

2014 CenUSA Switchgrass Bioenergy Feedstock Field Day

John Hay

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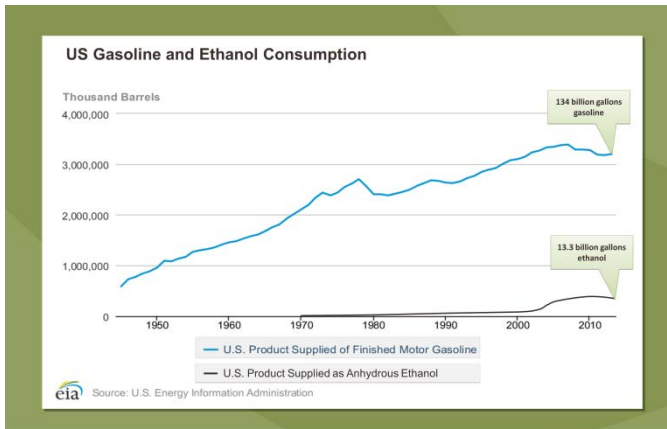
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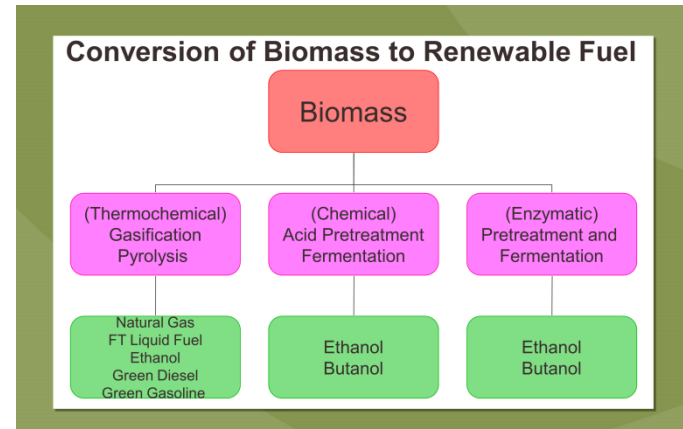
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CenUSA is supported by Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30411 from the USDA National Institute of Food and Agriculture.



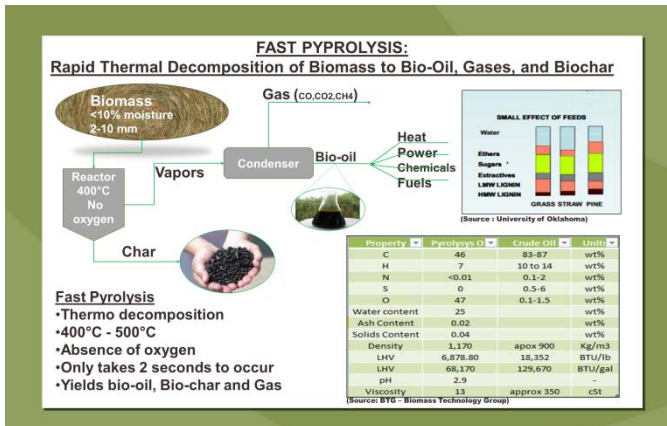
2014CenUSA-HAY (1)



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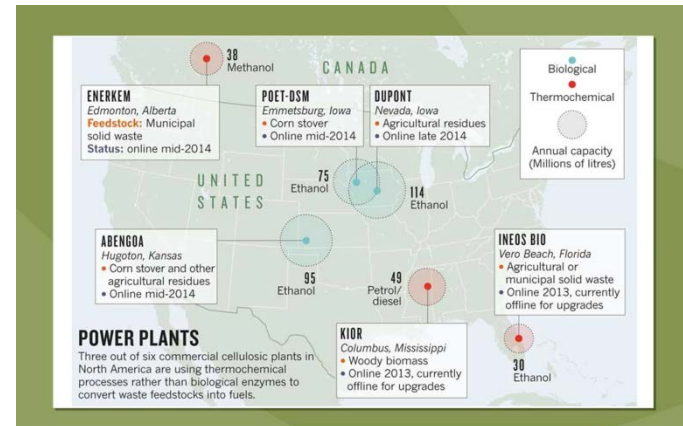
2014CenUSA-HAY (2)



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2014CenUSA-HAY (3)



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2014CenUSA-HAY (4)

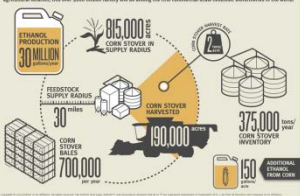


Project LIBERTY - 48,000 sq ft, 100,000 gal ethanol facility

DuPont
Nevada, IA
 • **Capacity:** 30 million gallons per year (ethanol)
 • **Feedstock:** Slower (second pass rake and bale)
 • **Biomass harvested:** ~2 ton per acre
 • **Acres:** ~190,000 acres
 • **Harvest:** Contract second pass harvest only

POET DSM - Project Liberty
Emmetsburg, IA
 • **Capacity:** 20 million gpy (ethanol)
 • **Feedstock:** Cobs, leaves, husks, stem (back of combine)
 • **Biomass harvested:** ~1 ton per acre
 • **Acres:** ~200,000 acres
 • **Harvest:** Contract second pass harvest of windrow behind combine or Farmer harvest and deliver – single pass or second pass

Making Cellulosic Ethanol a Reality: By the Numbers
 The Refinery Nevada Site Cellulosic Ethanol Facility is expected to be completed in the second half of 2011. Situated in a prime agricultural location, this one-of-a-kind facility will be among the first commercial-scale cellulosic bioethanol refineries in the world.



Sources:
<http://poet-dsm.com/liberty>
<http://biofuels.dupont.com/cellulosic-ethanol/>

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2014CenUSA-HAY (5)



Abengoa Bioenergy
Hugoton, KS
 • **Capacity:** 25 million gpy (ethanol)
 • **22 MW electricity and heat**
 • **Feedstock:** Mix of Ag waste and energy crops
 • **Biomass harvested:** varies
 • **Acres:** ~200,000 acres
 • **Harvest:** mix



Kior
Columbus, MS
 • **Capacity:** 13 million gpy (green gasoline and green diesel)
 • **Feedstock:** woody biomass
 • **Technology:** pyrolysis – refining to green gasoline and diesel



INEOS Bio
Vero Beach, FL
 • **Capacity:** 8 million gpy (green gasoline and diesel)
 • **Feedstock:** Varied - MSW
 • **Technology:** Gasification then syngas upgrade

Sources:
<http://www.abengoa.bioenergy.com/>
<http://www.kior.com/>

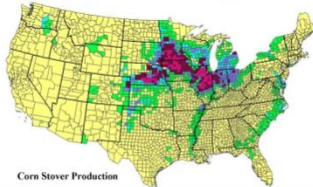
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2014CenUSA-HAY (6)

Cellulose Challenges

- Harvest
- Storage
- Marketing Contracts
- Opportunity Cost



2008CMDC-JHay001

Oil Seed Challenges



- Harvest
- Storage
- Markets
 - Oil
 - Meal
- Pests/Diseases
- Opportunity Cost

2008CMDC-JHay002

Opportunity Costs

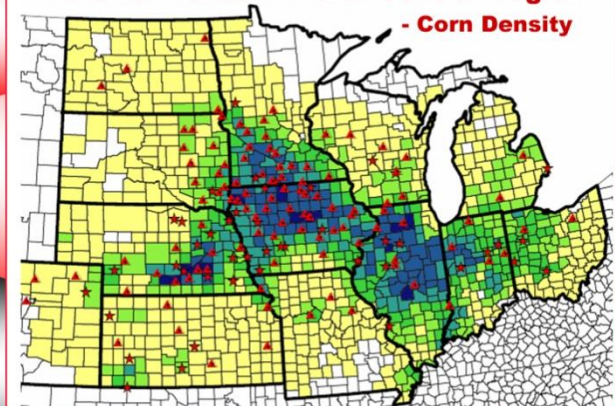
U.S. Crops	Yield bu/ac	Yield lbs. / acre	Products	Oil %	Oil Yield lbs/ac	Operating Costs	Opp Cost
Soybeans	dry 40	2,376	Oil, Meal	18%	428	\$194	\$286
	irr 65					\$299	\$481
Sunflowers (oil type)		2,200	Oil, Meal	40%	880	\$300	\$360
		dc 1,200			480	\$200	\$160
Canola**		irr 2,300	Oil, Meal	40%	920	\$194*	\$450*
Corn	dry 125	8,960	Oil, Ethanol, DDGS	<2%	130	\$268	\$482
	irr 200					\$406	\$794
Switchgrass		8,000	Hay, Biomass			\$125	\$175
Wheat	60	3,360				\$232	\$248

Source: USDA - National Agricultural Statistics Services, <http://www.nass.usda.gov/QuickStats/>

*estimated operating costs
** Western Nebraska

2008CMDC-JHay003

Ethanol Plants in North Central Region - Corn Density



2008CMDC-JHay004

Cellulose Harvest



Whole Plant Harvest

Harvest With Combine

Round Baling



Cobs with Combine



Cobs with Combine and Cart



Miscanthus Harvest



2008CMDC-JHay005

2008CMDC-JHay006