

Entretech - (A taste of) Everything Green

Sam Nejame
Promotum

Green Agenda

- Where we are now... Why we need green routes to fuels & chemicals
- Biofuels... Advanced & Otherwise
- Polymers & Chemicals from sustainable materials

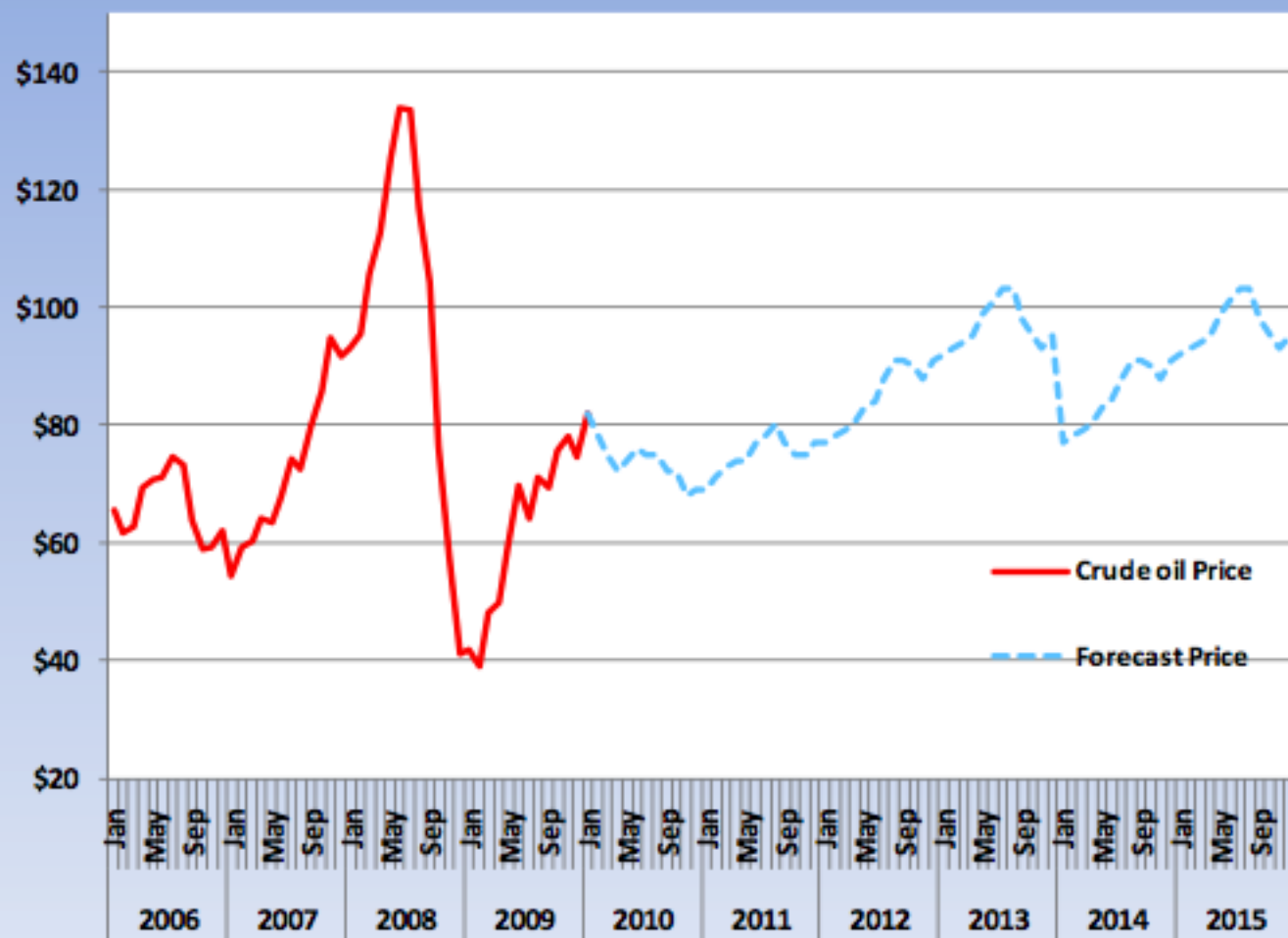
Top Ten Oil Consumers and Producers

(Million Barrels of Oil per Day)					
Country	Consumption	Production	Import	Export	Rank
USA	20,687	8,330	12,357		
China	7,201	3,485	3,356		
Japan	5,159	129	5,031		
Russia	2,811	9,677		6,866	No. 2
Germany	2,665	151	2,514		
India	2,572	854	1,718		
Canada	2,264	3,288	1,024	2,353	No. 6
Brazil	2,217	2,166			
So. Korea	2,174	18	2,156		
Saudi Arabia	2,139	10,665		8,525	No.1
Mexico	1,997	3,707		1,710	No. 10
Venezuela	668	2,803		2,131	No. 7
Iran	1,679	4,148		2,390	No. 5
UAE	381	2,945		2,565	No. 3
Norway	239	2,786		2,469	No. 4

Crude Oil: Changing Demand and Forecast

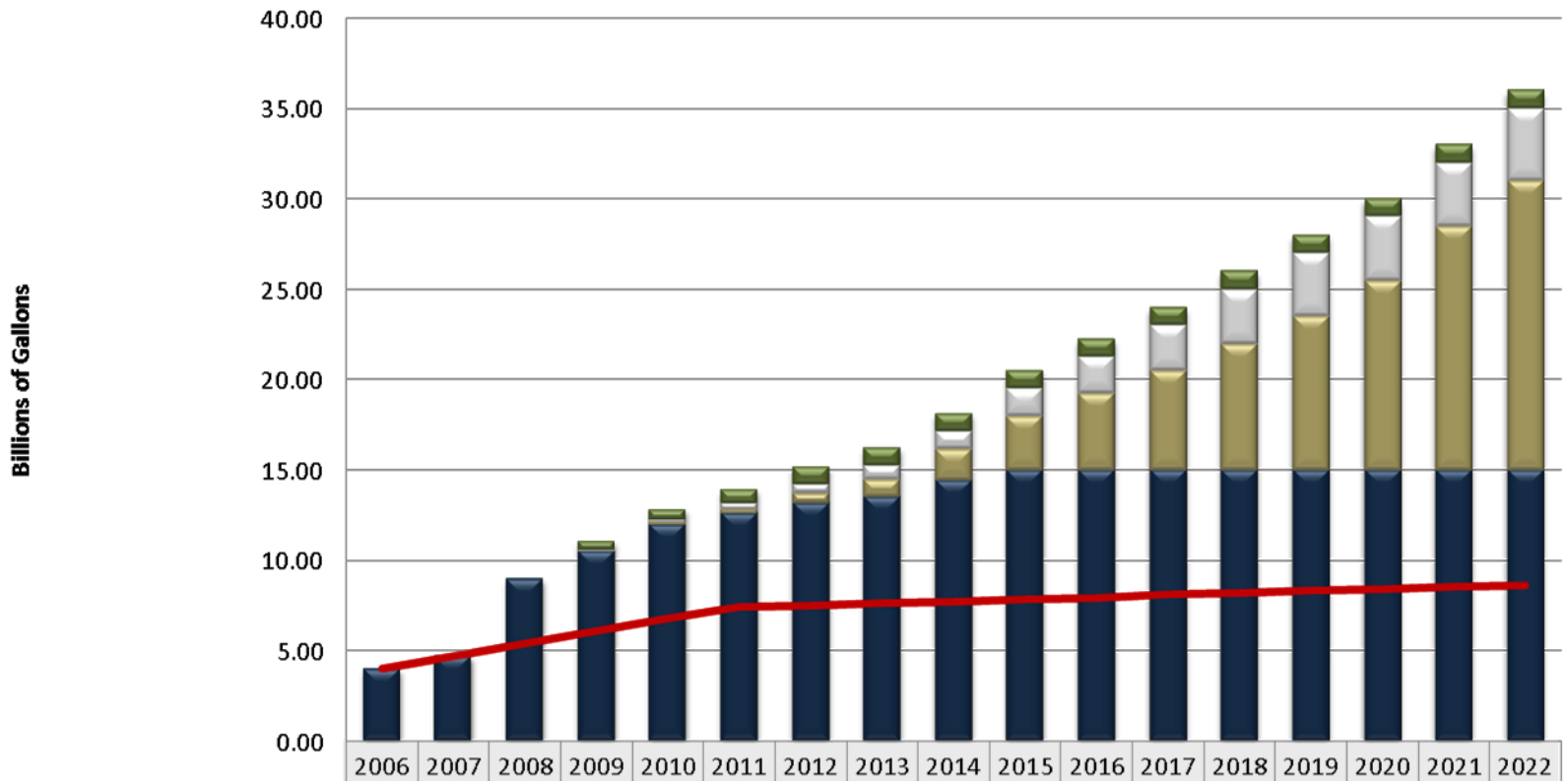
2010 Crude Oil Price Forecast

Average Monthly Price
2006 to 2015



RFS Requirements for Biofuels

Renewable Fuel Standard (RFS), 2007-2022



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biomass-based Diesel				0.50	0.55	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Non-cellulosic Advanced				0.10	0.20	0.30	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	3.50	3.50	4.00
Cellulosic Advanced					0.10	0.25	0.50	1.00	1.75	3.00	4.25	5.50	7.00	8.50	10.50	13.50	16.00
Conventional Biofuels	4.00	4.70	9.00	10.50	12.00	12.60	13.20	13.50	14.40	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Current RFS PL 109-55	4.00	4.70	5.40	6.10	6.80	7.40	7.50	7.60	7.70	7.80	7.90	8.10	8.20	8.30	8.40	8.50	8.60

Ethanol Plant Locations & Capacity

U.S. ETHANOL BIOREFINERY LOCATIONS



- Biorefineries in production (170*)
- Biorefineries under construction (20)

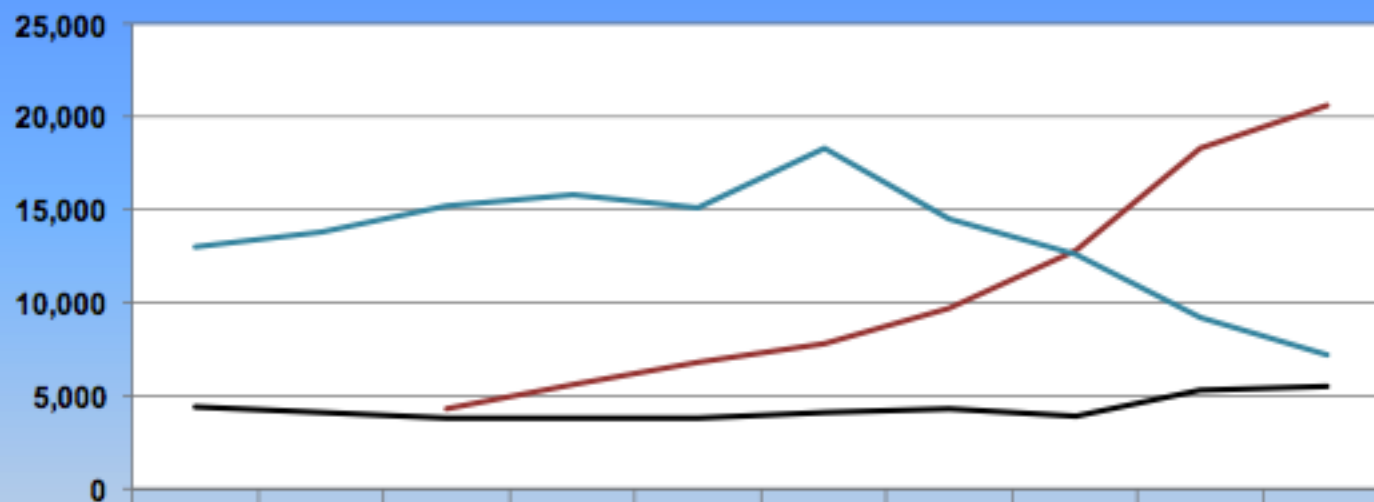
Source: Renewable Fuels Association, January 2009

RECENT ETHANOL INDUSTRY EXPANSIONS

	Jan 2000	Jan 2001	Jan 2002	Jan 2003	Jan 2004	Jan 2005	Jan 2006	Jan 2007	Jan 2008	Jan 2009
Biorefineries Online	54	56	61	68	72	81	95	110	139	170*
Capacity (mgy)	1,748.7	1,921.9	2,347.3	2,706.8	3,100.8	3,643.7	4,336.4	5,493.4	7,888.4	10,569.4

* This figure represents operating ethanol biorefineries as of January 2009. It does not include those facilities that have been temporarily idled.
For a complete list visit www.ethanolRFA.org.

Motor Gasoline Imports vs Ethanol Production Average in (000) Barrels per Month



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
— Ethanol Production			4,231	5,564	6,751	7,753	9,717	12,838	18,327	20,575
— Motor Gasoline Imports	13,019	13,823	15,158	15,752	15,140	18,331	14,454	12,551	9,199	7,136
— Motor Gasoline Exports	4,378	4,040	3,776	3,814	3,791	4,123	4,314	3,864	5,237	5,483

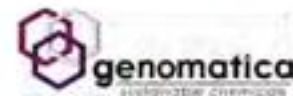
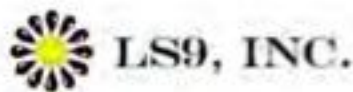
Current Location of Cellulosic Ethanol Biorefineries



Products—Other than Ethanol and Biodiesel



Evolve



Examples of Chemicals/Polymers

- Butanol
- Isobutanol
- Acrylic Acid
- Propylene Glycol
- Glycolic Acid
- Acetic Acid
- Caprolactam
- Succinic Acid
- 1,4 Butanediol
- MEK
- Isoprene
- PLA
- Adipic Acid
- SAP (Substitute)

What do we do?

We use metabolic engineering and metabolic evolution to construct organisms that make high value, high purity, renewable chemicals

- Engineer genes of biosynthetic pathways
 - Eliminated undesired activities
 - Identify rate-limiting enzymes
 - Substitute promoters with better, deregulated promoters
 - Replace ribosome binding sites, add terminators, etc.
 - Amplify genes

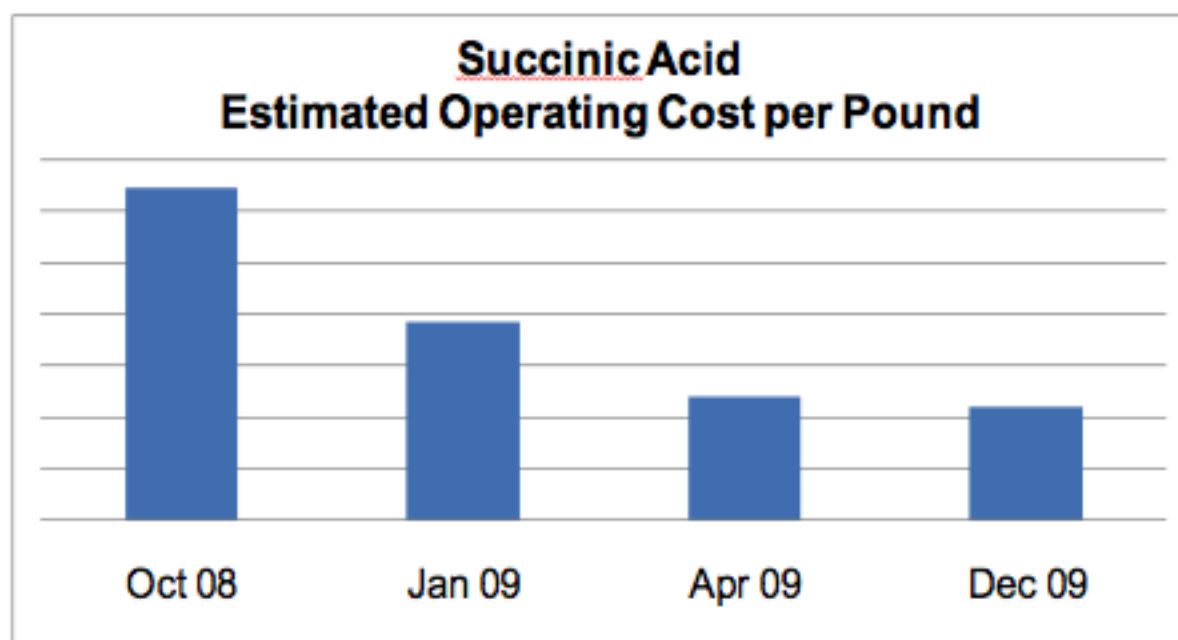


***We know how to turn
our bugs on or off!***

Myriant has already reached commercial cost targets for Succinic Acid



- 3X cost reduction from Oct '08 – Dec '09 on dextrose
- Further expected cost improvements with cellulosic sugars



We are competitive at today's oil prices and down to less than \$45/barrel equivalent!

Bio-Derived Plastics

Summary of Recent Large Projects

	DuPont Bio-PDO (Serona®)	NatureWorks™ PLA	Dow/Crystalev JV
Plant Scale	45 kTA	140 kTA	350 kTA
Fermented Product	1,3-Propanediol	Lactic Acid	Ethanol
Key Processes	Fermentation, Condensation Polymerization	Fermentation, Oligomerization, Ring-Closing, & Ring-Opening Polymerization	Fermentation, Dehydration, Polymerization
Initial Product	PDO/TPA Copolymer	Poly(lactic acid)	Ethylene, Polyethylene, Copolymers
Flexibility	Moderate	Low	High

