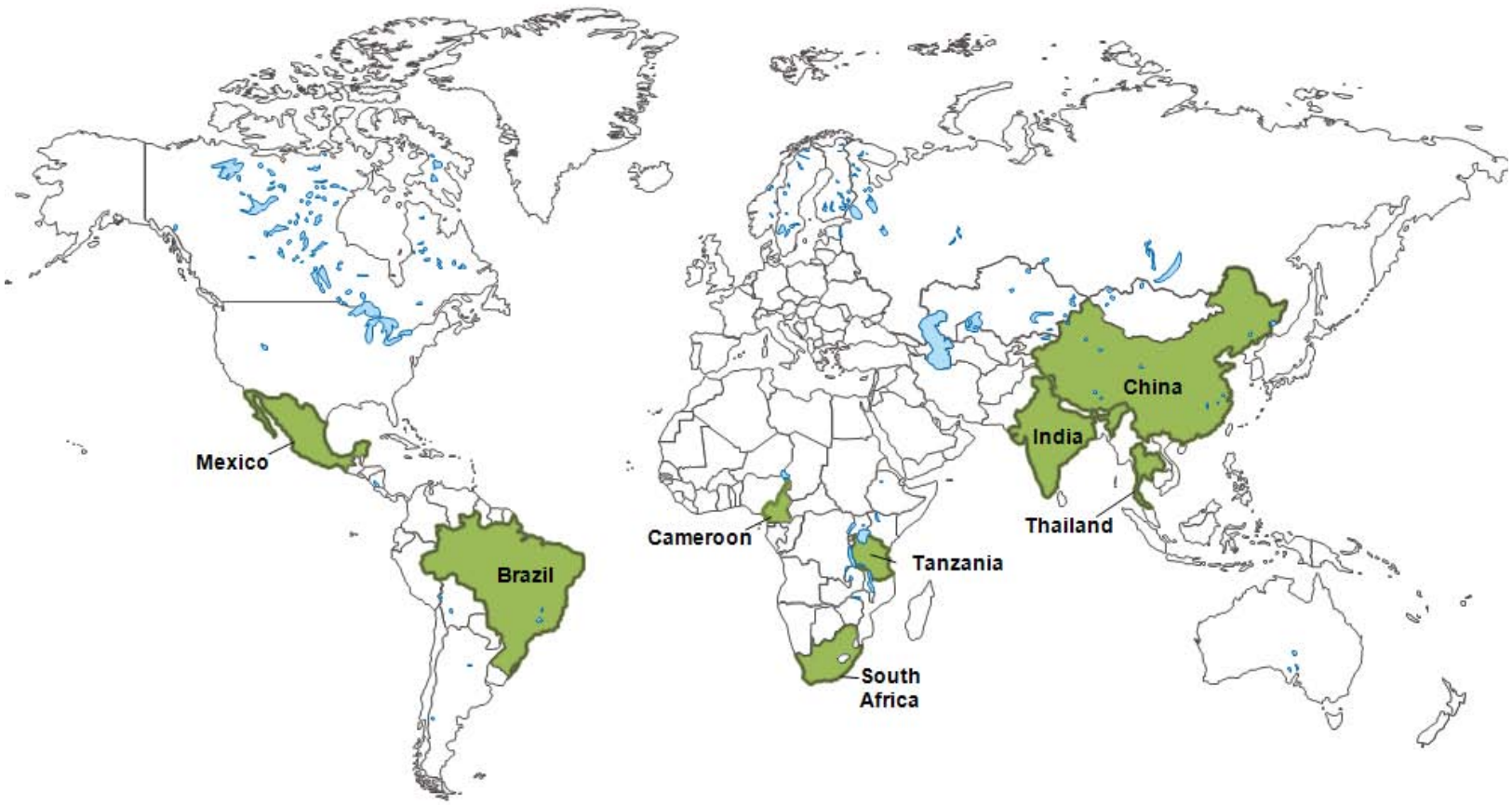
Member economies include: Australia Canada China Chile Hong Kong Indonesia Japan (observer), Korea Malaysia Mexico New Zealand Peru Philippines Russia Thailand, Chinese Taipei, and the United States This list comprises 4/5th of all APEC economies. Brazil is a non-APEC observer. APERC and EGNRET are also represented.

Figure 2. Biodiesel Feedstock in APEC Economies



International Energy Association (IEA)

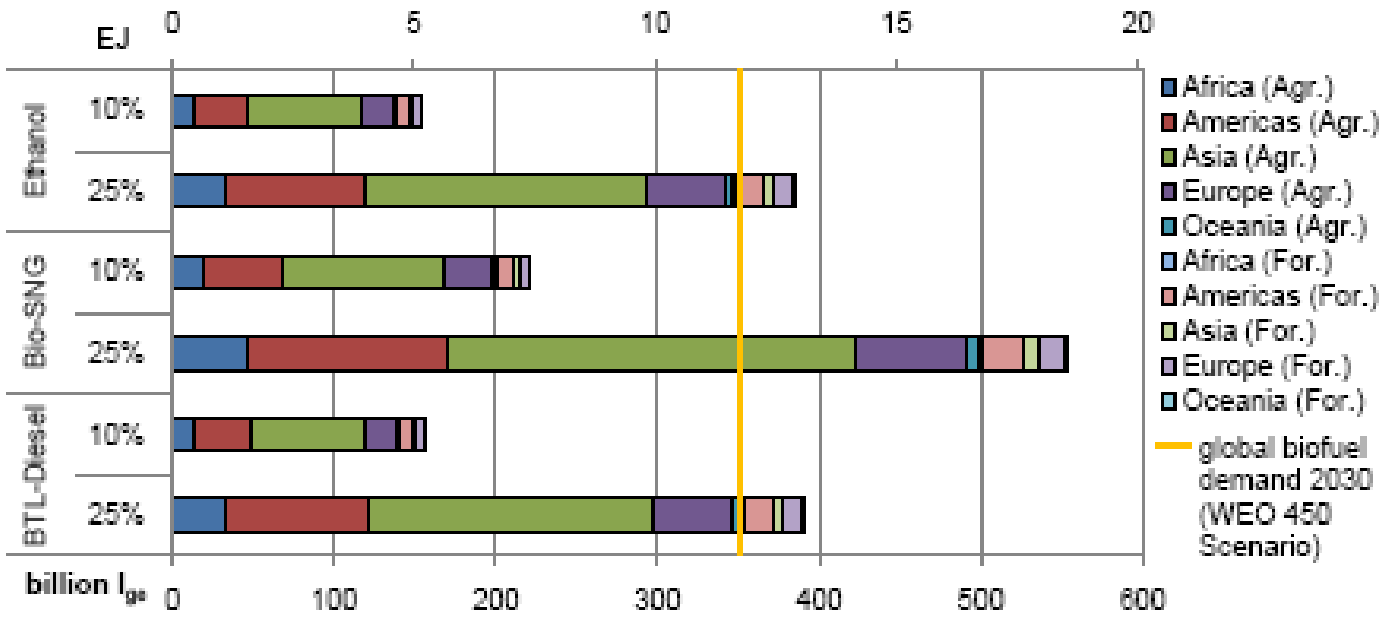
IEA completed a study on the sustainable production of second generation biofuels in February 2010. It offers an insight into the production potential in major economies and developing countries.



International Energy Agency (IEA)

The study focused on the potential contribution from non-food feedstocks such as agricultural and forest residues. The opportunity is enormous, most notably in Asia.

Figure 2. Theoretical second-generation biofuel production from residues in 2030



Amounts cannot be summed up. Each bar indicates biofuel yields using all available residues. "25%" and "10%" assume respective shares of agricultural and forestry residues to be available for biofuel production.

Assumed conversion factors: BTL-Diesel – 217 lge/t_{DM}, Ethanol - 214 lge/t_{DM}, Bio-SNG – 307 lge/t_{DM}

Conclusions

- The U.S. has a deep experience with biofuels both domestically and internationally. There is, however, **no one-size-fits all model** as regional priorities must be considered.
- **International cooperation** can accelerate global development in policies, technology and commercialization.
- Key **challenges**, such as economic viability, food security, sustainability, environmental responsibility and social impact are multifaceted and complex, but
- Key **benefits** include energy security, economic development and reduced environmental impact.
- A more **diversified energy matrix** is a global challenge & opportunity– and sustainable bioenergy has an important role in it.