U.S. Policy & International Perspectives on Biofuels

December 15, 2010
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Overview

- A well-rounded view
- Advantages of Biofuels
- Domestic U.S. Bioenergy Efforts
- An International View and Multilateral Cooperation
- Outreach Examples
  - Guatemala
  - El Salvador
  - Senegal
Key Benefits of Biofuels

Why is the U.S. pursuing sustainable biofuels?

- 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
Energy & Climate Benefits

*Biofuels can represent a sustainable, near term renewable energy solution that have a measurable impact on energy demand and the environment.*

- Biofuels account for approximately 1.5% of global transport fuels. Estimates indicate advances enabled in part by cooperation could approach 9%
- Aviation, Biodiesel, Cellulosic and Algae could be enabling areas of accelerated development
- Cooperation is essential to providing science-based answers to complicated environmental questions
- Examples include recent GHG reduction benefits and energy balance estimates of conventional biofuels
- Multi-disciplined and global perspectives are paramount
Renewable Energy in the U.S.A.

- Biomass as a whole accounts for about 3.5% of our energy portfolio.
- Nearly 8% of transportation fuels in the U.S. are derived from biomass.
- Other renewable resources account for about 7-8% of our energy matrix.

U.S. Renewable Resources: Technical Potential

- Solar PV/CSP: 206,000 GW (PV), 11,100 GW (CSP)
- Wind: 8,000 GW (onshore), 2,200 GW (offshore to 50 nm)

U.S. Renewable Resources: Technical Potential

- Geothermal: 40 GWe (conventional), 520 GWe (EGS), 7.5 GWe (co-produced)
- Hydro-power: >100 GW
- Biopower: 78 GW
Biofuels in the United States

Policy & Market Context:

In 2008, the U.S. produced 9.0 billion gallons of ethanol
In 2009, the U.S. produced 10.6 billion gallons of ethanol

For the past 4 years the U.S. has led the world in ethanol production

The U.S. has about 7 million flexible fuel vehicles on the road

E10 is the Federally established maximum blend in gasoline in standard vehicles
- E10 use is mandated in 10 states
- E10 use is optional in the remaining 40 states
- 2/3 of the U.S. gasoline supply is blended

Studies are pending to evaluate E15 blends in the current fleet
Note: In 2009, approximately 26% of U.S. corn production was used in the production of U.S. ethanol
U.S. Renewable Fuel Standard (RFS2)

- U.S. Government agencies led by DOE and EPA have updated our Renewable Fuel Standards, and included GHG emissions and volume objectives for advanced biofuels.

Our proposed plan requires rapid growth in advanced biofuels
Some 2nd Generation Biomass Feedstocks & Their Common Fuels

- Municipal Wastes
  - Landfill Gas
  - Solid Waste-to-Energy

- Oils

- Energy Crops
  - Corn
  - Soy
  - Sugarcane

- Cellulosic
  - Agricultural Waste
  - Crop by-products
  - Wood, chips, waste

- Aquatic Plants
  - Microalgae
  - Macroalgae
  - Other

- Natural Gases & Methane
- Biodiesel
- Grain Ethanol
- Butanol
- Cellulosic Ethanol
- Syngas Liquids
- Diesel from algae
- Jet fuel from algae
- Biomethane
- Hydrocarbons from Biomass
  - Co-firing
  - Synthetic fuel products

Addressing Technical Barriers & Challenges

*Lignocellulosic Biofuels Case Study: A US Department of Energy (DOE) approach*

- In-depth study of specific technical barriers
  - Biological
  - Chemical
  - Engineering

- “Technology Roadmap”
  - US Gov’t led, multi-year effort
  - Cross-Discipline Support
    - National & University Labs
    - Private Sector Research
    - Independent Consultants
    - International Partners
    - Other Stakeholders

- Determine ways to speed solutions
  - Unlocking the natural cellulosic biological structure
  - Expediting & facilitating research on chemical processing
  - Exploring & Addressing the engineering and commercial constraints
Achieve cost competitiveness and commercialization of cellulosic and other advanced biomass feedstocks and biofuels through:

- applied research,
- next generation pilot scale development,
- commercial scale biorefinery demonstrations and infrastructure activities.

Advanced biofuels that reduce GHG emissions up to 90% compared to gasoline

Advances in enzymes and catalysis Identification and engineering of new microorganisms

Novel agricultural sustainability indicators

Test ethanol blends of above 10%
Eg: Metabolic engineering and iterative development

- Study in genomes of yeast
- Optimization of Ethanol producing strains
- Systems approach may permit multiple variable changes simultaneously
- Evolutionary bio-engineering that permits 5, 10 and 15 year technical milestones

Source: U.S.DOE Biofuels Joint Roadmap, June 2006, with credit to: E. Gasteiger et al., Expasy: The Proteomics Server for In-depth Protein Knowledge and Analysis
Key International Collaborations

U.S. Bilateral
- Brazil
- Canada
- China
- European Union
- India
- Israel
- Japan
- Mexico
- Many Others

Multilateral
- GBEP – Global Bioenergy Partnership – Sustainability Task Force
- UN IBF – International Biofuels Forum – Biofuels Standards
- 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

Trilateral
A few Multilateral Mechanisms in Biofuels

- **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 is working to develop 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**
GBEP is defining future work in promoting capacity-building for sustainable bioenergy.
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 1. Ethanol Feedstock in APEC Economies
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.
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.
## A sample of ethanol blending around the world

<table>
<thead>
<tr>
<th>Country</th>
<th>Blend</th>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>E20-E25</td>
<td>Mandated</td>
</tr>
<tr>
<td>Paraguay</td>
<td>E12</td>
<td>Mandated</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>E10</td>
<td>Mandated (10 states)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optional (40 states)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/3 of supply blended</td>
</tr>
<tr>
<td>Columbia</td>
<td>E10</td>
<td>Mandated</td>
</tr>
<tr>
<td>Jamaica</td>
<td>E10</td>
<td>Mandated</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>E7</td>
<td>Mandated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Blend</th>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>E5–E10</td>
<td>Optional</td>
</tr>
<tr>
<td>Australia</td>
<td>E10</td>
<td>Optional</td>
</tr>
<tr>
<td>China</td>
<td>E10</td>
<td>Ten Provinces</td>
</tr>
<tr>
<td>France</td>
<td>E10</td>
<td>Optional</td>
</tr>
<tr>
<td>India</td>
<td>E5</td>
<td>Mandated</td>
</tr>
</tbody>
</table>

These charts are unofficial and based on second hand sources, and are intended merely to show directional adoption of ethanol fuels. Additionally, many other countries have legislation or policy work pending to address adoption of some blends of biofuels.
U.S. Brazil MOU to Advance Cooperation on Biofuels

US-Brazil MOU to Advance Cooperation on Biofuels

- **Bilaterally**
  - Joint Development on R&D of Next Generation 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 and the Caribbean
  - Policy Development & Assistance
  - Technical Assistance to Encourage Development of Domestic Production Capacity for Domestic Consumption
US-Brazil Bilateral R&D
Recent Efforts

- **Systems Integration and Modeling**
  - Enhance current methods for economic, life cycle, and sustainability analyses of biofuels production pathways and scenarios

- **Lignocellulosic Biofuels Production**
  - Advanced R&D of lignocellulosic biomass biochemical and thermochemical conversion
  - Methodologies of Biomass and Processing Streams Chemical and Spectroscopic Analyses
Figure 1: GHG reductions from gasoline emissions for ethanol production as a function of the net energy ratio (absent land use change) in the Brazil,\textsuperscript{a} Canada,\textsuperscript{b} and U.S.\textsuperscript{c} using system expansion methodology for coproducts and indicating methodological results’ agreement for maize ethanol\textsuperscript{d} and projected values for lignocellulosic ethanol.
U.S.-Brazil Biofuel Standards Activities through their National Metrology Institutes (NMIs)

NIST (U.S.) and INMETRO (Brazil)

are engaged in cooperative development to harmonize test and measurement standards:

- **Certified Reference Materials:**
  - Soy and Animal-based biodiesel (NIST)
  - Anhydrous and Hydrated bioethanol (INMETRO)
  - for **calibrating** measurement instruments to a known and internationally accepted reference
  - for **validating** the accuracy of measurement results and measurement platforms, space and time.
  - US, Brazil, EU are testing biofuels in laboratories worldwide

- **Reference Measurement Methods:**
  - Chemical pattern recognition to identify feedstock source of biodiesel (e.g. soy, rapeseed, animal fat)
Chemical Pattern Recognition to Identify Feedstock Source of Biodiesel

An ESI-MS (electrospray ionization mass spectrometry) technique being developed at INMETRO in Brazil and NIST for providing a fingerprint for categorizing biodiesel by source.
US-Brazil MOU for Biofuels Cooperation

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

- **Trilateral Partner Countries**
  - 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 domestic implementation of policies
  - Address infrastructure requirements

- **El Salvador** (OAS, Winrock, ESG, Arkel/Delta, FGV)
  - Support and advise drafting of biofuels legislation
  - Provide policy 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
  - Develop phase II strategy for future support
• 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
De la producción actual de etanol de 199 millones de litros al año, se exporta principalmente a Europa:
- 22 millones de litros es para uso en automóviles
- 177 millones de litros es para uso industrial
Se espera incrementar la producción a 269 millones en 2011 para capturar oportunidades en EUA. Se requeriría incrementar el 35% de la capacidad para suministrar E10 sin tocar mercados industriales de mayor valor.
Precio de etanol similar o menor a costo de oportunidad de importación de combustibles.

### Biocombustibles –Etanol

<table>
<thead>
<tr>
<th>Nombre</th>
<th>Capacidad instalada (lt/día)</th>
<th>Días de operación</th>
<th>Producción anual estimada (MM litros)</th>
<th>Mercado</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palo Gordo</td>
<td>120,000</td>
<td>155</td>
<td>18.60</td>
<td>Alcohol industrial: Europa, Mexico, local</td>
</tr>
<tr>
<td>Servicios Manufactureros</td>
<td>120,000</td>
<td>300</td>
<td>36.00</td>
<td>Alcohol Industrial: Europa, C.A., Mexico</td>
</tr>
<tr>
<td>DARSA</td>
<td>250,000</td>
<td>300</td>
<td>75.00</td>
<td>Alcohol industrial y carburante: Europa, Mexico, local</td>
</tr>
<tr>
<td>Bioetanol</td>
<td>150,000</td>
<td>155</td>
<td>23.25</td>
<td>Alcohol carburante: Estados Unidos y Europa</td>
</tr>
<tr>
<td>Alcoholes MAG</td>
<td>300,000</td>
<td>155</td>
<td>46.5</td>
<td>Alcohol Industrial: Europa, C.A., Mexico</td>
</tr>
<tr>
<td><strong>Total (2009)</strong></td>
<td><strong>940,000</strong></td>
<td></td>
<td><strong>199.35</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total (2011)</strong></td>
<td></td>
<td></td>
<td><strong>269.00</strong></td>
<td>Nueva planta etanol carburante de Bioetanol de 450 mil lt/d</td>
</tr>
</tbody>
</table>

Fuente: CENGICAÑA, ASAZGUA
### Biocombustibles- Biodiesel, Potencial

#### Capacidad Actual de Producción de Biodiesel

<table>
<thead>
<tr>
<th>Productor</th>
<th>Capacidad Instalada</th>
<th>Materia Prima</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biocombustibles de Guatemala, S. A.</td>
<td>1,500 galones/día</td>
<td>Jatropha Curcas, Aceite reciclado</td>
</tr>
<tr>
<td>Combustibles Ecológicos S. A.</td>
<td>500 galones/día</td>
<td>Aceite reciclado</td>
</tr>
<tr>
<td>Comunidad Nueva Alianza</td>
<td>50 galones/día</td>
<td>Aceite reciclado, Jatropha Curcas</td>
</tr>
<tr>
<td>Empacadora Toledo</td>
<td>1,500 galones/día</td>
<td>Aceite reciclado propio</td>
</tr>
<tr>
<td>Fuerza Verde</td>
<td>50 galones/día</td>
<td>Aceite reciclado</td>
</tr>
<tr>
<td>Guatebiodiesel, S. A.</td>
<td>1,500 galones/día</td>
<td>Aceite reciclado, soya, maíz, girasol</td>
</tr>
<tr>
<td>Helios, S. A.</td>
<td>290 galones/día</td>
<td>Aceite reciclado, Jatropha Curcas</td>
</tr>
<tr>
<td>TecnoServe</td>
<td>250 galones/día</td>
<td>Jatropha Curcas, aceite reciclado, semilla de hule</td>
</tr>
<tr>
<td><strong>Total</strong>*</td>
<td><strong>5,640 galones/día</strong></td>
<td></td>
</tr>
</tbody>
</table>

Fuente: MEM

- Producción actual es alrededor de 750,000 galones (2.84 millones de litros) y se usa en flotillas privadas
- Aproximadamente 4% del nivel necesario para llegar a B5
- Costos de producción mayores a precio de mercado de diesel
- Se ha identificado 600 mil hectáreas subutilizadas no protegidas que se podrían usar para de Jatropha y 740 mil de zonas para Palma
- El programa de biodiesel tendría que ser obligatorio, con apoyos a la producción y con metas a largo plazo
- En las condiciones económicas actuales sólo operan tres
## Ley actual de Biocombustibles en Guatemala
### Comparación con las de otro países

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

La ley se implementará en el territorio nacional según los calendarios de abajo.
Sin embargo, en el caso de etanol existe la posibilidad de una implementación por etapas, en función de la segmentación de la demanda que existe en el país y tomando en cuenta las zonas cercanas a las zonas productoras (El biodiesel se introducirá en el territorio nacional).

Optar por implementación regional podría:
- permitir la oportunidad de cambiar el plan estratégico según el éxito que tenga o no el programa de implementación
- evitar problemas de suministro y de instalaciones
- dar tiempo para solucionar problemas imprevistos

<table>
<thead>
<tr>
<th>Año</th>
<th>Implementación Nacional</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0%</td>
</tr>
<tr>
<td>2012</td>
<td>3%</td>
</tr>
<tr>
<td>2013</td>
<td>6%</td>
</tr>
<tr>
<td>2014</td>
<td>10%</td>
</tr>
<tr>
<td>2015</td>
<td>10%</td>
</tr>
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<table>
<thead>
<tr>
<th>Año</th>
<th>Implementación Nacional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Año 1</td>
<td>0%</td>
</tr>
<tr>
<td>Año 2</td>
<td>0%</td>
</tr>
<tr>
<td>Año 3</td>
<td>0%</td>
</tr>
<tr>
<td>Año 4</td>
<td>1%</td>
</tr>
<tr>
<td>Año 5</td>
<td>2%</td>
</tr>
<tr>
<td>Año 6</td>
<td>3%</td>
</tr>
<tr>
<td>Año 7</td>
<td>5%</td>
</tr>
</tbody>
</table>
El programa de gasolina con 10% de etanol (E10) podría reducir las emisiones de gases de efecto invernadero en 380,000 toneladas de CO2 por año.

El programa de diesel con 5% de biodiesel (B5) podría reducir las emisiones de gases de efecto invernadero en 240,000 toneladas de CO2 por año.

El total de los programas podría alcanzar una reducción de 620,000 toneladas por año hacia el 2020.
Status & Recent Progress: EL SALVADOR

Objectives:
(1) Promote biofuels (ethanol) policy development for domestic consumption; and
(2) Provide technical assistance for development of domestic production

Completed Tasks:
- Government Consultation
- Definitional Mission (Winrock)
- Evaluation of Biofuels Potential in El Salvador (FGV)
- Technical & Policy Assistance, Market Development (ESG)
- Feasibility Study for Ethanol Production (Arkel/Delta)

Recent Activities
- U.S., Brazil, El Salvador Exchanges November 2009, January, April, June, August 2010
- Phase II IDB Projects: Industrial/Business Development & Agricultural Support
- Bioenergy site visit & strategy session Miami August 2010
Technical Assistance Study: EL SALVADOR

Land Capability & Agroclimatic Zoning for Sugarcane

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 breakpoint 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**
Biomass Share of Energy Matrix

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

- 23% Petroleum Products
- 4% Electricity
- 73% Biomass

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

Figure 4-2: Biomass in Energy Consumption, 2005

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

Liquid Biofuels Assessment

Box 6-3: Assessing Liquid Biofuels in the UEMOA

In 2006, UEMOA's Biomass Energy Regional Program conducted a feasibility study to identify market opportunities, the supply chain, and technological and economic benefits of promoting liquid biofuels in its member countries.

The report found that from a regional perspective, the agricultural production potential for the ethanol sector is very consistent with: (1) the humid areas of Côte d’Ivoire, Guinea Bissau, Benin, and Togo where rain-fed sugarcane, cassava, and cashew tree are cultivated; and (2) the geographical zones around the Niger, Senegal, and Gambia Rivers with intensive irrigation of sugarcane and rain-fed oilseeds such as cotton and jatropha.

Results are highlighted below.

- **Household Fuels.** At 2005 prices, household fuels based on ethanol could not compete with subsidized butane. The price levels of wood and charcoal, on an energy basis, were definitely lower than those of butane, but gel fuel production costs were typically 20 to 30% higher than those of butane. In Senegal and Côte d’Ivoire, however, ethanol could compete with butane gas when subsidies for butane are eliminated or if equivalent subsidies are introduced for ethanol. At today’s fossil fuel prices, ethanol gel may now be competitive.

- **Motor Fuel.** In all countries studied, the production of anhydrous ethanol for use as motor fuel is advantageous. With the exception of Benin and Guinea Bissau, the local production of anhydrous ethanol can compete with gasoline. Feasibility in Benin suffers from illegal import of hydrocarbons from Nigeria, while production costs in Guinea Bissau are based on high raw material costs and low capacity utilization as a result of the limited seasonal availability of cashew fruit. In these countries, modest support measures (e.g., tax exemptions) could render the production of anhydrous ethanol viable. In Côte d’Ivoire, Senegal, Mali, and Burkina Faso, production should be particularly stimulated. These countries with important resources can save on the import of hydrocarbons, especially by developing local resources. Regarding the production of biodiesel in Niger and Togo, preliminary calculations indicate that this fuel can compete with (fossil) diesel. Biodiesel production costs are 5 to 11% less than those of diesel. These costs are highly sensitive to the price of jatropha seeds.

In summary, though ethanol-based household fuels were not competitive with butane in 2005, steep increases in fossil fuel prices since that time may change these results and the figures should be reexamined. Incentives for cleaner-burning fuels such as ethanol gel, and/or elimination of butane and related subsidies, could also change the market dynamics. Other uses of ethanol, such as motor fuels, were competitive in 2005, and should be even more so today. Yet, the countries will need to develop a blending scheme for the ethanol product. Appendix 1 provides economic and price data in more detail.
Land Cover and Infrastructure Maps

Figure 7-2: Land Cover 2000, Africa

Global Land Cover 2000
- Background
- Bare soil
- Cakes
- Closed deciduous forest
- Closed evergreen broadleaf forest
- Closed grassland
- Crops (60%)
- Crops with open woody vegetation
- Deciduous shrubland with sparse trees
- Deciduous woodland
- Degraded evergreen broadleaf forest
- Irrigated croplands
- Mangrove
- Montane forest (>1500 m)
- Mosaic Forest / Croplands
- Mosaic Forest / Savanna
- Open deciduous shrubland
- Open grassland
- Open grassland with sparse shrubs
- Salt hard pans
- Sandy desert and dunes
- Sparse grassland
- Stony desert
- Submontane forest (500 - 1500 m)
- Swamp bushland and grassland
- Swamp forest
- Tree crops
- Waterbodies

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. The outputs are classified and ranked in color coded preference.

Among key crops considered in Senegal were: Sugarcane, elephant grass, sunflower, eucalyptus, cotton, African palm and Jatropha.

Overall Suitability, for a given crop

Land Capacity

Agroclimatic Zoning
Business Model & Economic Feasibility
Manual Harvest Sugarcane Ethanol, Senegal

Table 108
Annual cost of each type of worker of the agriculture part

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<th>Position</th>
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<th>Months</th>
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</tbody>
</table>


Total Accumulated Results
Conclusions

- The U.S. has a deep experience with biofuels both domestically and internationally. There is, however, no one-size-fits all model.

- Appropriate international cooperation can accelerate global development in technology and commercialization. The third country biofuels efforts are a tangible example of this.

- Taken in full context, with sensitivity to regional priorities and constraints, sustainable biofuels contribute to energy security, economic development and reduced environmental impact.

- The challenges, such as economic viability, food security, sustainability, environmental responsibility and social impact are multifaceted and complex, but the benefits are rewarding.

- A diversified energy matrix can include sustainable biofuels for a large portion of the world. This benefits everyone!