BRAEMAR
ENERGY VENTURES

A Financial Perspective on Bioenergy

Biomass Research Development Initiative
September 10, 2007

Braemar Summary

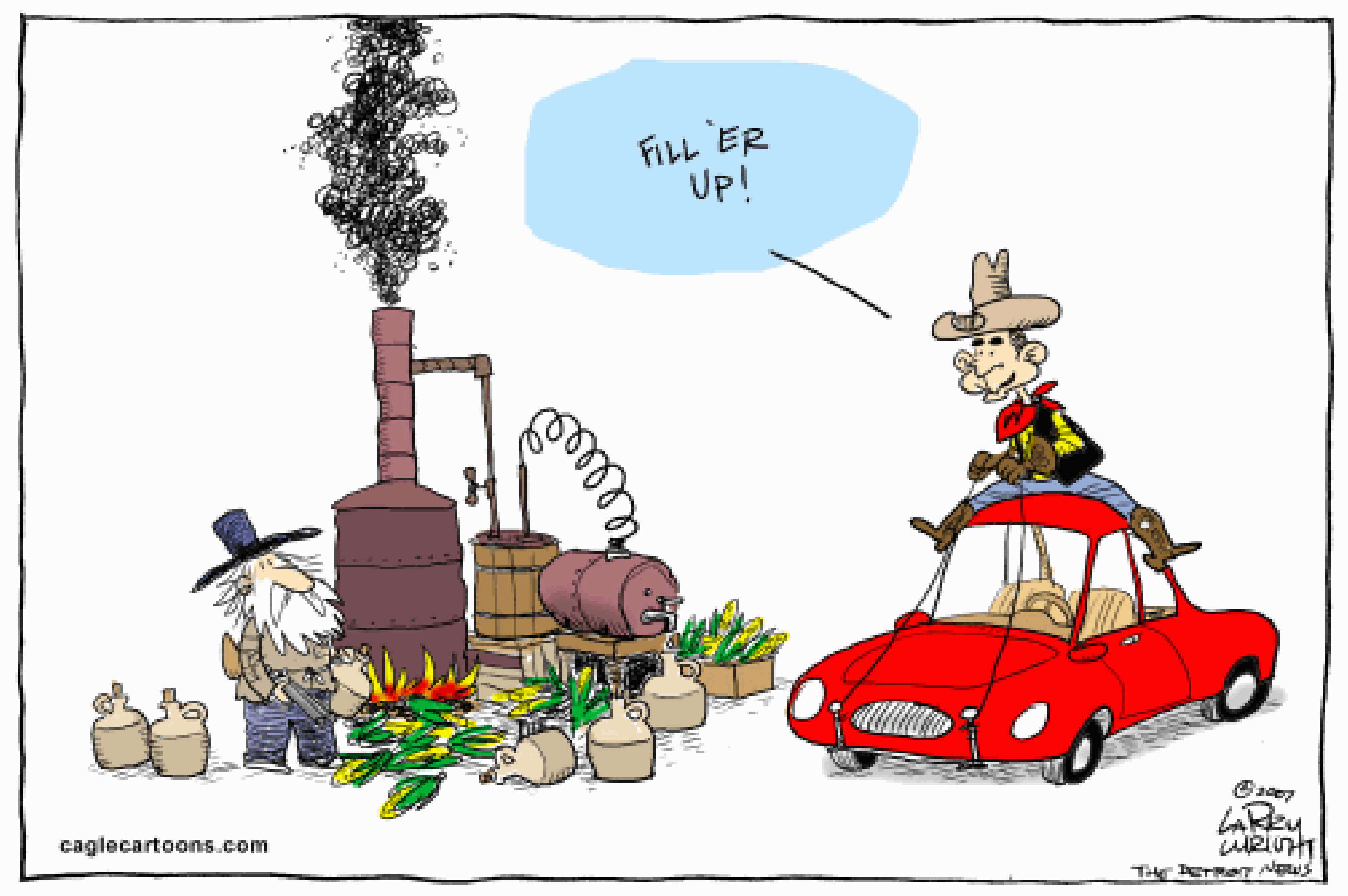
The Firm

- Braemar Energy Ventures is a venture capital firm devoted to financing companies developing new technologies for conventional and alternative energy markets.
- Braemar has one of the strongest teams in this specialized sector with over 100 years of collective energy experience, and extensive technical and operating skills.
- Braemar's first fund has a current book value of 3.0x investments and a gross unaudited IRR of 85.5%.
- Principals' prior energy and environmental investments returned $226 million on investment of $106 million through 10 IPO's and 11 trade sales.

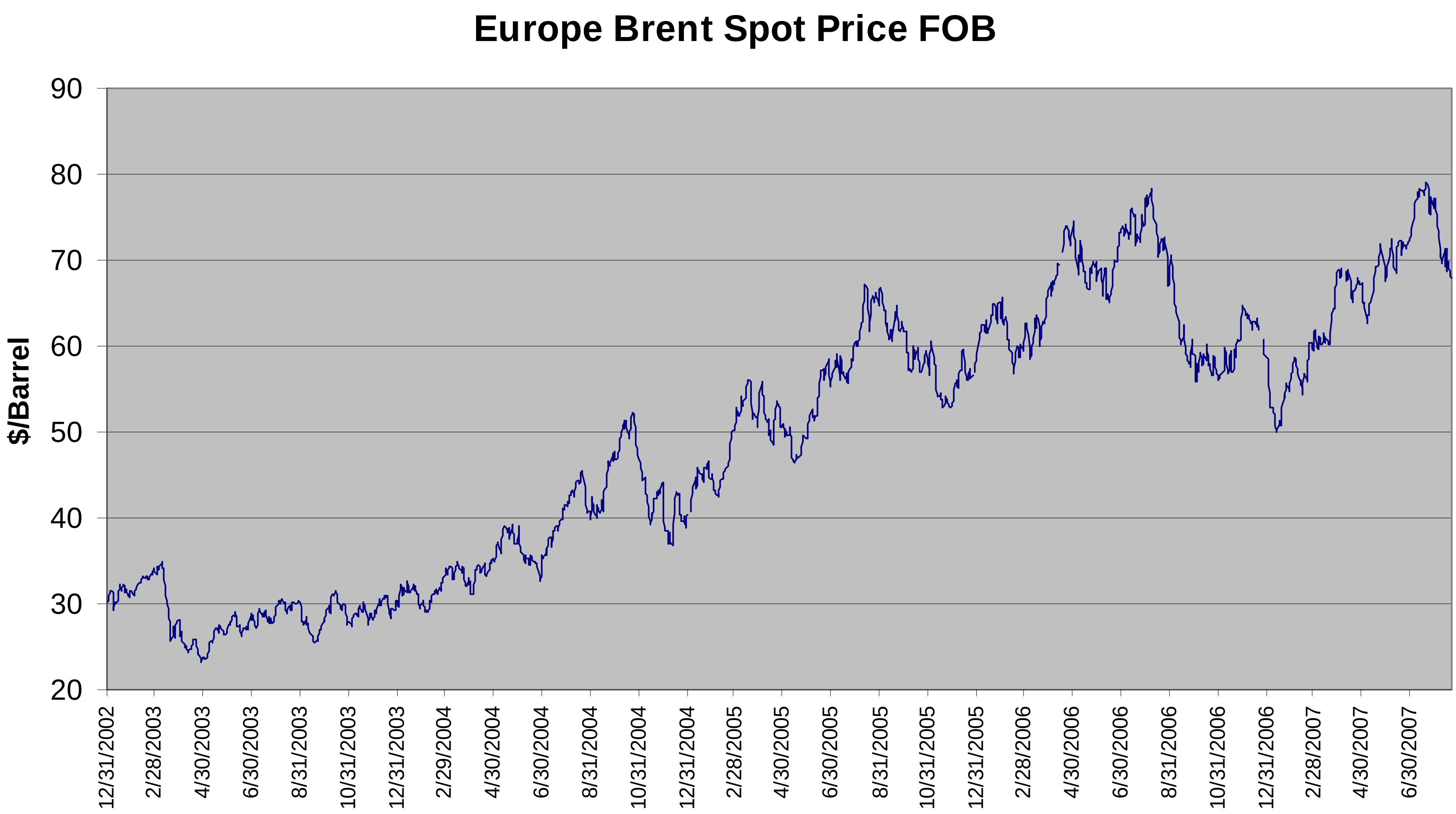
The Opportunity

- The multi-trillion dollar global market for energy is historically underserved from a technology perspective.
- Demand for new energy technologies is being driven by rising energy consumption, increasing environmental and security concerns, and strained infrastructure.

Makin' Alcohol Ain't Like It Used To Be…

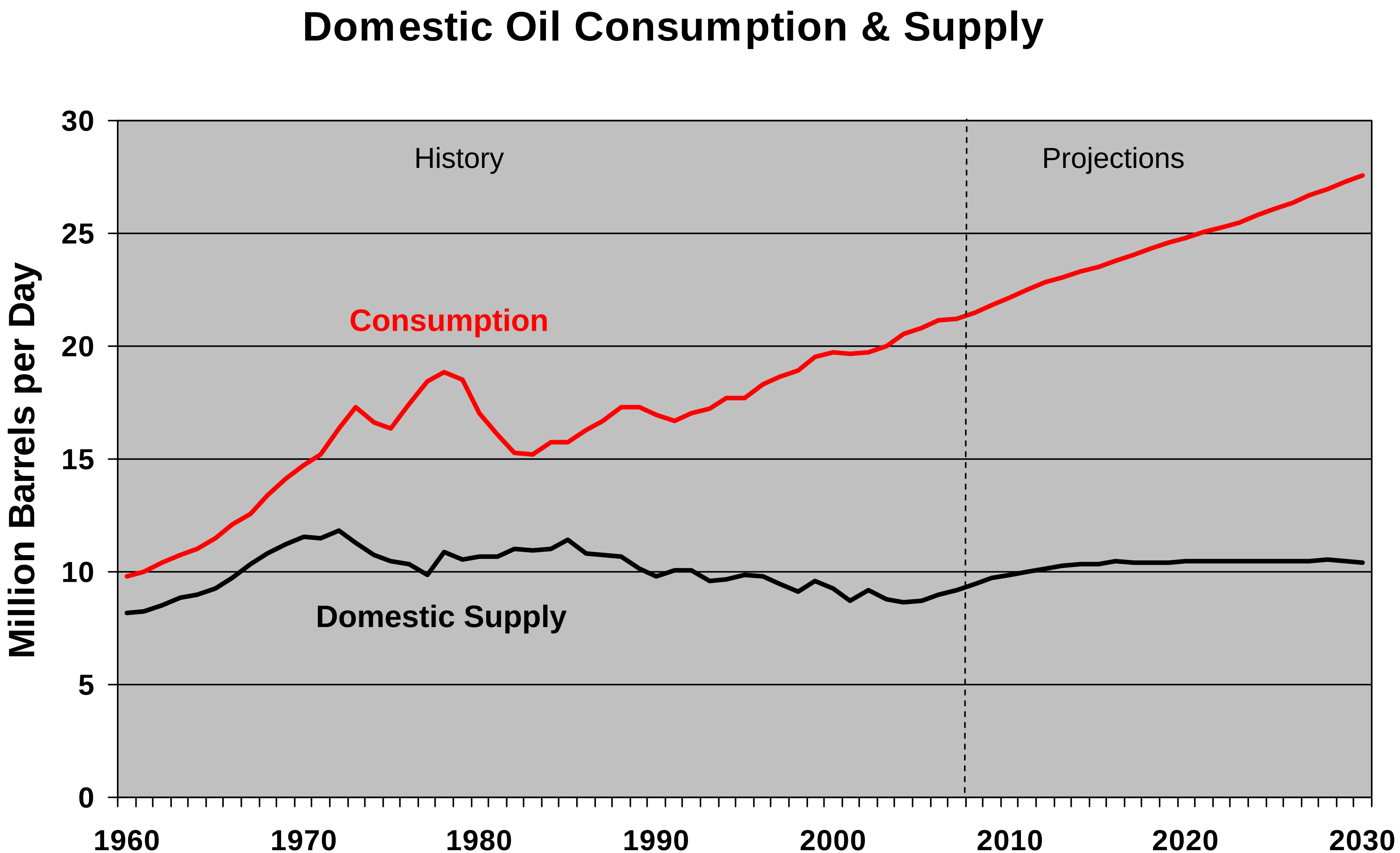


Pressure on Oil Prices



Source: EIA

Increasing Demand for Oil imports in US



Source: EIA Annual Energy Outlook 2006

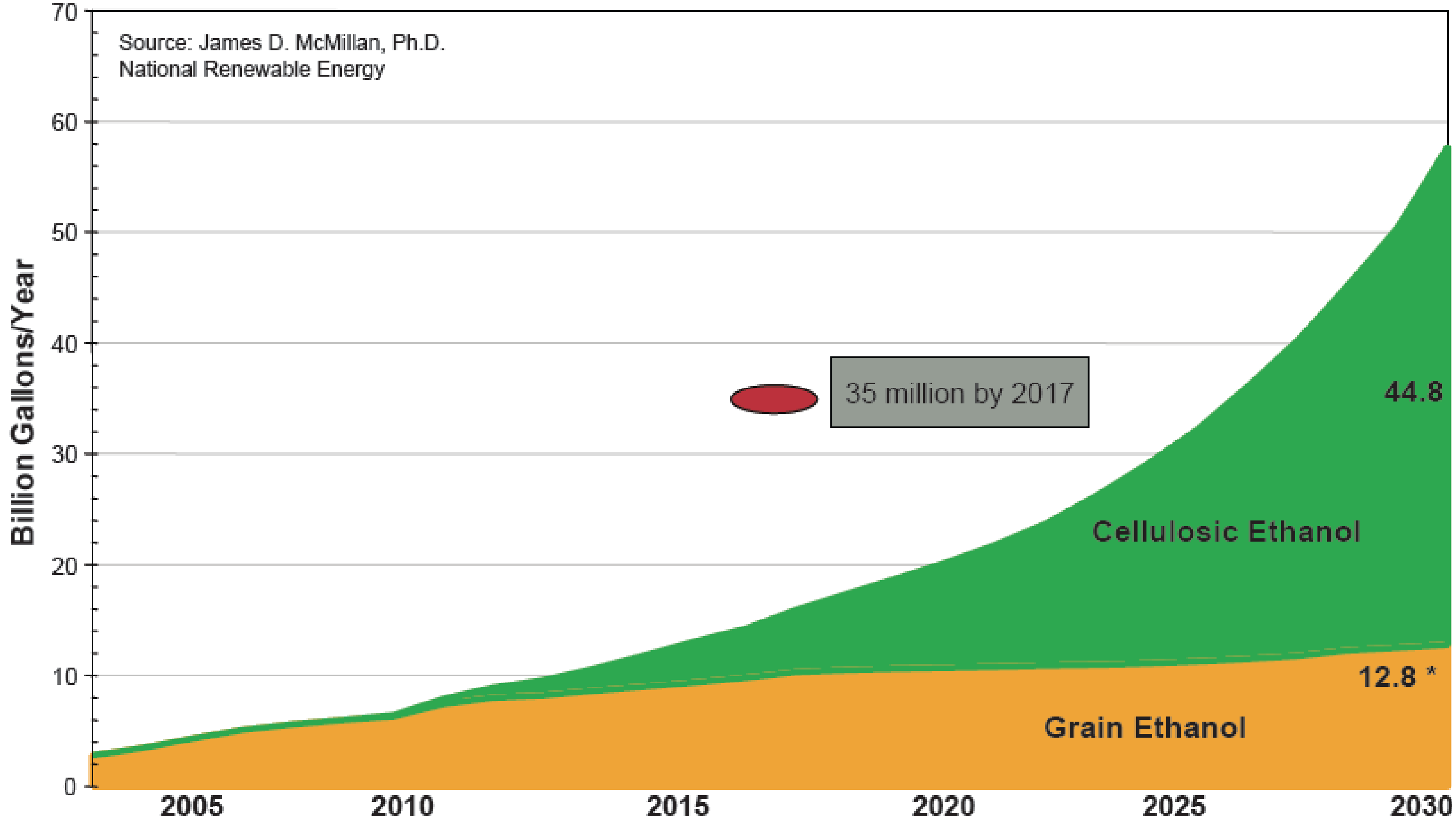
Why Cellulosic Ethanol?

- US DOE Developing 30 x 30 Road map to replace 30% of transportation fuels by 2030
- 1.3 billions tons of cheap abundant feedstocks in the US alone
- Fewer transportation bottlenecks (not limited to the breadbasket)
- No disruption to food production
- Reduced green-house gases
- Government Support and loan guarantees
- Expected to eventually become lower cost than grain ethanol

Market Opportunity—US Ethanol Demand

Reaching 60 Billion Gallons of Biofuels by 2030

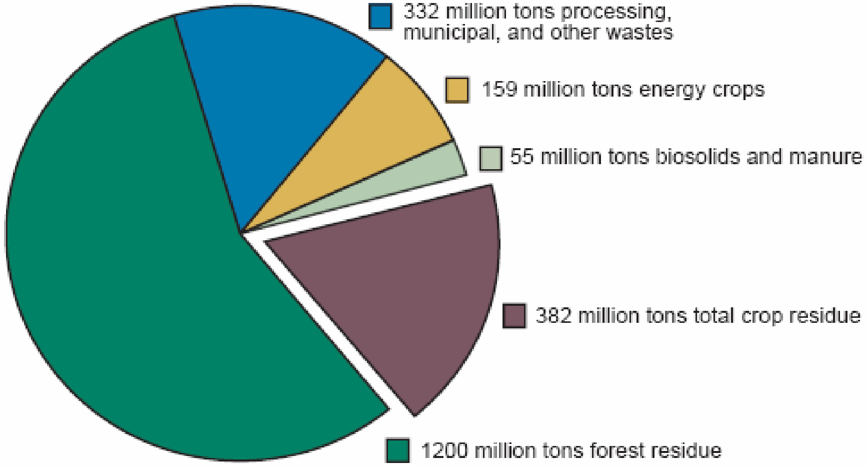
A Scenario for Growth of Ethanol to Supply 30% of 2004 U.S. Gasoline Demand by 2030



* Note: This number could be higher. The National Corn Growers Association predicts that as much as 15 -18 billion gal/yr could be produced from grain. Major changes to land use, exports, etc could also have substantial impacts. Regardless, significant cellulosic ethanol will be required to meet the 2030 goal and future national needs.

Source: NREL

No Shortage of Feedstocks for Cellulosic Ethanol



Arthur D. Little. 2001. "Aggressive Growth in the Use of Bioderived Energy and Products in the United States by 2010." Reference 71038. Final Report.

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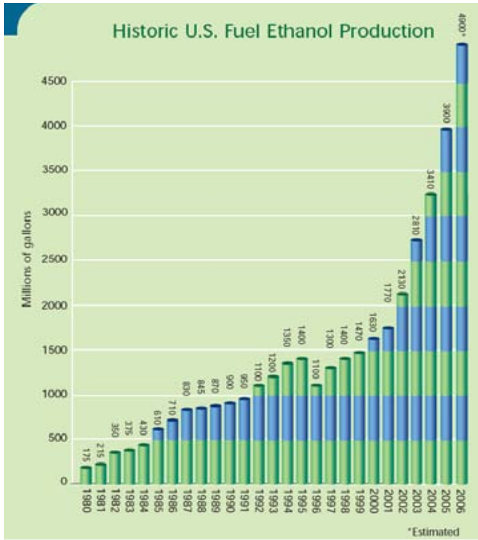
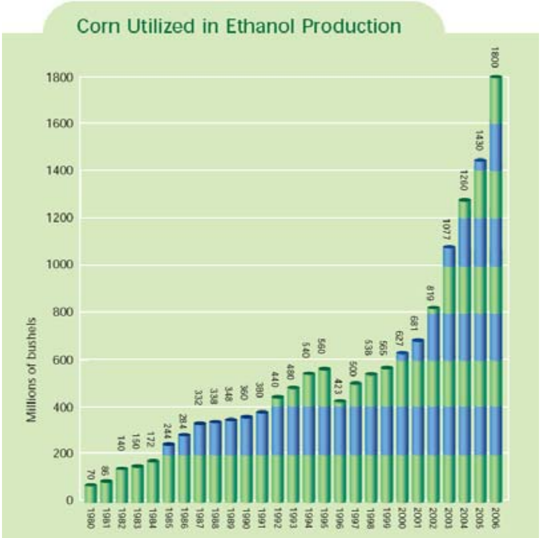
Source: DOE

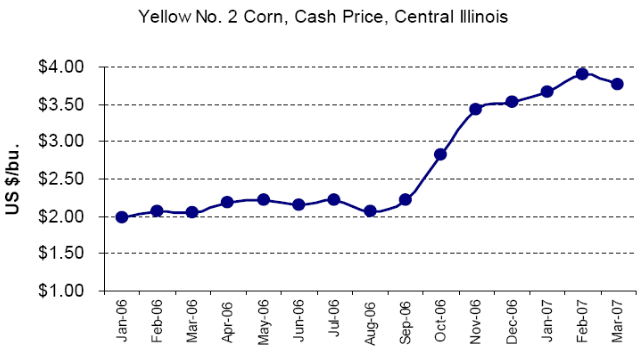
Locate Near Feedstock and Customer Fewer Transportation bottle necks

Source: Oak Ridge National Laboratories

Avoids Use of Corn to Prevent Disruption to Food Production







The Result…

USA TODAY

75,000 protest tortilla prices in Mexico

Updated 2/1/2007 9:43 AM ET

MEXICO CITY (AP) — Some 75,000 unionists, farmers and leftists marched to protest price increases in basic foodstuffs like tortillas, a direct challenge to the new president's market-oriented economic policies blamed by some for widening the gulf between rich and poor.

CNNMoney.com

Mexican government renews tortilla price cap

Price of the staple crop, pushed up by ethanol producers, threatens to spark inflation, angering consumers.

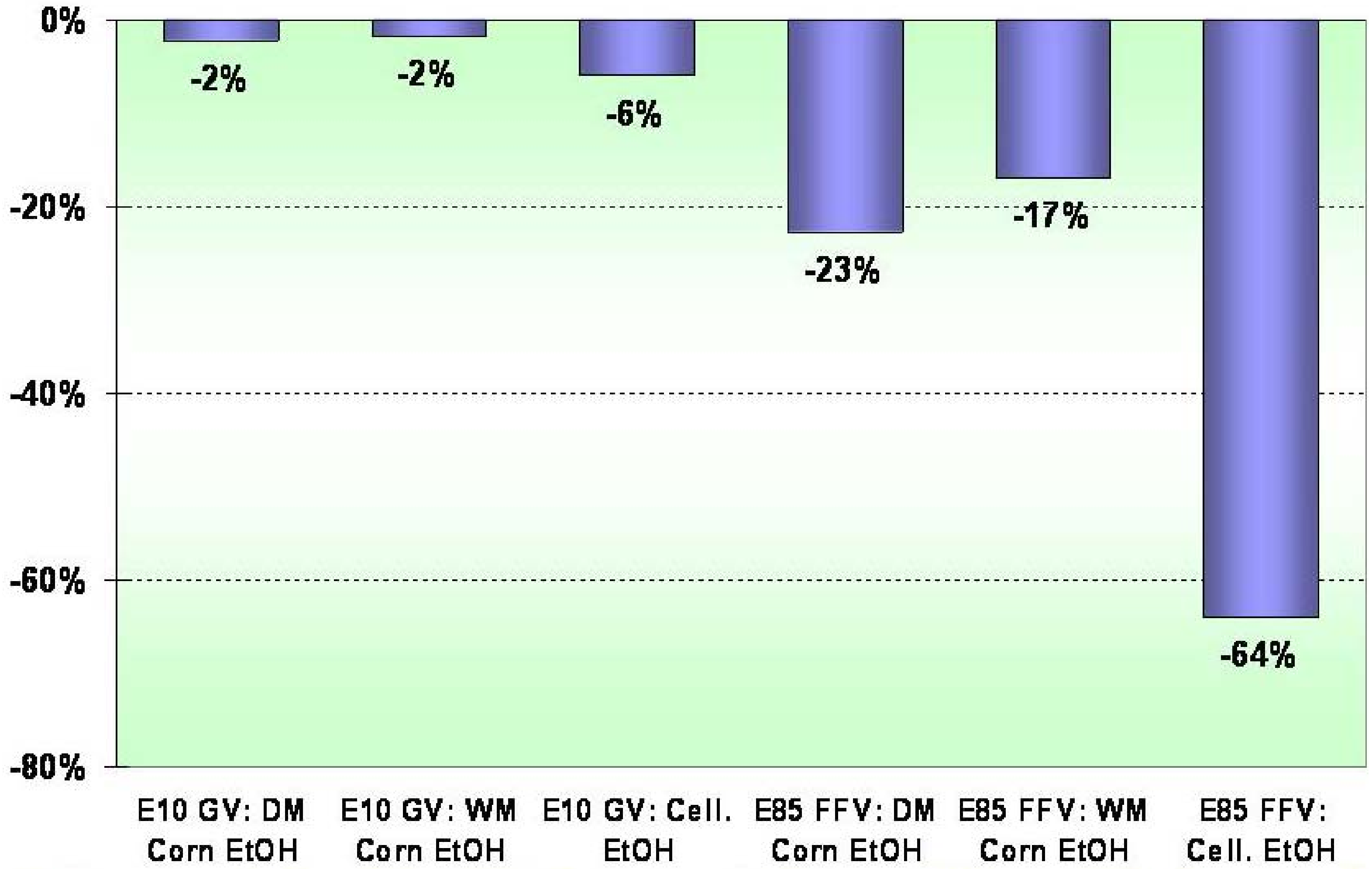
April 25 2007: 4:32 PM EDT

MEXICO CITY (Reuters) -- Mexico's government renewed a deal with retailers and producers Wednesday to cap prices of the food staple tortilla to control inflation and placate angry consumers.

Prices for corn, the main ingredient in tortillas, surged in December and January to their highest in a decade because of increased demand for the grain from U.S. ethanol fuel producers

Sources: USDA, EIA, RFA, USCGA, USA Today, CNN

Ethanol Blends, Especially E85 Made from Cellulosic Ethanol, Can Significantly Reduce GHG Emissions



Reductions in Per-Mile GHG Emissions by Ethanol Blend to Displace Gasoline

Source: Argonne National Labs

President's New Biofuels Initiative

- Reduce U.S. gasoline consumption 20% by 2017
  - Require 35 billion gallons of renewable and alternative fuels by 2017 to displace 15% of projected annual transportation use
- President's 2008 Budget will
  - Include nearly $2.7B for the Advanced Energy Initiative, an increase of 26% above the 2007 request
  - Provide $179M for the President's Biofuels Initiative, an increase of $29M (19%) compared to the 2007 budget
- President's Farm Bill proposal will include more than $1.6B of additional new funding over ten years for energy innovation, including bioenergy research and $2B in loans for cellulosic ethanol plants

Source: NREL

DOE Selects Five Ethanol Conversion Projects for $23M in Federal Funding

- "These projects will play a critical role in furthering our knowledge of how we can produce cellulosic ethanol cost-effectively," Assistant Secretary Karsner said.

- Commercialization of fermentative organisms is crucial to the success of integrated biorefineries.

- Fermentative organisms speed refining by converting lignocellulosic biomass material to ethanol.

- Winners
  - -Cargill Incorporated to receive up to $4.4 million
  - -Verenium Corporation to receive up to $5.3 million
  - -E.I. Dupont de Nemours & Company to receive up to $3.7 million
  - -Mascoma Corporation to receive up to $4.9 million
  - -Purdue University to receive up to $5.0 million

Source: DOE

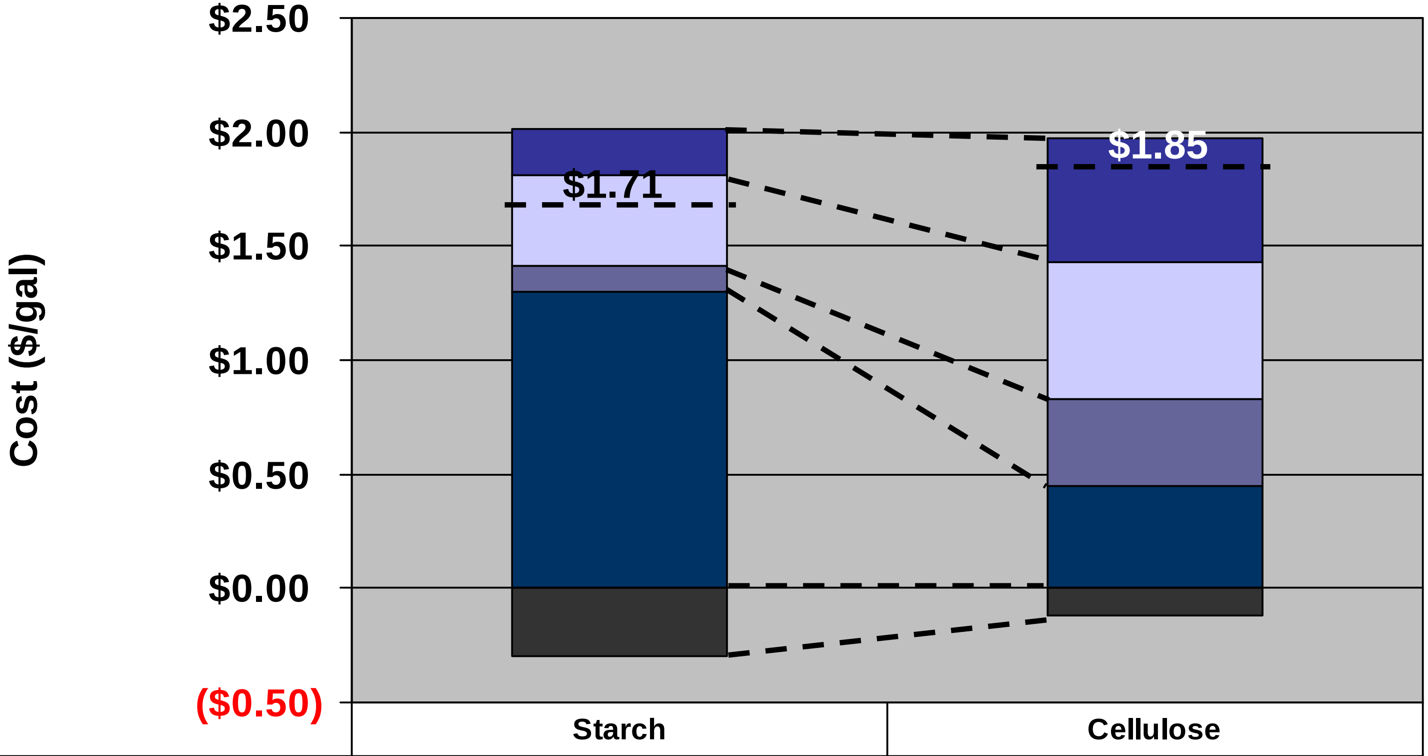
DOE Loan Guarantee Program

- The DOE Loan Guarantee Program authorized by EPAct of 2005 for alternative energy projects has been Funded
  - **Review of pre-applications has begun**
  - **Congress gave DOE authority to issue guarantees for up to $4 billion in loans**
- DOE hopes to announce selected pre-applicants before the end of the fiscal year (30 September 2007).
- On August 3, DOE hired David Frantz to direct the loan guarantee office
- For FY 2008 (beginning October 1 2007), the President is seeking authority to issue guarantees for up to **$9 billion** in loans
- Pre-application submittals are heavily weighted toward biomass
- DOE is under pressure to advance the Loan Program

Source: DOE

Cellulosic Plant Economics

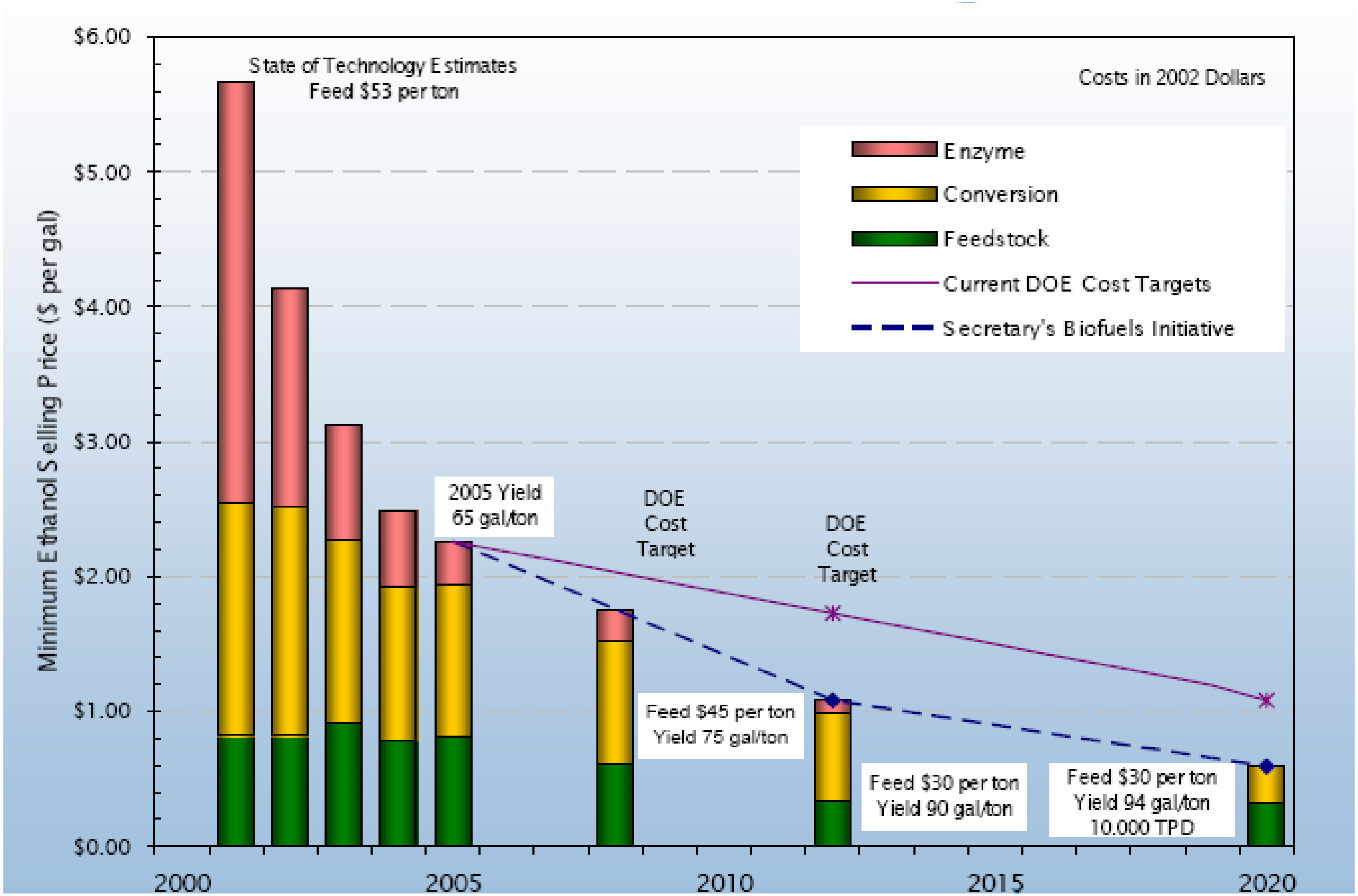
Corn Ethanol v Cellulosic Ethanol (25Mg/y)



	Starch	Cellulose
Depreciation of Capital	$0.20	$0.54
Variable Operating Costs	$0.40	$0.60
Fixed costs	$0.11	$0.38
Feedstock	$1.30	$0.45
Co-products	($0.30)	($0.12)

Notes: Based on data from USDA study comparing a traditional dry mill to a facility processing corn stover. Costs adjusted for inflation, commodity prices (corn at $4/bushel) and recent industry price quotes. Capex depreciated over 10 years. Does not account for any government subsidies.
Source: USDA, January 2005.

Cellulosic Ethanol Production Costs



Source: NREL

Case Study: Enerkem Technologies

- Canadian gasification and catalysis group, spin-off of the University of Sherbrooke, Quebec. Based in Sherbrooke and Montreal. Staff of 26 full-time
- has a 125,000 gallon pilot plant which can produce syngas and alcohols from a variety of biomass wastes and will be producing ethanol by year end
- is about to build a 2 million gallon alcohol commercial demo plant to be operational in 2008
- is in discussions with partners to build three 10 million gallon commercial plants producing ethanol from municipal solid waste and wheat straw and being approached by others regularly
- has a highly evolved and thorough R&D plan committed to the development of downstream, high value added fuels and chemicals

Source: Enerkem Technologies

Case Study: What are the main barriers to commercialization for new tech biofuel producers?

There are essentially 4 major barriers which Governments can address:

1. Funding first commercial projects
2. Red tape
3. Permitting blue-print
4. Feedstock security

Source: Enerkem Technologies

Barrier 1: Funding first commercial projects

- First commercial 10 million gallon project costs expected to be in the $40 to $60 million range
- Significant venture capital funds now available in the market for biofuels but are typically directed at funding a company's development and organization, not projects. Realistically, as an average, approx. $10 to $20 US million from VC funds can be allocated to a first commercial scale project
- Company may be able contribute a further $10 US million in-kind (essentially engineering labor in project)
- $20 to $30 million i.e. approx 50% of total capital is still needed
- Technology not bankable at that point i.e. banks will not fund given technology has minimal profitability track record
- Government has to step-in for approx. 50% of the total investment

Source: Enerkem Technologies

Barrier 1: Funding first commercial projects

- Government investment ideally in the form of grants not to put pressure on the project’s financials given likelihood of extended commissioning and marginal profitability of first projects
- Project could reimburse the funds without interest once it has started being profitable. Example of such Gvt funding program in Canada: SDTC $500 Million Next Generation Renewable Fuels Fund (www.sdtc.ca/en/news/media_releases/media_23032007.htm)
- Alternatively, loan guarantees could be considered by Gvt but this is suboptimal since it has a tendency of having the Gvt think as a banker and questions a technology’s “bankability” (role of Gvt should be to unlock it not to question its “bankability”)

Source: Enerkem Technologies

Barrier 1: Funding first commercial projects

- Farmer MAC or the Federal Home Loan Bank System charters could be expanded to allow these government sponsored enterprises (GSEs) to purchase renewable energy loans for a premium from lenders
- Congress could authorize the establishment of the "Renewable Energy Government Loan Corporation" that has a mission of purchasing renewable energy loans from lenders- loans could be pooled and securitized

Source: Crain Consulting

Barrier 2: Red tape of Government programs

- Application and Reporting requirements of most Gvt programs make it challenging for small companies to apply and follow-up
- In many cases only large corporations with sufficient administrative staff can deal with the red tape involved in certain Government funding programs
- Most technologies are developed by smaller, quicker and more creative entrepreneurial groups; not by large corporations. Therefore by making their programs so difficult for small companies Government is possibly “defeating its purpose” i.e. actually blocking the development of high quality technologies that the nation could be benefit from
- Efforts have to be made by Government to simplify its application and reporting requirements while making sure only the best candidates get selected (A big candidate doesn’t necessarily mean the best)

Source: Enerkem Technologies

Barrier 3: No permitting blue-print

- Most technologies have minimal permitting precedents
- Therefore permitting authorities require more information than usually before granting a construction permit. This slows down process and puts more cash pressure on technology groups as they have to continue funding their business and projects while permit demands are being processed
- It is the opposite that should actually occur: premiere projects of national priority should be considered as pilots from a permitting standpoint
- "Pilot Permits" should be quickly granted with close involvement/monitoring from planning authorities to gather data and build the case/blueprint for following commercial projects

Source: Enerkem Technologies

Barrier 4: Feedstock security

- Often difficult to convince biomass resource groups or waste managers to supply first commercial projects
- Government may be able to help by, in example:
  - "Incentivizing" resources (biomass, waste, crops etc) going to first industrial scale ups ($ per ton incentive)
  - Adjusting policy to prioritize the conversion of opportunity feedstocks into fuels vs. other uses. Perhaps eventually government could set a quota obligating a certain % of a specific resource to supply fuel to projects (e.g. setting penalties to pulp & paper groups for not converting 10% of their feedstock into ethanol)

Source: Enerkem Technologies

Cellulosic Ethanol Production Value Chain

Feedstock

Resource Development
- Ceres
- Syngenta
- Agrivida
- EdenSpace
- Dupont
- Monsanto
- Tate & Lyle
- Florida Crystals
- Chevron/ Weyerhauser
- Kruger

Biomass Handling and Collection
- John Deere
- Waste Management

Biomass Processing

Pretreatment/ Hydrolysis

Enzymatic
- Iogen
- Mascoma
- C5-C6
- Dyadic
- Novozymes
- Sigma Adlrich
- Actelios
- **Verenium**

Non-Enzymatic
- Bluefire
- Altra
- Sunopta
- Abengoa

Fermentation

Glucose
- Earthanol
- Citrus Ethanol

Pentose
- **Verenium**

Co-products
- Ambrozea

Thermochemical

Gasification
- Lurgi
- **Enerkem**
- Thermo Chem Recovery Intl.
- Xethanol
- Woodland Biofuels
- Clear Fuels

Pyrolysis
- Dynamotive
- Ensyn

Catalysis
- Range Fuels
- Gas Technologies
- Coskata
- BRI

Ethanol Recovery
- Transionics
- Ceramem
- Compact Membrane Systems
- Vaperma

Transportation/ Distribution/ Utilization
- ADM
- Pure Energy Corp.
- Cillion
- Hawkeye
- Verasun
- Greenfield Ethanol
- Propel Biofuels
- Petrobras

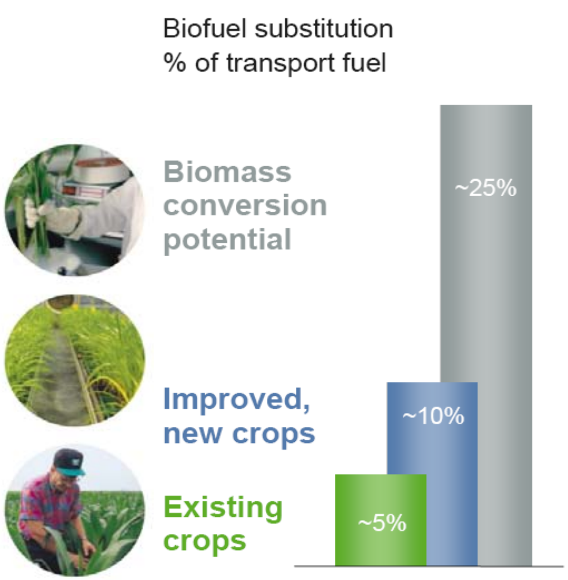
Resource Development

Parts of the Equation	Relevant Traits	Impact
Acres	▪ Stress tolerance (e.g. drought, heat, cold, salt)	▪ Growth on marginal acreage helps enable critical mass
Tons per acre	▪ Increased yield (e.g. photosynthetic efficiency)	▪ Lower production and transport costs and increased carbon sequestration
Dollars per acre	▪ Nutrient requirements (e.g. nitrogen utilization)	▪ Lower fertilizer costs and less N_2O emissions
Gallons per ton	▪ Composition & structure (e.g. C5/C6, cell wall structure)	▪ Increase theoretical yield of ethanol per ton of biomass
Capital cost of refinery & variable cost per gallon	▪ Composition, structure & enzyme production (e.g. cellulases)	▪ Eliminate need for acid hydrolysis, reduce need for enzymes and bring actual yield closer to theoretical
Co-products	▪ Metabolic engineering & sequestration	▪ Enhance overall economics

Source: Ceres Company Presentations

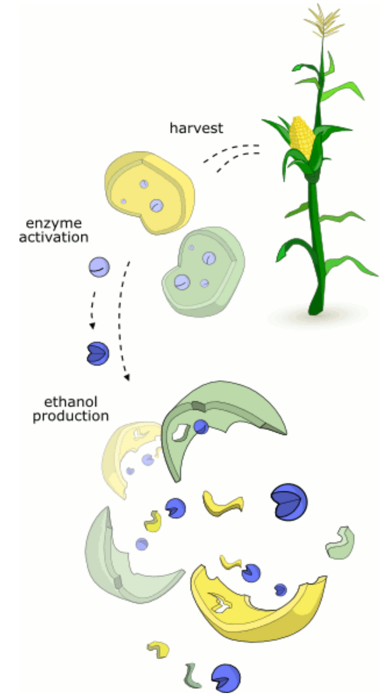
Some Examples of Energy Crop Developments

Syngenta –Designing GM corn which will to help convert itself into ethanol, by co-producing enzymes within kernels and well as research in plant-expressed enzymes in cellulose biomass-waste



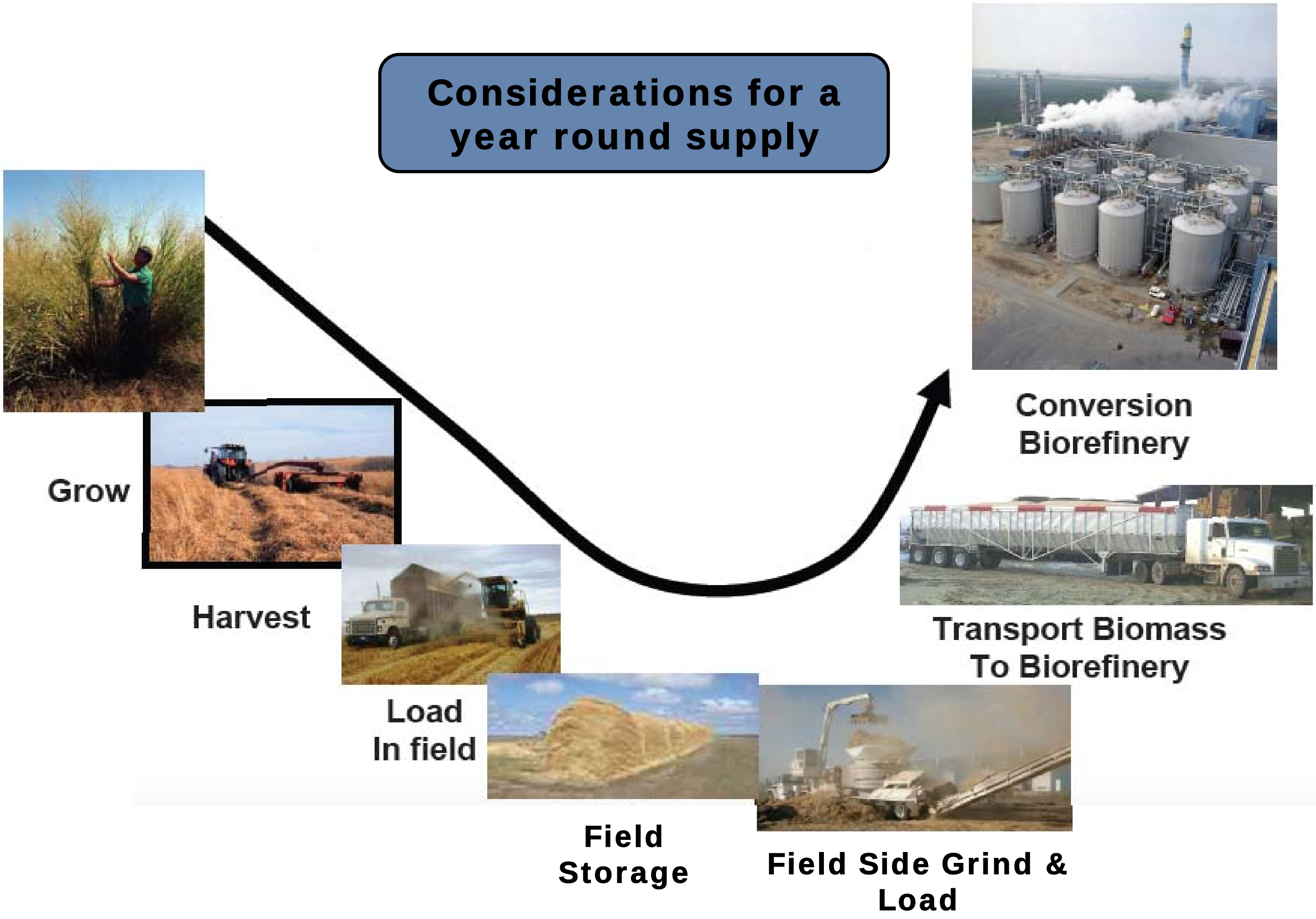
Ceres – Developing energy crops such as switchgrass, miscanthus, energycane and poplar for the production of biofuels utilizing breeding and genomics technologies to boost yields and increase usable acreage while minimizing energy inputs

Agrivida – Working on improved liquefaction and saccharification characteristics for entire corn plant to be converted into ethanol, including the unused stover



Source: Company Websites

Biomass handling



Sources: ORNL, UT Battelle.

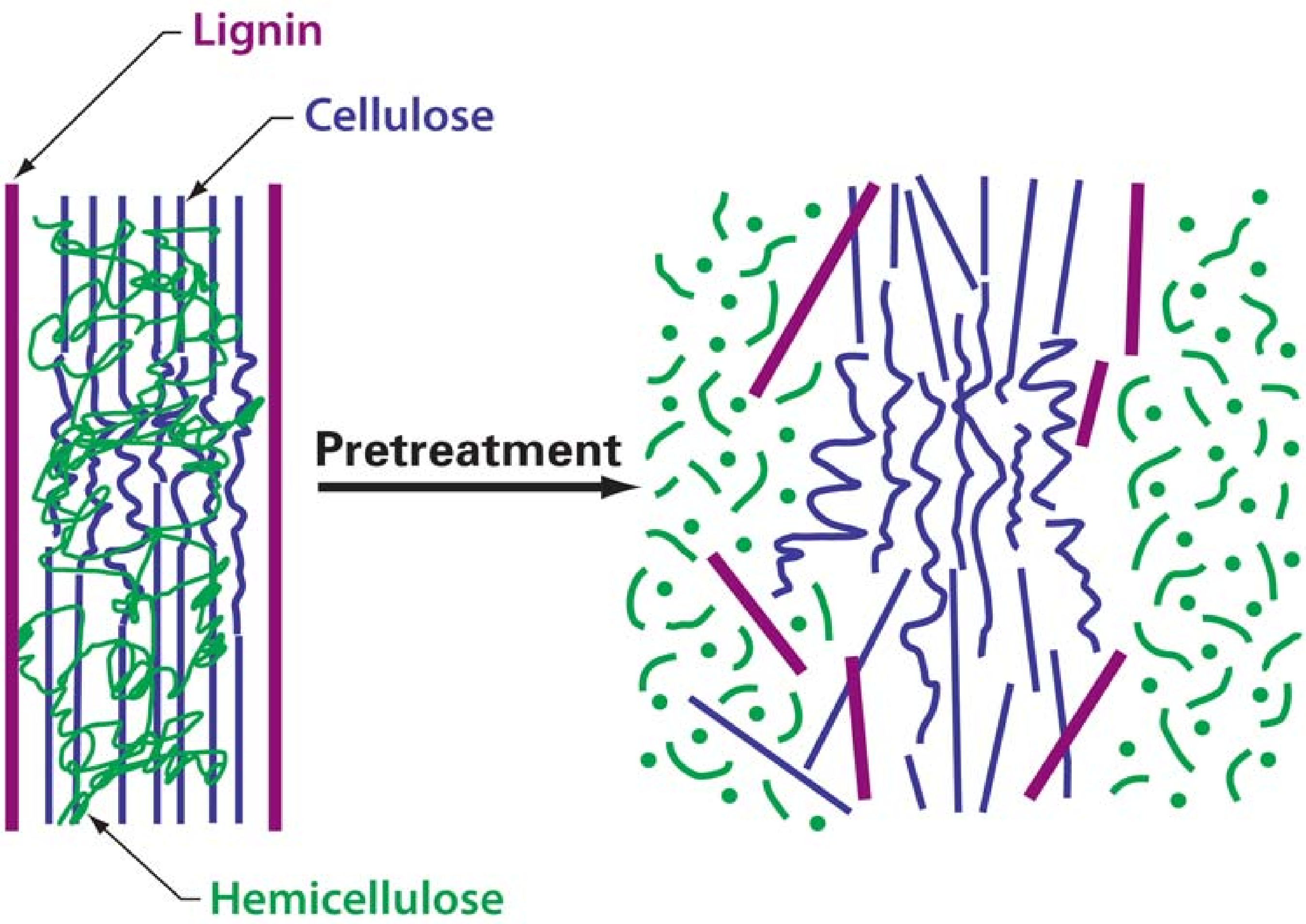
Novel methods of harvesting

New methods under development for collecting corn *and* stover simultaneously

John Deere Combine with stover attachment

Modified Claas head

Pretreatment



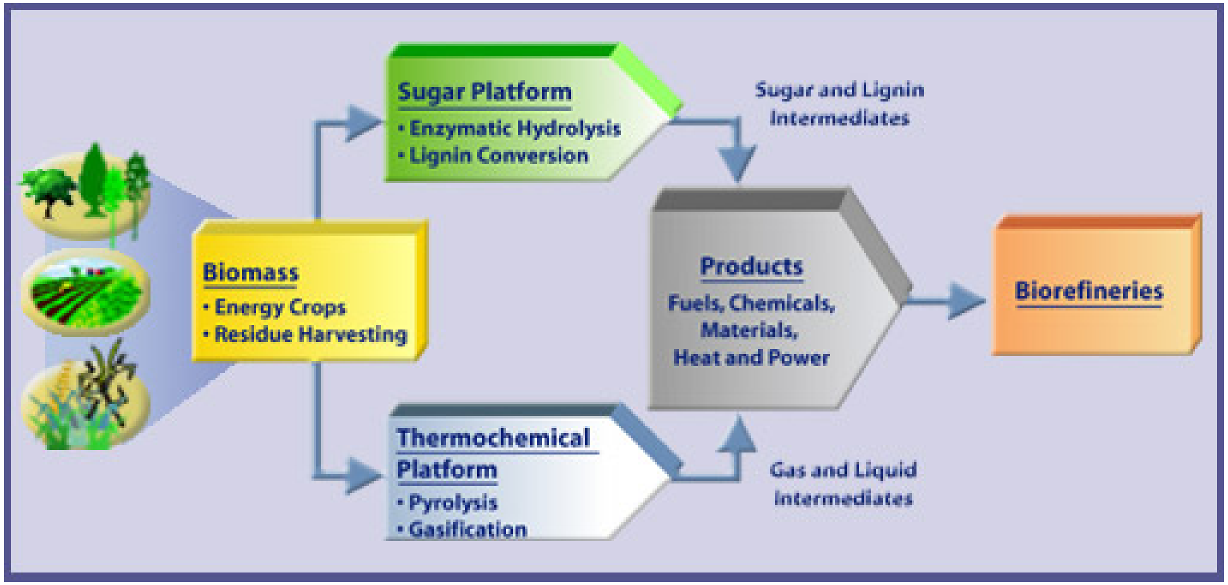
Source: DOE

Pretreatment methods

Approach	Technologies	Pros	Cons
Physical	Freeze/Thaw Cycles Radiation Mechanical Sheering Pyrolysis	• No chemical or water inputs • No toxic residuals	• High energy input • Limited effectiveness • Expensive
Biological	Microbial/Fungal Enzymatic	• Good cellulose and lignin degradation	• Not very efficient • Requires long treatment times
Bio-chemical	**<u>Non Catalyzed</u>** Steam Explosion Hot Water (batch) Hot Water (percolation) Hot Water pH Neutral	• Hydrolyze significant fraction of hemicellulose • Prevents lignin re-precipitation • Relatively well understood	• High energy input • Often requires additional processing or the addition of a catalyst for maximum yield
	<u>Acid Catalyzed</u> Nitric Acid Sulfer Dioxide Sulfuric Acid Sulfuric Acid (hot wash process)	• Hydrolyze significant fraction of hemicellulose • Can reduce cost	• Some undesirable glucose degradation • Byproducts can inhibit fermentation
	<u>Base Catalyzed</u> AFEX/FIBEX Ammonia Lime	• More effective at solubilizing a greater fraction of lignin • Can reduce cellulase requirement	• Leaves much of the hemicellulose in an insoluble polymetric form
	<u>Solvent-Based</u> Organosolv (Clean Fractionation)	• Hydrolyze significant fraction of hemicellulose • Can provide more valuable byproducts	• Significantly more expensive • High energy input
	<u>Chemical-Based</u> Peroxide Wet Oxidation	• Extremely simple • Low energy input • By products do not inhibit fermentation	• Not very efficient when used alone • Requires highly consistent feedstock • Leave a large portion of cellulose in solid fraction

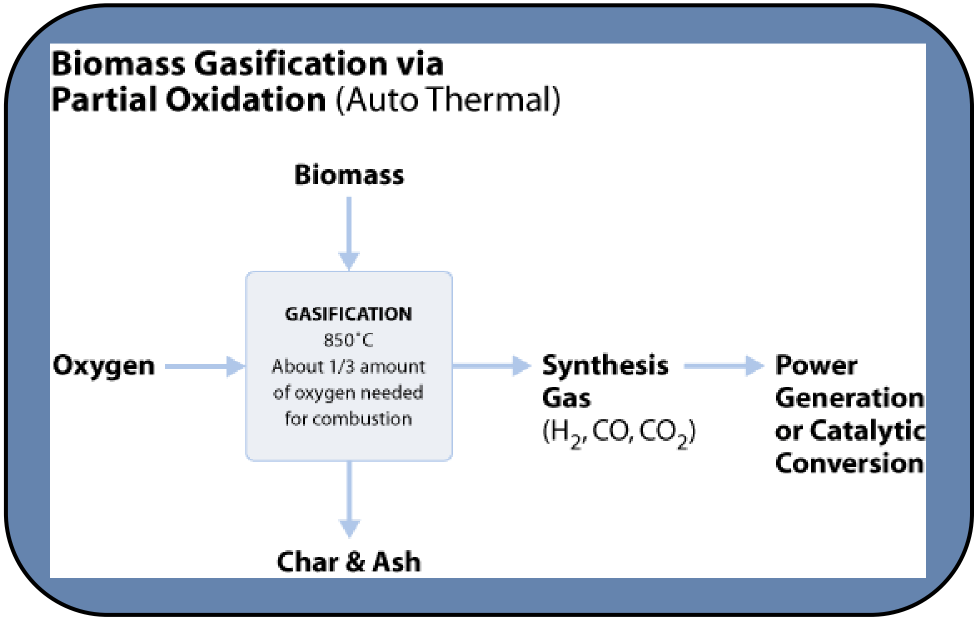
There are multiple pathways for biomass conversion

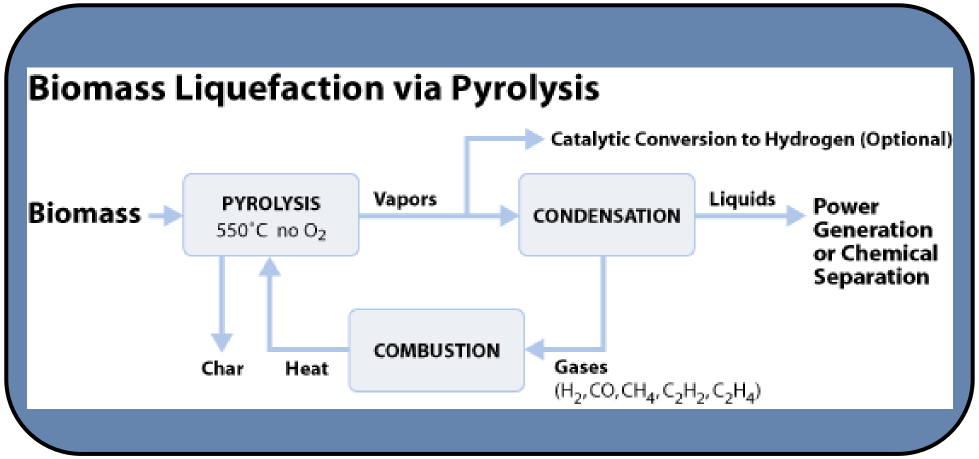
- Fermentation (the sugar platform) is only one method for converting biomass to ethanol
- Various thermo-chemical methods are also viable pathways for the creation of a variety of biofuels



Source: DOE

Thermo-chemical approaches to biomass treatment

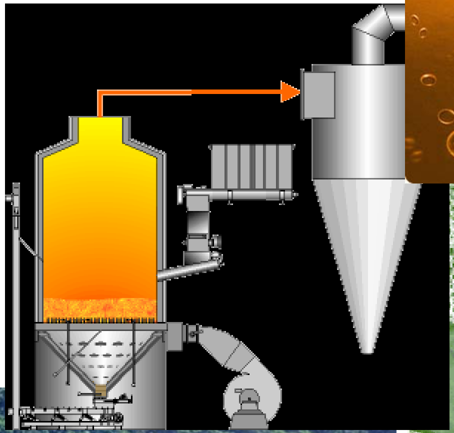




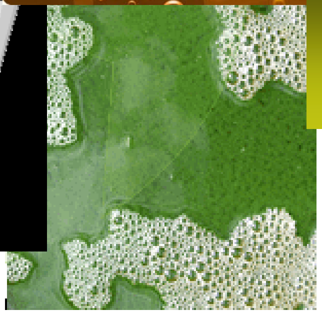
Technology Progression

Synthetic Biorefinery

Gasification



Direct Synthesis?



Algae

Corn

Cellulosic Bioethanol

Where in the Supply Chain Should a VC Invest?

- Resource Development (Feed stocks)
- Biomass Handling
- Pretreatment
- Biochemical Treatments –Sugar Production
- Gasification Treatments/Catalytic Conversion
- Ethanol Recovery
- Integrated Plant Systems
- Energy Reduction Technologies
- Transportation and Storage Technologies
- All the above

Answer

- **Resource Development Technologies / Feed stocks**
  - Technology to improve yields and increase processing efficiency will significantly reduce costs
- **Pretreatment**
  - Low cost enzymes and/or little or no enzymes
- **Integrated Biochemical Plant Systems for Homogenous Waste Streams**
  - Full value is recognized from systems that can produce high volumes of low cost sugar and convert sugars into ethanol at the highest possible concentrations
- **Integrated Gasification Systems for Homogenous and Non Homogenous Waste Streams**
  - Full value is recognized from producing large volumes of low cost syngas and catalytically converting syngas into ethanol or other biofuels.
- **Ethanol Recovery**
  - Alternatives to distillation
  - Improved Catalysts
- **Energy Reduction / Water Reduction Technologies**

To What Extent should VCs be Investing in Capital Intensive Projects?

- Pilot Plant

- Demo Plant

- Commercial Plants

- All of the Above

Answer

- VCs should be prepared to invest in pilot, demo and part of small commercial plants with some government funding support, then use proven technology to develop projects with third party financing and/or launch an IPO.
- Licensing is an alternative, but revenue generation is much more limited.

Strong Partners needed for VC Backed Companies to be Competitive and Scale

- Strategic Partners
  - -Project Developers/EPC contractors
  - -Industrial Companies with low cost Feedstocks
  - -Industrial Biotech Companies
  - -Energy companies

Financial Partners

Large Private Equity Funds

Hedge Funds

Key Lessons learned Investing in Cellulosic Ethanol

- Commercializing Cellulosic Ethanol technology has many technical challenges, takes longer and costs more than one would expect.
- If your technology is new, make sure you grill your proposed contractor to make sure you really understand the contractor's capabilities and risk tolerance for new technology
- A great technology is important, but a strong management team is still the key
- A bull market has advantages, but also have disadvantages, i.e. shortage of contactors, suppliers and engineers.
- Government support and loan guaranties are important
- Make sure you have an experienced rock-solid investor syndicate
- Make sure you understand the entire supply chain

Potential Exit Strategy

- IPO
  - -Verasun, Aventine
- Merger with a Public Company
  - -Celunol/Diversa > Verenium
- Strategic Buyer
  - -ADM, Cargill, Broin, Pacific Ethanol
  - -Shell, BP, Chevron
- Financial Buyer
  - -Energy focused private equity groups

Comparable Company analysis for Cellulosic Ethanol Companies

COMPARABLE COMPANY ANALYSIS

COMPANY	STOCK PRICE 9/5/2007	52 WEEK HIGH	52 WEEK LOW	MARKET CAP	TEV	LTM Rev.	LTM EBITDA	NTM Rev.	TEV/ LTM Rev.	TEV/LTM EBITDA	TEV/ NTM Rev.	LTM EPS*	NTM EPS*	LTM PE	NTM PE
Cellulosic															
Abengoa Bioenergy Corporation	5.59	5.66	2.75	91.68	105.81	164.51	13.19	NA	0.64x	8.02x	NA	0.30	NA	18.90	NA
Colusa Biomass Energy Corp.	0.18	0.18	0.02	7.09	7.08	-	-	NA	-	-	NA	(0.01)	NA	(13.24)	NA
Xethanol Corporation	0.97	4.50	0.90	28.61	10.97	10.93	(8.24)	NA	1.00x	-1.33x	NA	(0.84)	NA	(1.16)	NA
Bluefire Ethanol Fuels, Inc.	4.61	7.90	1.30	102.22	102.80	-	-	NA	-	-	NA	-	NA	-	NA
Verenium Corporation	5.50	6.98	4.10	356.81	364.41	51.53	(14.75)	NA	7.07x	-24.71x	NA	(1.59)	NA	(3.47)	NA
Biotech															
Dyadic International, Inc.	5.30	7.10	3.65	158.68	130.18	15.38	(8.61)	20.04	8.46x	-15.12x	6.50x	(0.45)	(0.40)	(11.89)	(13.25)
Genencor International, Inc.	19.27	19.30	13.48	1,158.51	1,223.50	410.42	70.03	NA	2.98x	17.47x	NA	0.31	NA	62.39	NA
Novozymes A/S	662.00	705.00	402.50	40,915.24	42,479.24	6,662.00	1,732.00	NA	6.38x	24.53x	NA	13.22	NA	50.07	NA
Syngenta AG	227.30	248.30	175.90	22,145.65	23,882.41	7,919.00	1,512.00	8,895.92	3.02x	15.80x	2.68x	6.67	11.53	34.10	19.71
Ethanol															
Archer-Daniels-Midland Co.	33.05	42.35	30.20	21,753.17	26,375.17	37,416.08	3,022.09	45,161.55	0.70x	8.73x	0.58x	2.32	2.68	14.23	12.34
Holdings, Inc	14.50	28.83	13.10	607.58	531.70	1,451.74	110.37	1,813.65	0.37x	4.82x	0.29x	1.23	0.63	11.84	23.12
Pacific Ethanol, Inc.	11.84	19.80	11.24	481.28	635.47	181.87	(0.51)	466.11	3.49x	-1252.55x	1.36x	(2.73)	0.30	(4.33)	39.15
Verasun Energy, Corp.	13.11	26.90	12.11	1,049.07	1,291.42	509.25	173.03	1,253.43	2.54x	7.46x	1.03x	0.83	0.78	15.82	16.70

* LTM Diluted EPS Before Extraordinary Items

Valuation in this area requires a multi-disciplinary approach

Source: CapitalIQ

Recommendations for Cellulosic Industry Development and Growth

- Implement a stronger RFS Standard that helps meet the DOE 30x30 Road map or supports the President's initiative to reduce gasoline consumption by 20% in 2017
- Develop strong and flexible loan guarantee programs
- Create a Production Tax Credit for cellulosic ethanol producer
- Address Crop Risk Insurance issue regarding moving from more traditional crops to energy crops
- Develop a national carbon reduction strategy either in the form of a cap and trade system or implement a carbon tax that will help provide more incentive for cellulosic ethanol developers

Summary

- Cellulosic ethanol has the potential to replace a significant portion of US gasoline consumption but several technical, logistical and project finance challenges must be solved
- Cellulosic ethanol development has powerful market drivers: High volatile oil prices, Renewable Fuel Standards, environmental concerns, subsidies, energy security and growing numbers of financial and strategic investors
- VCs investing in companies that commercialize cellulosic ethanol production must be very patient investors and prepared to leverage government support and strategic relationships

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