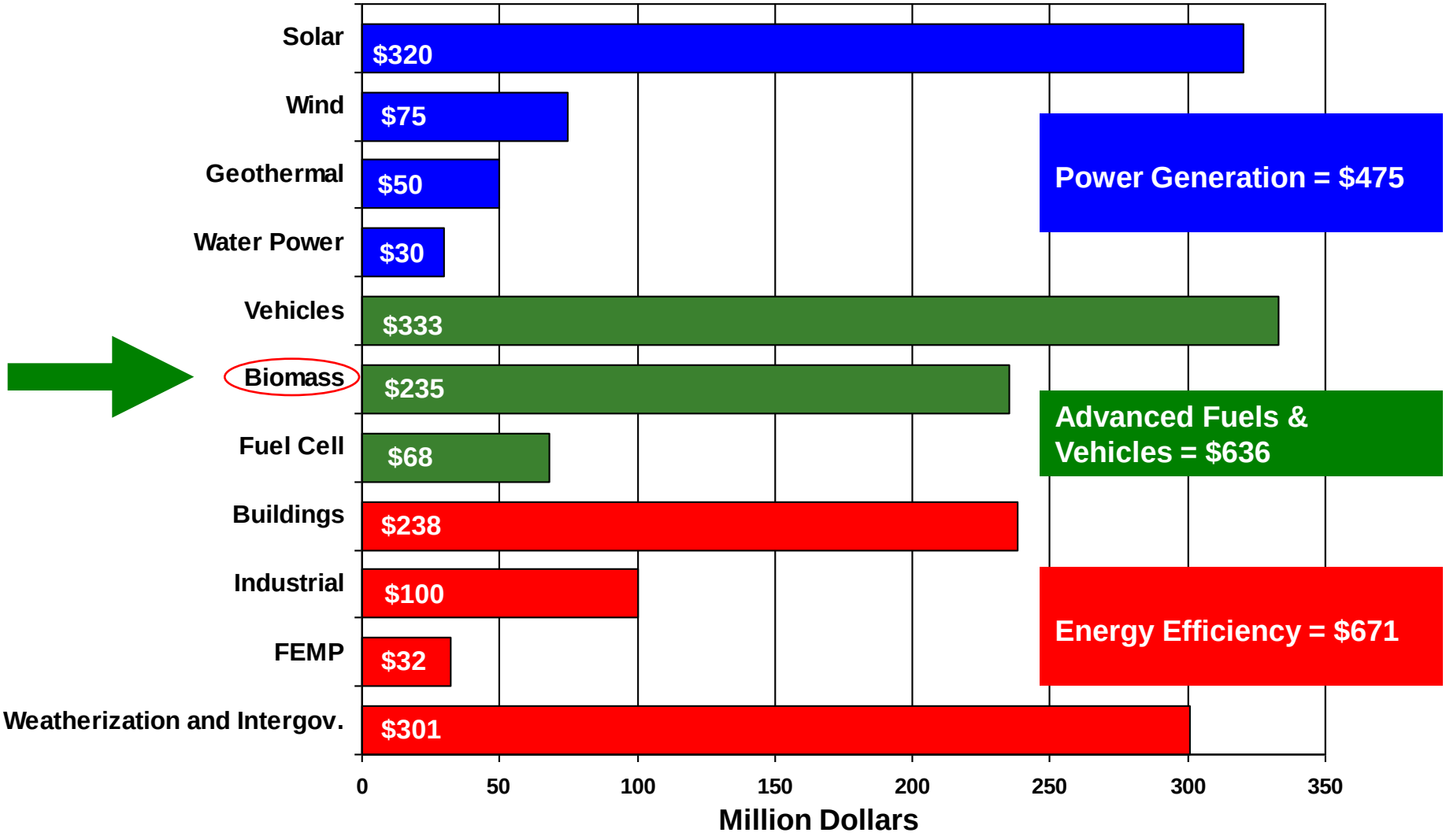
Fiscal Year 2010 Budget Request - $2.3 Billion



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

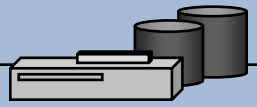
Biochemical

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

Thermochemical

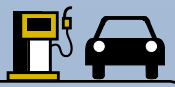
- Cost & Efficiency
- Gasification Process
- Fuel Stabilization

Demonstration & Deployment



Integrated Biorefineries

- Integrating process technologies
- Financing
- Technical expertise
- Profit potential



Infrastructure

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

Product Development

- Fuel purity & cost
- By-products/markets
- Infrastructure compatibility

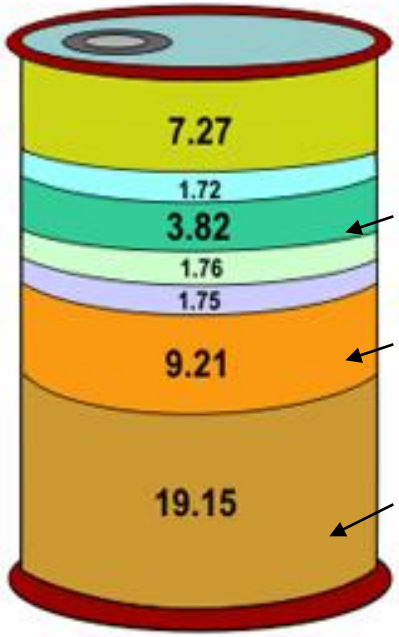
Sustainability

- 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



Source: Energy Information Administration

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

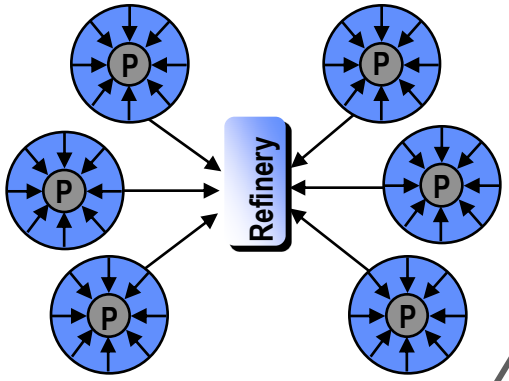
Cellulosic ethanol displaces light duty gasoline fraction only.
Need heavy duty/diesel substitutes to displace entire barrel.

Biomass-Based Jet Fuel Efforts

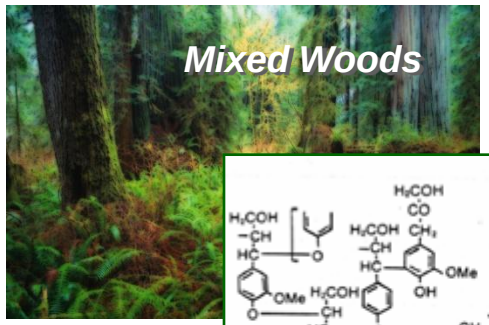
- Biomass program is funding a joint effort by NREL, PNNL, and UOP (a Honeywell Company) to characterize fuel characteristics of upgraded pyrolysis oils, including the Jet Blending component
- The work was promising enough that UOP is continuing their research with internal resources
- The Department of Energy is exploring advanced biofuels
- August 2 demonstration in hydroplane using 100% biofuel in Boeing jet

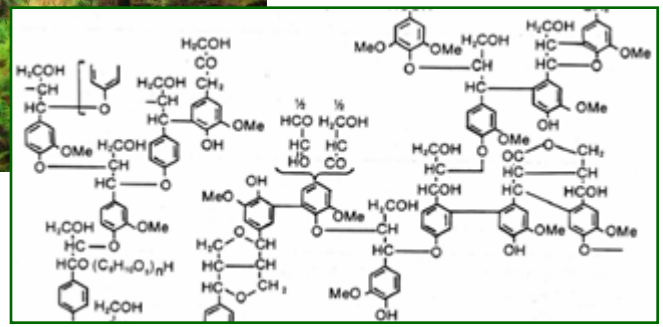
Image used courtesy of UOP LLC

Pyrolysis Oil to Energy & Fuels Vision



Biomass → Fast Pyrolysis → Pyrolysis Oil





- Electricity Production
- Fuel Oil Substitution

Available Today

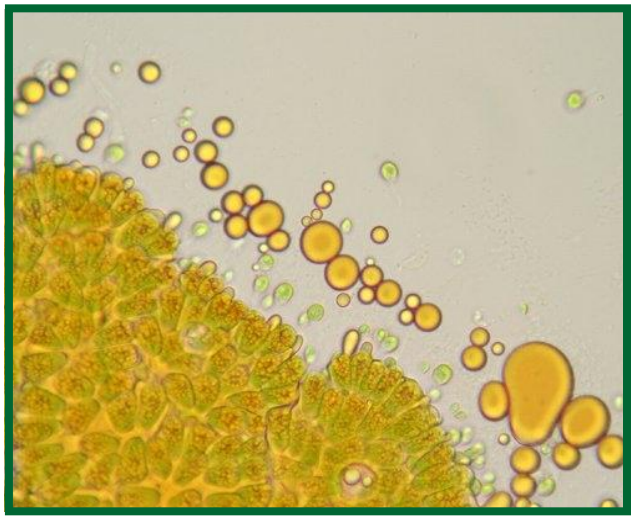
- Transport Fuels (Gasoline, Jet Diesel)
- Chemicals (Resins, BTX)

3-5 Years to complete R&D

Transport Fuels already achieved on lab-scale
Collaboration with NREL, PNNL, UOP

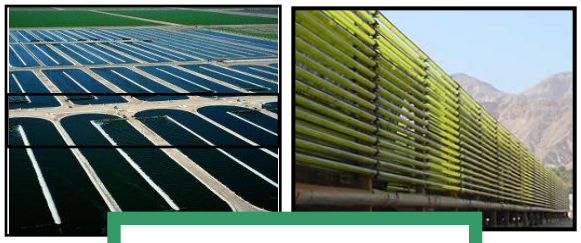
Slide from UOP Presentation at Biomass 2009 Conference

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 CO_2 vent resources
- Minimal competition with food, feed, or fiber

Technical Barriers



Algal Cultivation

- Bioreactor design
- Starting species
  - Growth rate
  - Oil content
- Nutrient requirements
  - CO_2 and H_2O sources

Oil Recovery

- De-watering methods
- Extraction
- Purification

Fuel Production

- Process optimization
- Fuel characteristics
- Engine testing (ASTM)

Algae are a long-term potential solution – but lots of barriers