

Corn Stover to Methanol Why & How

Presented by

Cecil Massie

March 13, 2007

Today's Topics

- Why methanol from corn stover?
- How will it be done?
- Tax credits and renewable energy

Agriculture Definition

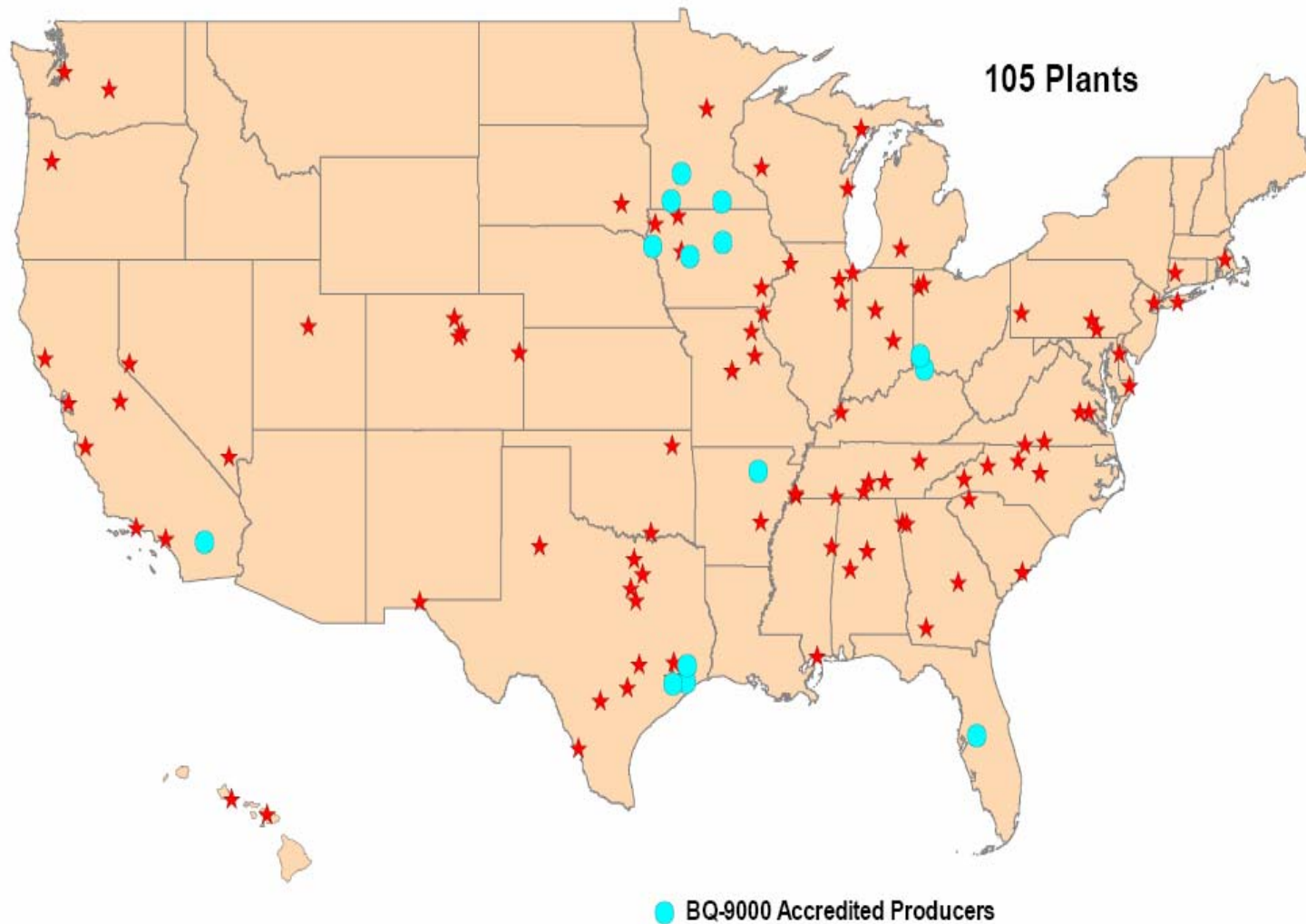
- Agriculture is the business of
 - collecting
 - storing
 - refining solar energy
- Diverse energy markets that were once closed to biomass based fuels are now opening to them.

Why Methanol?

- Local demand from biodiesel plants
- As a stepping stone to what we really want
- As a biomass densification process
- Process is proven

Biodiesel Plants

Commercial Biodiesel Production Plants (January 31, 2007)



Biodiesel Methanol Demand

- Total annual capacity of 864 million gallons of biodiesel creates methanol demand of approximately 86 million gallons vs total capacity of 1800 million gallons
- MTBE was the largest use of methanol at 37% of domestic demand
- Several US plants have closed due to high natural gas prices

As a Stepping Stone

- The process for making methanol is similar to the process for making
 - Synthetic natural gas
 - Synthetic diesel
 - Higher alcohols: Ethanol, Propanol & Butanol
 - Ammonia
 - DME or Dimethyl ether
- What we learn making methanol helps with all of these

Biomass Densification

- Low mass and energy density make biomass unattractive to haul long distance.
- Need to recycle N,P,K and micronutrients to the soil argues for local separation of energy bearing CHO from the ash
- One potential way to do this is to locally convert biomass into readily useable and transportable forms such as methanol or methane.

Proven Process = Financing

- Ethanol industry has grown up with “process warranties” and banks have grown accustomed to them
- Methanol production is “off the shelf” technology and gives comfort to investors that it will work
- Once the feedstock prep is in place, plants can build on the methanol foundation

How Will it Be Done?

- Overall process will involve
 - Collection/storage/transport of stover
 - Fuel conditioning for moisture and particle size
 - Gasification to produce synthesis gas
 - Removal of contaminants
 - Reaction and purification to make methanol

The Chemistry



- Reaction conditions

- Catalyst comprised of copper, zinc oxide and alumina
- Pressure – 50 to 100 atm or 750 to 1500 psi
- Temperature – 250C or 482F



Energy Balance

- Plants are self sustaining on thermal energy by burning part of their feedstock supply
- Plants avoid large electrical demand by using heat of reaction to generate steam that drives turbines or direct connected turbo expanders.

Water Balance

- Plants consume water for steam production used to make synthesis gas
 - About $\frac{1}{2}$ gallon of water per gallon of methanol
- Plants use cooling tower water to dissipate heat from the reaction and condense methanol
- Overall balance is probably around 1 gallon per gallon compared with 4 or 5:1 for current ethanol process

Renewable Tax Credits

Reference Info

- Internal Revenue Bulletin 2006-43
- Notice 2006-92
- Alternative Fuel and Alternative Fuel Mixtures;
Blood Collector Organizations

The Credit

- For liquid fuels - \$0.50 per gallon
- For CNG - \$0.50 per 121 SCF or \$4.13 per million Btu
- Credits are first applied to fuel tax refunds and then eventually to income taxes
- This is not tax advice. Check with your accountant!

Thank You

Cecil T. Massie PE

6Solutions, LLC

Bloomington, MN 55437

612-819-2235

c.massie@att.net