Fiscal Year 2010 Budget Request - $2.3 Billion

Note: Bar chart does not include Facilities and Infrastructure ($63), RE-ENERGYSE ($115), Program Direction ($238), and Program Support ($120).
Program Areas & Key Challenges

**Research & Development**

**Feedstock Systems**
- Diverse regional biomass resources
- Yield & price
- Water & fertilizer
- Land use
- Metrics & standards

**Conversion Technologies**

- **Biochemical**
  - Cost & Efficiency
  - Pretreatments
  - Enzymes/yields
  - Fermentation

- **Thermochemical**
  - Cost & Efficiency
  - Gasification Process
  - Fuel Stabilization

**Product Development**
- Fuel purity & cost
- By-products/markets
- Infrastructure compatibility

**Demonstration & Deployment**

**Integrated Biorefineries**
- Integrating process technologies
- Financing
- Technical expertise
- Profit potential

**Infrastructure**
- Transport
- Storage
- Codes & Standards (Blend wall)
- Demand/markets
- Compatibility

**Sustainability**
- GHG emissions
- Water quality
- Land use
- Socioeconomics
- Predictive Modeling
- International
Biofuels Portfolio Diversification

Products Made from a Barrel of Crude Oil in Gallons (2007)

Petroleum

7.27
1.72
3.82
1.76
1.75
9.21
19.15

Jet Fuel Fraction
Diesel Fraction
Gasoline Fraction

U.S. Jet Fuel Outlook
(EIA FY2008 Reference Case for 2030)
• 35 billion gal/yr

U.S. Diesel Outlook
(EIA FY2008 Reference Case for 2030)
• 75 billion gal/yr

Cellulosic ethanol displaces light duty gasoline fraction only. Need heavy duty/diesel substitutes to displace entire barrel.
Biomass-Based Jet Fuel Efforts

- Biomass program is funding a joint effort by NREL, PNNL, and UOP (a Honeywell Company) to characterize fuel characteristics of upgraded pyrolysis oils, including the Jet Blending component.

- The work was promising enough that UOP is continuing their research with internal resources.

- The Department of Energy is exploring advanced biofuels.

August 2 demonstration in hydroplane using 100% biofuel in Boeing jet.
Pyrolysis Oil to Energy & Fuels Vision

Biomass → Fast Pyrolysis → Pyrolysis Oil

Corn Stover

Mixed Woods

Electricity Production

Available Today

Fuel Oil Substitution

Transport Fuels (Gasoline, Jet Diesel)

3-5 Years to complete R&D

Chemicals (Resins, BTX)

Transport Fuels already achieved on lab-scale
Collaboration with NREL, PNNL, UOP
What about Algae?

- Algae can produce more lipids (plant oils) per acre than other plants -- potentially 10x - 50x
  - Lipids are the preferred starting point to make diesel or jet fuel from biomass

- Algae cultivation can utilize:
  - marginal, non-arable land
  - saline/brackish water
  - large waste CO₂ vent resources

- Minimal competition with food, feed, or fiber
Algae are a long-term potential solution – but lots of barriers.