36th Annual Engineering Insurance Conference
October 14, 2009

Technology and Risks of Bioethanol and Biodiesel Production

Courtesy of DOE/NREL, Credit - Warren Gretz

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Presented By:

The Hartford Steam Boiler Inspection & Insurance Company

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Presenter:

James Splain

Principal Engineer

Courtesy of DOE/NREL, Credit - Warren Gretz

Bio-Fuels
-a definition-

An alternative energy source which is:

- Gas, solid or liquid
- Made from renewable sources
- Produced from recent living biological sources (bio-mass)

Courtesy of DOE/NREL,
Credit - Charles Bensinger and
Renewable Energy Partners of New Mexico

Examples

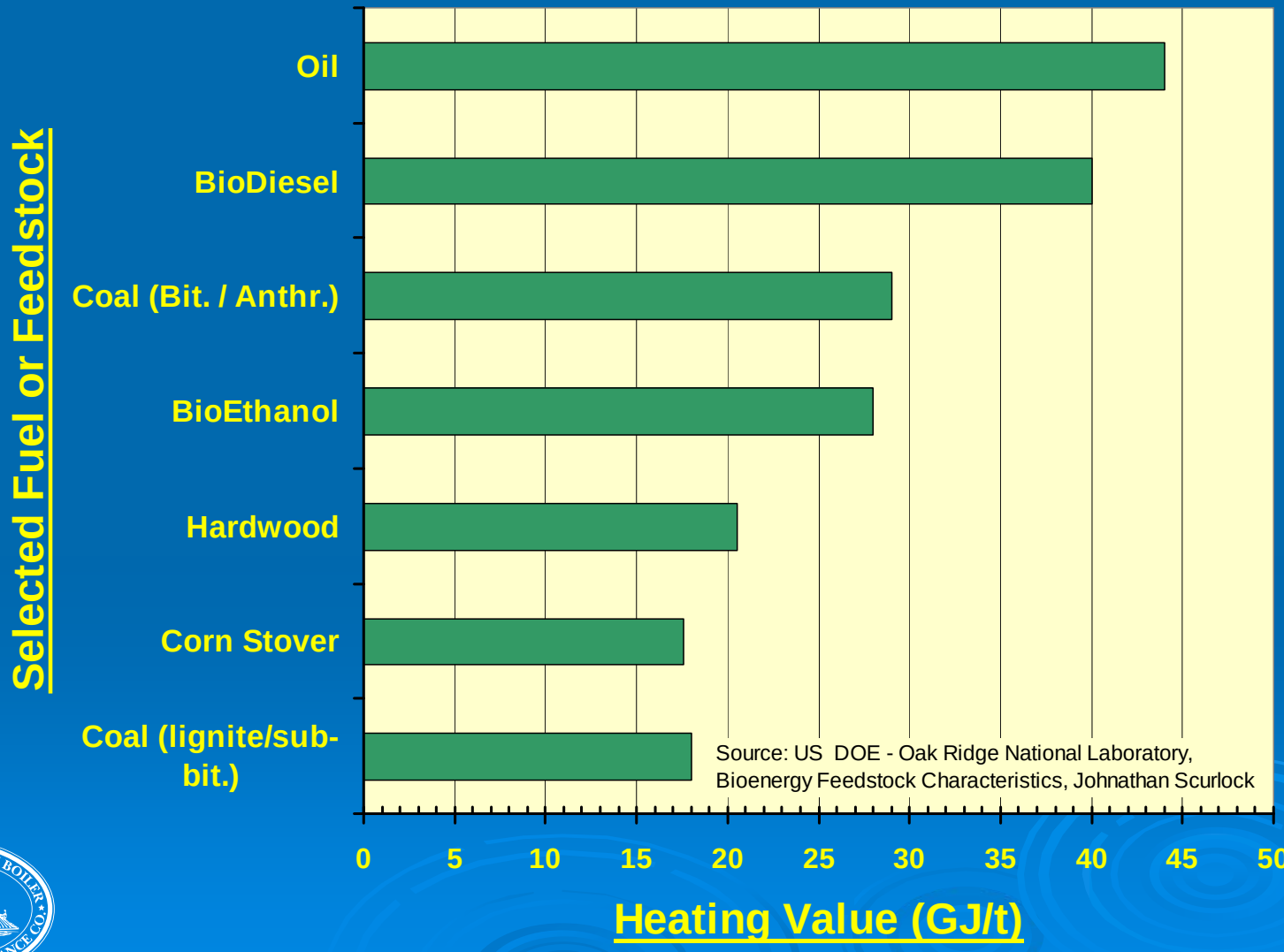
- Bio-Ethanol
- Bio-Diesel
- Fuel Pellets
- Syngas
- Bio-Methane

Sources of Bio-Mass

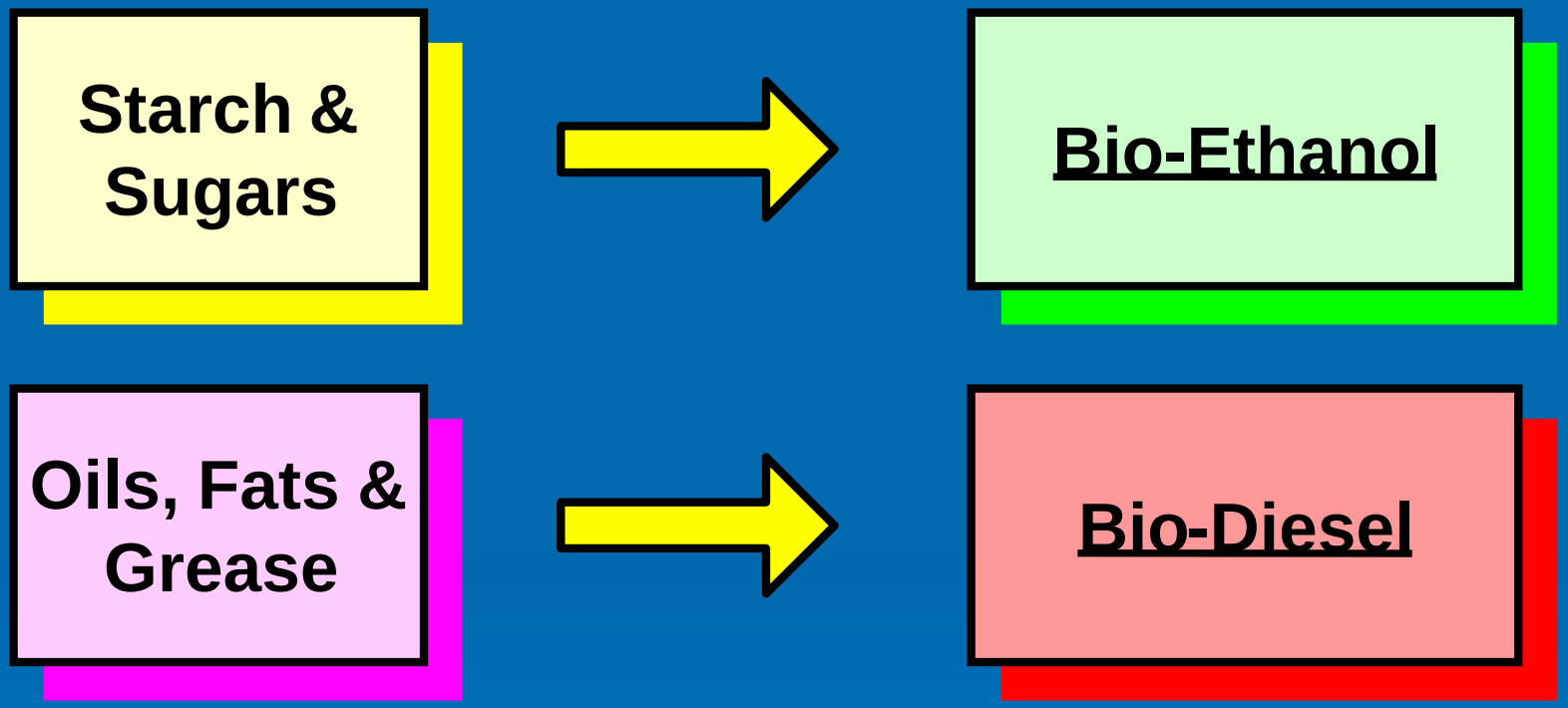
- Soy
- Corn
- Grains
- Manure
- Cellulosic
- Sugar Cane
- Animal Fats
- Other Crops
- Municipal Waste
- Canola (Rape Seed)
- New and recycled wood
- Recycled Fats, Greases and Oils

Courtesy of DOE/NREL, Credit - Warren Gretz

Fuel & Feedstock Heating Values



Bio-Ethanol v Bio-Diesel



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➢Bio-Diesel

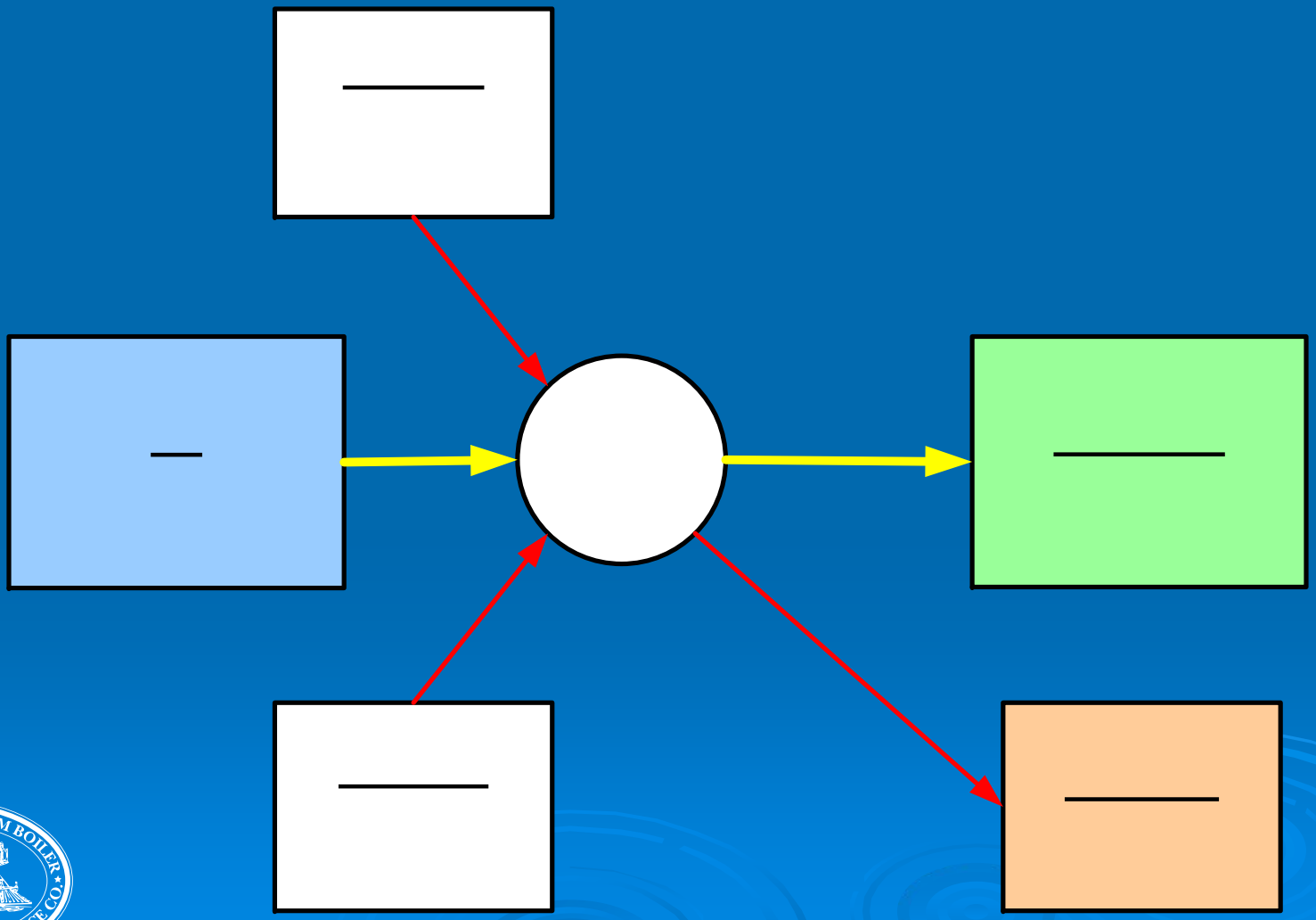
a catalyst reaction of oil/fats

January 2009 Installed Capacity:
216 million liters/year*
Feedstock: 49% tallow, 37% yellow grease, 14% canola*

Ethanol

***Source: USDA Foreign Agricultural Service Gain Report Number CA9037 6/30/2009**

Bio-Diesel Production
-the basics-



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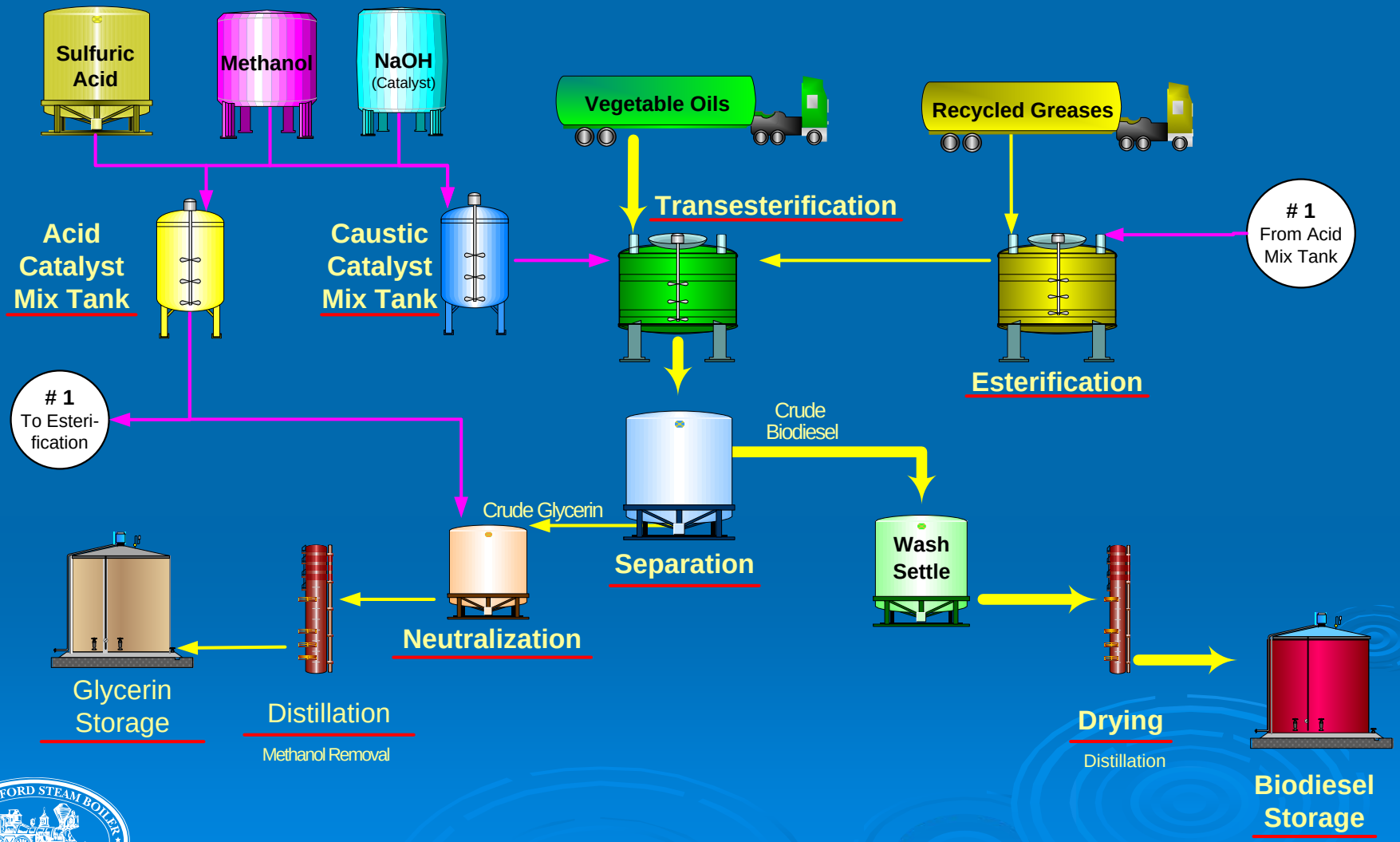
Bio-Diesel "Home Brewing" The Dr. Pepper® Method

- Sodium Hydroxide
- Methanol
- Vegetable Oil
- Soda Bottle
- Funnel
- Measuring Cup
- Gloves
- Thermometer
- Teaspoon
- Goggles
- Glass Jar
- Water

Bio-Diesel
Small & Mid Size Systems

Used by Permission of Piedmont Biofuels
http://biofuels.coop/services/reactors/

Bio-Diesel Production



Bio-Diesel Typical Risks

- Methanol fueled fire
- Inexperienced owner/operator
- Long lead components
- Feed stock change or shortage
- Process equipment failure
- Storage equipment failure
- Loss of key utilities including power and steam.

Bio-Diesel
Major Equipment

- Agitators/Mixers
- Automated Process Control System
- Boiler – Hot Oil or steam
- Cooling Tower / Chiller
- Distillation Columns
- Electrical – MEA, Transformers, Motors
- Evaporators / Dryers
- Heat Exchangers / Reboilers / Condensers
- Pumps
- Reactor - Plug Flow or Continuous Stirred
- Separator – Centrifuge
- Tanks – Atmospheric
- Tanks – NF Pressure Vessels

BioDiesel
New Plant Capital Investment ($)

Typically costs vary widely.
We would expect to see costs of :

$1.1 million for each 4.0 million liters/yr of biodiesel production capacity.

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Bio-Diesel

➢Ethanol

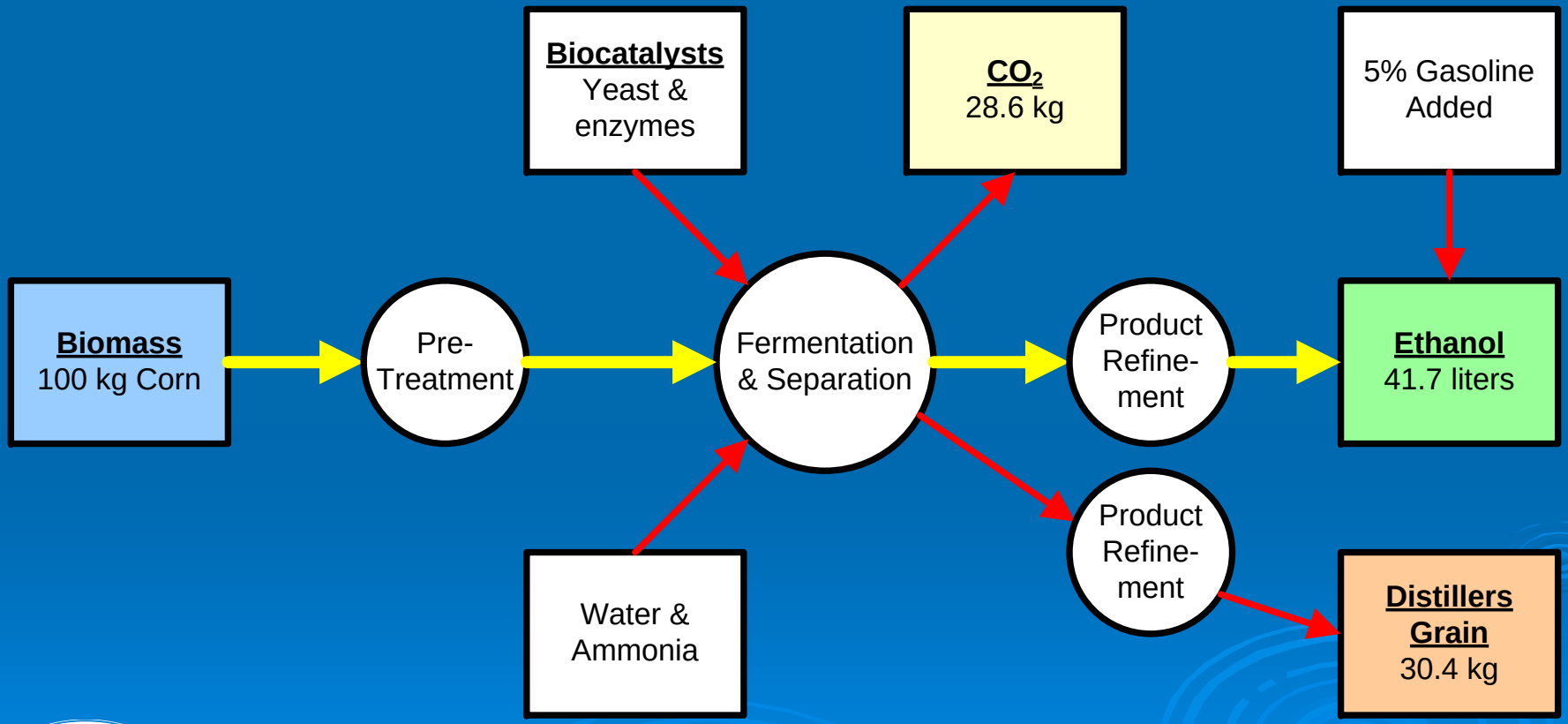
a fermentation reaction of sugars/starches

January 2009 Installed Capacity:
1.42 billion liters/year*

Feedstock: 69% corn, 30% wheat, 1% other*

*Source: USDA Foreign Agricultural Service
Gain Report Number CA9037 6/30/2009

Bio-Ethanol
- the basics-

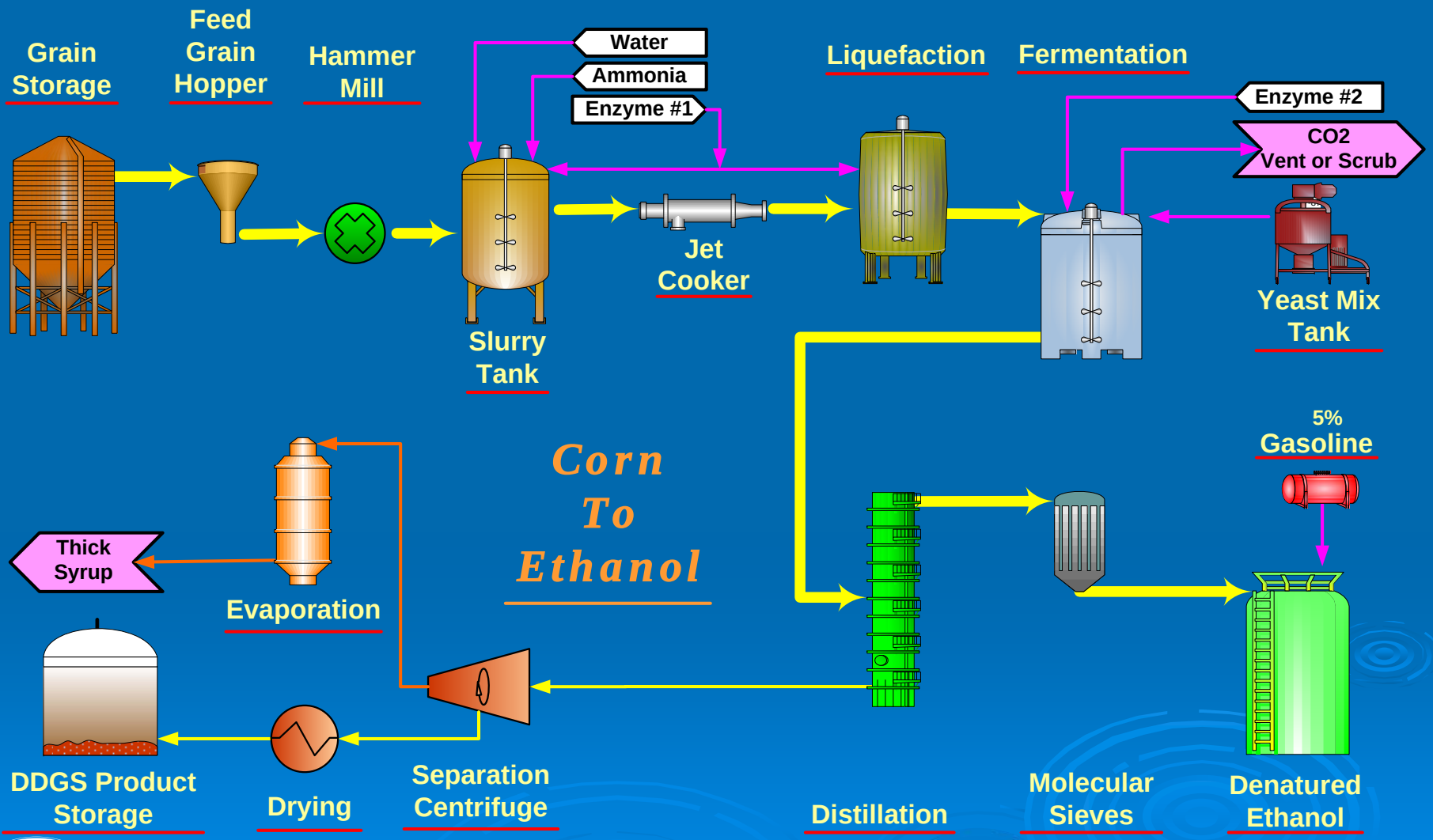


BioEthanol Production

Courtesy of DOE/NREL, Chris Standlee

208.2 million liters per year/ Cost: $73.2 - $133.4 million

Bio-Ethanol Production



BioEthanol
New Plant Capital Investment

Typically costs vary widely.
For large scale plants, we would expect to see costs of:

$1.94 million for each 4 million liters/yr
of bioethanol production capacity.

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Bio-Ethanol
-typical risks-

Molecular Sieves at 151 million liters/yr Plant

- Inexperienced owner/operator
- Perishable Goods
- Drying the Distillers Grain
- Process Instrumentation Failure
- Process Equipment or Component Failure
- Storage equipment failure
- Loss of key utilities - power, steam and coolants.

Bio-Ethanol Major Equipment

- Agitators / Mixers
- Automated Process Control System
- Boiler – Steam
- Compressors - Air, CO_2
- Cooling Tower / Chiller
- Distillation Columns
- Dryer
- Electrical – Transformers, Motors, MEA
- Evaporators
- Hammer Mill
- Heat Exchangers /Reboilers /Condensers
- Hoppers and Materials Conveyance
- Molecular Sieve
- Pumps - Centrifugal, Metering, Vacuum
- Separator – Centrifuge
- Tanks – Atmospheric, NF Pressure Vessels

Additional Information and Resources

- Jim Splain - HSB - (860) 722-5108 james_splain@HSB.com
- US Department of Energy - Energy Efficiency and Renewable Energy - www1.eere.energy.gov/biomass/
- National BioDiesel Board -www.biodiesel.org
- USDA Foreign Agricultural Service, Gain Report Number CA9037, 6/30/2009, Darlene Dessureault,

  http://gain.fas.usda.gov/Recent%20GAIN%20Publications/General%20Report_Ottawa_Canada_6-30-2009.pdf

- Canadian Renewable Fuels Association - www.greenfuels.org/

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Questions ?????

Courtesy of DOE/NREL, Nebraska Ethanol Board

273 million liters per year/ Cost: $98-$169 million

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