Global Biofuels Outlook: 
*Policy, Market and Technology Trends*

Hart Energy Breakfast Series  
September 6, 2012
Presentation Overview

Petroleum Product Overview
- Regional Product Demand Growth & Share
- Refined Product Market Share

Global Biofuels Overview
- Global Trends
- Global Mandates
- Next Gen Biofuels

Ethanol
- Supply and Demand
- U.S. Ethanol & RFS2
- Brazilian Ethanol Supply & Demand

Biodiesel
- Supply & Demand
- Biodiesel in the EU Countries
- Biodiesel in the Major Producing Countries

Conclusions
Petroleum Product Overview
Regional Petroleum Product Demand Growth
Or...Why Do Biofuels Still Matter?

Asia-Pacific accounts for 54% of 2011-30 growth, China 33% of global growth

Annual percent growth shown above bars

MILLION BARRELS PER DAY

North America: -0.3%
Latin America: 2.0%
Europe: 0.3%
CIS: 2.0%
Asia-Pacific: 2.2%
Middle East: 2.6%
Africa: 2.2%

Refined Product Market Share

Distillate dominates refined product market, accounting for nearly half of refined product growth

Global Biofuels Overview
Global Biofuels Trends and Outlook

- **Biofuels Largely Rely on Food-Based Feedstocks**
  - Biodiesel and renewable diesel prices are forecasted to be uncompetitive with petroleum products and depend on troubled mandates

- **Difficulties in Implementing Far-Reaching Biofuels Programs in the U.S., EU**
  - ILUC is a headache for EU policymakers

- **Brazil Considered the “Linchpin” but Internal Market Uncertainties**
  - Internal market demand and constraints make export volumes cyclical and uncertain

- **Next generation/advanced biofuels largely not available**
  - Technologies still unproven and scale-up has been very slow

- **Despite these constraints: Biofuels consumption will continue to grow!**
  - Ethanol: Strongest growth from Asia Pacific but the U.S. and Brazil remain largest consumers
  - Biodiesel: Strongest growth from Asia Pacific but the EU remains the largest consumer
Latin America: More countries push for mid- and higher level ethanol blends

Africa: Countries beginning to set mandates

Europe: RED implementation, sustainability and GHG savings

Middle East: Ethanol & jatropha R&D projects; algae

Asia Pacific: High variance in blend levels

North America: RFS2, LCFS, intermediate blends

Latin America: More countries push for mid- and higher level ethanol blends

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Europe: RED implem
Next Generation Biofuels Outlook

Hart Energy projects less than 800 million gallons commercial-scale production by 2020 in the U.S.

25 operating next generation biofuels pilot/demo plants in the U.S.
- 18 cellulosic ethanol plants with capacities ranging from 1,600 gallons to 1.5 million gallons per year
- 5 FT or HVO renewable diesel plants: undisclosed to 0.07 gallons to 5 million gallons per year
- 2 for biogasoline or biojet

2 operating commercial plants in the U.S.
- Gevo: 18 million gallons per year of butanol
- Dynamic Fuels: 18 million gallons per year of HVO renewable diesel
Evolution of Next Gen Potential Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Pilot/demo</th>
<th>Commercial</th>
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<tbody>
<tr>
<td>2010</td>
<td>Biobutanol</td>
<td>FT Liquids / Hydrocarbons</td>
</tr>
<tr>
<td>2011</td>
<td>Cellulosic Ethanol</td>
<td>Methanol</td>
</tr>
<tr>
<td>2012</td>
<td>Hydrogenated vegetable oil / animal fat</td>
<td>Synthetic gasoline</td>
</tr>
<tr>
<td></td>
<td>DME</td>
<td>Non FT Hydrocarbon clean diesel, jet fuel</td>
</tr>
</tbody>
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Note: Includes all capacity (operating, under construction and proposed)

Source: Hart Energy’s Global Biofuels Center, June 2012
Ethanol
Global Supply & Demand for Ethanol

Source: Hart Energy's Global Biofuels Center, September 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Region</th>
<th>Supply</th>
<th>Demand</th>
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<tbody>
<tr>
<td>2015</td>
<td>Asia Pacific</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>EU27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>Latin America</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>North America</td>
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Source: Hart Energy's Global Biofuels Center, September 2012
Ethanol in the Major Producing Countries

Ethanol Supply & Demand in 2025

Source: Hart Energy's Global Biofuels Center, September 2012
Iceberg Right Ahead!

U.S. Ethanol Demand and RFS2

2015
2020
2025

Billion Gallons

RFS 2 - Role of E15 & E85

Projected Demand

- RFS 2 - Wet Ethanol
- E10, E15, E85
- E10, E15, limited E85
- E10, Limited E15 & E85 - Hart Energy Scenario
- E10, limited E85
Biodiesel
Biodiesel in the Major EU Countries

Source: Hart Energy’s Global Biofuels Center, September 2012
Biodiesel in the Major Producing Countries

Biodiesel Supply & Demand in 2025

Source: Hart Energy's Global Biofuels Center, September 2012
Conclusions
Conclusions

**Ethanol: No Shortage Until 2025**

- The main ethanol consumer, the U.S., has hit a blend wall and cannot consume more ethanol until E15 penetrates the market. Vehicle fuel economy improvements will drive gasoline consumption down thus reducing even more the ethanol blending potential.
- The Brazilian ethanol market suffers from competition with the sugar industry.
- The EU ethanol market is also limited by blending levels and declining gasoline consumption.
- These factors have led to a reduced ethanol demand and potentially over supply until 2025.

**Biodiesel: Large Deficit Expected Until 2025**

- The use of biodiesel in off-road applications creates a very large demand in the EU27.
- Great uncertainties with regard to the sustainability of available supplies.
- Argentina seen as major potential supplier to the global market, but hurdles seen in the domestic (price setting, taxes) and export markets (export taxes, sustainability).

**Biofuels: Global Demand Equivalent to 5.4% by Energy of Gasoline and Diesel Pool by 2025**

- 60% of the demand is to be met by ethanol.
Thank You!

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