

# *Biofuels at the Crossroads: The Critical Success Factors*



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# *Current Perspective*

- SAIL Venture Partners: Cleantech focus, based in Costa Mesa, California. Five Partners; 5 current portfolio companies including Earthanol ([www.sailvc.com](http://www.sailvc.com))
- GETF: developing clean energy and water projects globally ([www.getf.org](http://www.getf.org))
- Commissioner, National Commission on Energy Policy ([www.energycommission.org](http://www.energycommission.org))
- Steering Committee, Energy Future Coalition ([www.energyfuturecoalition.org](http://www.energyfuturecoalition.org)), ACORE, and 25x'25



# Premises

- The need for a domestic, low carbon fuel is compelling
  - The supply-demand imbalance has a structural demand component
  - More than 2 billion vehicles by 2050!
- At risk: US economic leadership, national security, global environment
- Economics, politics, and technology lining up for biofuels (trillion dollar market)
- Market penetration and growth of biofuels requires alignment of entrepreneurs, finance, government, NGO's on priority issues



# *Where Policy Impacts Business Models*

- RD<sup>3</sup>: Including Department of Defense
- Finance
  - Production tax credits
  - Tax-exempt financing, loan guarantees
  - Emission trading, including CO<sub>2</sub>
- Goals/Mandates: RPS, 25x25, Utility Green Pricing, Climate, Clean air and water
- Integrated Sector Strategies: agriculture, transportation, buildings, development assistance



# *Crisis of opportunity: Good News*

- The new Graduate: “one word...biofuels”
- Commodity prices + \$.51 per gallon tax break  
= 1 year paybacks
- A dozen pro-Ethanol bills  
(see June 7 Hill event for 25x'25)

***Can The President, Goldman Sachs, Bill Gates  
and Vinod Khosla all be wrong?***



# *Crisis of Opportunity: Less Good News*

- Corn ethanol may hit wall before cellulosic and second-generation biofuels are ready
- Research and cost uncertainties inhibit funders
- Big oil infrastructure versus fragmented ethanol industry
- Demand growth pathway not yet clear



# *The State of the Market*

- EPACT mandates 7.5 billion gallon production by 2012
- Demand comprises: conventional gas (10% blends), octane enhancers (alternatives to MTBE), E85, other fuels
- Feasible production: 60 billion gallons per year (DOE, White House, Lugar-Harkin)...Can we reach 150 billion gallons?
- 25-year potential: 37% of fuel needs (75% if fuel economy doubles)
- Today: 97 plants, 35 under construction, 150 in planning. 2 Billion gallon capacity by the end of 2007



# *Nomenclature*

- “First generation”:
  - Conventional corn ethanol, biodiesel
  - Limitations on production and energy content
- “Second generation”:
  - Cellulosic ethanol
  - Biomass/coal to liquids: “Designer fuels”
  - Advanced biodiesel
  - Investors in 2<sup>nd</sup> generation include Shell, DuPont, and Khosla Ventures



# *Energy Balance of Biofuel Types*

<b>Fuel (feedstock)</b>	<b>Fossil Energy Balance</b>
Cellulosic ethanol	2-36
Biodiesel (palm oil)	~9
Ethanol (sugar cane)	~8
Biodiesel (waste vegetable oil)	5-6
Biodiesel (soybeans)	~3
Biodiesel (rapeseed, EU)	~2.5
Ethanol (wheat, sugar beets)	~2
Ethanol (corn)	~1.5
Diesel (crude oil)	0.8-0.9
Gasoline (crude oil)	0.8
Gasoline (tar sands)	~0.75

Note: Figures represent the amount of energy contained in the listed fuel per unit of fossil fuel input. The ratios for cellulosic biofuels are theoretical. For sources see full report

Source: *Worldwatch, Biofuels for Transportation, June 2006*



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# *The Primary Challenges*

- Culture
- Science/Technology
- Economics, Project Finance, Trade
- Effective, Stable Policy
- Turf



# *Challenges: Culture*

- Openness of big oil
- Acceptance by OEM's (automotive)
- Capacity commitment of retailers
- Consumer demand pull  
(do we need FFV mandate?)
- Farmer engagement—capacity building
- Environmental collaboration  
(see July 2005 NRDC report)



# *Challenges: Science/Technology*

- Enzymes, advanced processes for non-food feedstocks (GMO issues?)
- Relationship to alternatives (e.g., advanced batteries)
- Designer fuels: biomass to liquids (related farm technology advances)
- Enablers (e.g., feedstock separation, drying and preparation)
- Evaluation of full environmental impact
- Multi-product biorefineries



# *Challenges:*

## *Economics, Project Finance, Global Markets*

- First plant costs (first mover disadvantage)
- Price of commodities  
(can OPEC engineer price collapse?)
- Scale - multiple outputs?
- Off-take commitments
- Predictable government incentives/guarantees
- Infrastructure - pipelines, shipping
- Farming and trade subsidies



# *Different Risks Require Different Approaches*

Resolving the key risks requires that states and federal agencies work “smarter” together. *Risk-based approaches spread benefits to more states / regions !*

<b>Key Risk</b>	<b>Approach</b>
Feedstock shortages, variation	Multiple feedstocks, sources; hedging
Regulations on feedstock	Working with states on clarity
Higher transportation costs	Plant siting and infrastructure analysis
High plant capital costs	Tax incentives: state grants
First plant costs	Federal RD & D
High processing/reagent costs	Federal RD & D
Excessive downtime	State grants; Federal RD & D
Lagging private investment	Better clarity on policies, sales, costs, credit support (loan guarantees)
Revenue and off-take uncertainty	Federal support; futures contracts

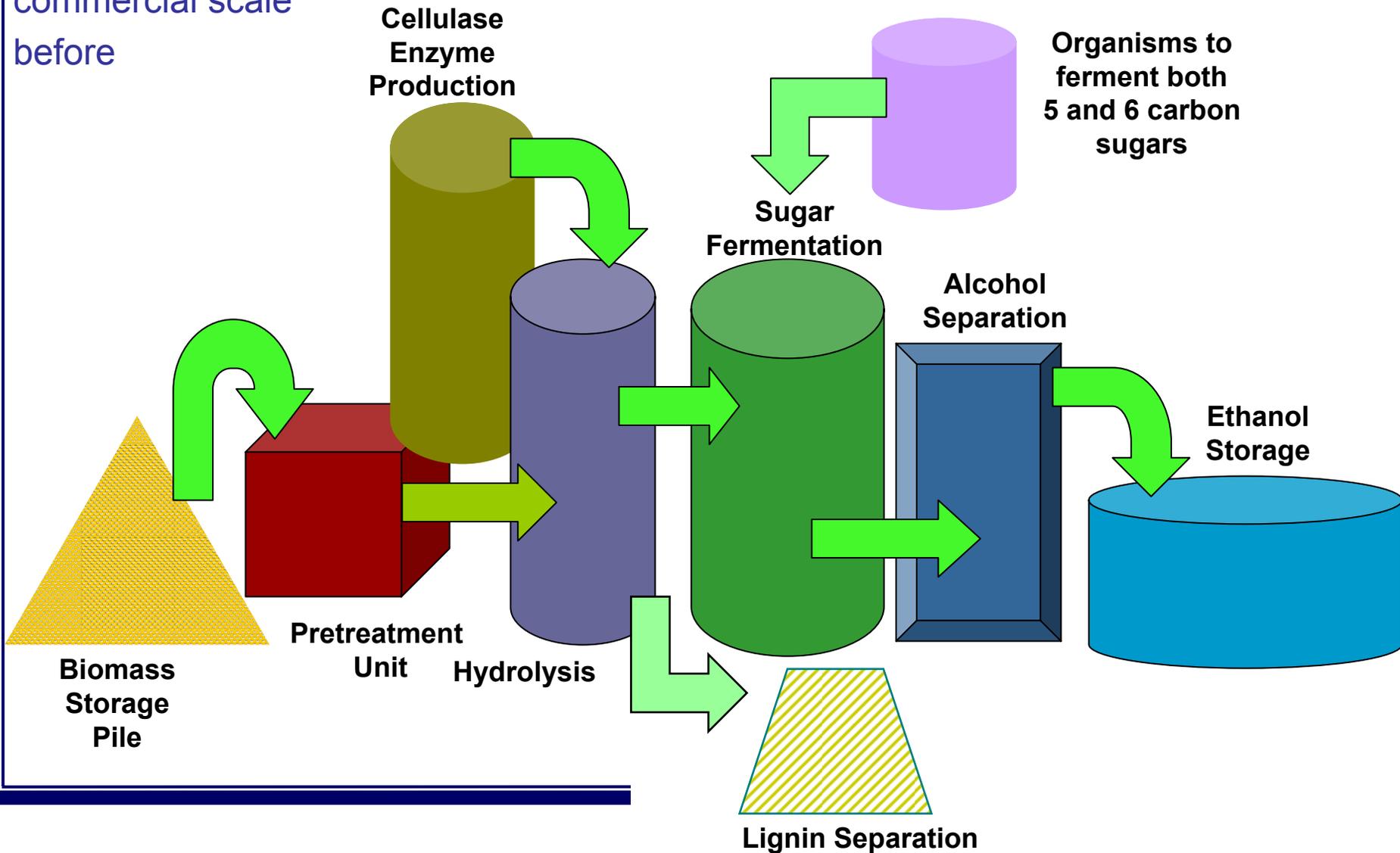
Source: DOE Risk Framework Study for Biofineries & Bioprocessing

(6/12/05)



# Biorefinery Systems Approach

PROBLEM: Modules must work together and have never been assembled at commercial scale before



# *Challenges: Effective, Stable Policy*

- Incentives suited to needs (do not shift)
  - Standby credit facility
  - Direct loans
  - Power purchase incentives
- Agencies take broad view and collaborate
- Agriculture subsidies
- Trade duties
- Collaborative R & D
- Infrastructure



# *Next Steps*

- Engage Wall Street, VCs, Industry: determine optimal mix of risk-sharing tools
- Interagency collaboration to improve forecasting and define research/infrastructure needs
- Be opportunistic about forums to engage farm leaders (25x'25)
- Educate about the trajectory (or generations) of biofuels: avoid boom-bust
- Move projects forward; continuous learning and improvement



*Thank you*



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