Integrating the Bio-Petroleum Sector

Paul F. Bryan
Vice President – Technology
Chevron Biofuels

Transition to a Bio-Economy –
Risk, Infrastructure and Industry Evolution

Berkeley, California – June 25, 2008

© 2008 Chevron Corporation
The Dimensions of Energy

**Corn:**
- Corn ethanol – 420 gallons per year
  (typical for one acre of land – US Midwest)

**Crude Oil:**
- Global petroleum – 5,000 MMT/year (2007)
  (1,000 barrels per second or 1/3 x Colorado River)
- Oil well – 1,500,000 gallons per year
  (typical for 1.5” pipe – “average” oilfield)
Growth in Renewables – Conventional Crude Oil will not meet consumer demand for motor fuel

Source: U.S. DOE/EIA Energy Annual 2006
Advanced Biofuels Development

Key Components

Large, concentrated supplies of feedstock

2\textsuperscript{nd}-Gen conversion technology

Industrial-scale infrastructure

Plus sustainable business models
Feedstock Challenges

The three most important things in commercial biofuels:

- Feedstock Scale
- Feedstock Cost
- Feedstock Sustainability

Critical Issues:
- Food / feed vs. fuel
- Land availability
- Subsidies
- Water supplies
- Land-use change
- Regulation

Potential non-food sources:
- Wood, pulp, paper waste
- Agricultural waste
- New oilseed crops
- Fast-growing grasses & trees
- Microalgae
Feedstock Supply Chain

Preprocessing

Harvesting

Transportation

Storage

System Integration
Biofuels Conversion Technology

Create technologies to bring biofuels to an industrial scale:

- Hydrolysis & fermentation
- Pyrolysis
- Gasification
- Emerging technology
- Catalytic conversion to transportation fuels
- Supporting technology
Biofuels Products

- **Fuels & blendstocks:**
  - Compatible with storage & distribution infrastructure?
  - Compatible with existing fleet?
  - Compatible in broad blending range with petroleum fuels?
  - Meets consumer expectations for superior performance?
Chevron’s Biofuels Business Unit

Catchlight Energy LLC
- 50/50 JV: Chevron + Weyerhaeuser (one of the world’s largest forest products companies)
  - WY: Feedstock resources & know-how
  - CVX: Products resources & know-how
  - Both: (some) Conversion resources & know-how
- Initial focus on non-food biomass conversion to economical, low-carbon biofuels

R&D Alliances (focused on non-food biofuels):
- National Renewable Energy Laboratory
- Georgia Tech
- UC Davis
- Texas A&M
- “C2B2” (Colorado Center for Biorefining and Biofuels)