This presentation focuses on biofuels for transport

- Main biofuels:
  - Ethanol
  - Biodiesel

- This presentation will not focus on biomass more generally
Potential Benefits of Biofuels

- Energy Security
- Economic Development
- Poverty Reduction
- Greenhouse Gas Emissions Reduction

Policy Choice: Energy Security & Other Goals vs. GHG

<table>
<thead>
<tr>
<th>Reduction</th>
<th>Energy Security (&amp; development, poverty reduction) Priority</th>
<th>GHG Reduction Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production location</td>
<td>Promote domestic production (if possible)</td>
<td>Location doesn’t matter</td>
</tr>
<tr>
<td>Trade policy</td>
<td>Protection/tariffs</td>
<td>Free trade</td>
</tr>
<tr>
<td>Environment Policy</td>
<td>Low priority</td>
<td>Strict environmental standards, certification</td>
</tr>
<tr>
<td>Subsidies</td>
<td>To increase production</td>
<td>To support environmental standards</td>
</tr>
</tbody>
</table>

Mark Eber | IGES | http://www.iges.or.jp | IGES公開フォーラム「アジアの地球環境戦略 --IGESの成果と展望」: IGES公開フォーラム「アジアの地球環境戦略 --IGESの成果と展望」の公開中（2007年7月10日）| 1/3 | 2/3 | 3/3 | 4/3 | 5/3 | 6/3 | 7/3 | 8/3 | 9/3 | 10/3 | 11/3 | 12/3 | 13/3 |
Overview of Biofuel Policies and Production in Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>Current BF standards</th>
<th>Current BF production</th>
<th>BF Production targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Allows 3% of bioethanol blend in gasoline and 5% fatty acid methyl esters in diesel oil</td>
<td>Bioethanol 30 kilo liters/year biodiesel 4,000-5,000 kilo liters/year at the end of FY 2005</td>
<td>100,000 – 200,000 kilo liters biodiesel from used oil by 2030</td>
</tr>
<tr>
<td>China</td>
<td>Trial blends of 10% ethanol in several provinces</td>
<td>3 billion liters/year. 3rd largest ethanol producer (2004).</td>
<td>Ethanol 6 million tons by 2010, 15 mil. tons by 2020, and 5 mil. Tons biodiesel</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Allows 10% ethanol blend in gasoline and 10% biodiesel in diesel (April 2006)</td>
<td>Annual capacity at the beginning of 2007 about 300,000 tonnes.</td>
<td>(Both) Committed 6 million tonnes annually of crude palm oil for biodiesel manufacture</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Requires 5% palm oil in diesel (April 2007)</td>
<td>Annual capacity of 300,000 tonnes (April 2007).</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>5% ethanol blending is promoted.</td>
<td>Actual total production averages 480,000 liters per day (approx 50% of gasoline)</td>
<td>Gasohol 4 million liters per day</td>
</tr>
</tbody>
</table>

Limitations and Emerging Problems-1

- Biofuels can only replace a small share of fossil fuel consumption
  - International Energy Agency estimates biofuels could account for 7% of world road fuel by 2030 under optimistic assumptions.
  - Even 2nd generation cellulosic biofuel might reach 25% of world energy needs in 20 years (Food and Agriculture Organization)
Limitations and Emerging Problems—2

- Price increases for food
  - Tortillas in Mexico
  - Pork in China (due to higher feed costs)
  - Flour in Japan
- Water shortages
- Deforestation by expanded palm oil production
- Threats to biodiversity (from large plantations)
- Agricultural pollution (land degradation, water pollution)
- Air pollution (Nitrogen Oxide (NOX) from biodiesel)

Greenhouse Gas Reduction Potential

Varies widely depending on evaluation method and:
- type of biofuel (biodiesel is better than bioethanol)
- production method
- feedstock

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>GHG Reduction Potential (in optimum conditions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn ethanol E10</td>
<td>-1 ~ -2%</td>
</tr>
<tr>
<td>Corn ethanol E85 (85% biofuel)</td>
<td>-14% ~ 23%</td>
</tr>
<tr>
<td>Soybean biodiesel</td>
<td>-41% ~ -78%</td>
</tr>
<tr>
<td>Sugar ethanol, waste cooking oil, cellulose bioethanol</td>
<td>-80% ~ -96%</td>
</tr>
</tbody>
</table>
Greenhouse Gas Reduction Potential

Lower cost production methods may not be environmentally sustainable

- Example: low cost biofuel production methods may include burning tropical rainforests, or using peatlands to create large scale plantations

- These methods may actually significantly increase GHG emissions

Policy Implications

- Need careful consideration of environmental effects of policies
  - Especially biofuels based on agricultural feedstocks
- Biofuels still need subsidies
  - Should pay for environmental sustainability
  - Not environmentally unsustainable production
- Next generation cellulosic biofuels are more promising, especially waste-to biofuels
  - Wait for research results
- Develop sustainable production standards, certification
- Capacity development to help farmers produce biofuel crops sustainably
- Don’t forget energy conservation!
Sources - 1

Overview of “Biofuel Policies and Production in Asia” p. 5

Sources - 2

Limitations and Emerging Problems-1, p. 6.
• NOTE: GHG reduction figures related to corn ethanol in the chart on p. 8 represent changes in tailpipe GHG emissions, whereas figures for soybean biodiesel, sugar ethanol, waste cooking oil, and cellulose bioethanol represent changes in lifecycle GHG emissions.

Mark Elder | IGES | http://www.iges.or.jp | IGES公開フォーラム「アジアの地球環境戦略—IGESの成果と展望」2007年7月11日09時00分発表

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