Cellulosic Ethanol
Update on Project Liberty

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POET-DSM Advanced Biofuels LLC Licensing
POET-DSM Advanced Biofuels

two innovative companies – one shared vision
Total Petroleum Demand

Source: IEA 2012
### Fast progress but some challenges

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<th>US</th>
<th>Brazil</th>
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| • Two medium size plants in start up phase  
• Three larger plants coming on next year  
• Some headwinds from RFS discussion | • Initial plant start up early next year  
• Several projects underway  
• Biomass availability, ethanol infrastructure and BNDES support are key positives. |

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<th>Europe</th>
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| • Several small/medium scale plants running  
• Announcements on larger plants  
• Government expected to come with clear positive direction short term | • First plant in place in Italy  
• Policy discussion slowing further progress  
• Biomass availability differs regionally |
Cellulosic Ethanol

Corn Crop Residue → Pre-treatment
Pre-treatment softens the rigid structure of cellulose

Hydrolysis & Fermentation
breaks down the cellulose to sugars which are converted to ethanol

Distillation collects ethanol by means of evaporation & condensation

SOLID FUEL BOILER
converts residual solid materials, producing steam energy

Solids → Separation

Liquid non-ethanol

Lignin (non-fermentable)

Anaerobic Digestion breaks down biodegradable materials producing a methane-rich biogas

Steam & Biogas to power cellulose & grain ethanol plants
Project LIBERTY

- 22-acre biomass stackyard, saccharification, and fermentation tanks are complete.

- Biomass receiving and grinding building complete. Biomass processing equipment nearly installed.

- Pretreatment, biogas, and solid-fuel boiler installation is ongoing.

- Start up early 2014. Capacity of 25 mln gallons
Corn crop residue
*Strategic, logistical advantage*

- Plentiful supply—Now starting fourth annual harvest
  - Existing crop
  - Project LIBERTY’s needs can be met from 1/3 of corn hectares in a 55 km radius

- Existing relationships
  - POET Biorefining – Emmetsburg currently purchases corn from 600 area farmers

- Existing harvest equipment
  - Harvesting can be done with a standard combine and baler
Sustainability

• 5 years of on-site research by Iowa State University and USDA

• “The five-year results of this project have shown that with good management practices corn stover can be safely and sustainably harvested from fields similar in nature.”
  – Dr. Stuart Birrell, ISU

• Conclusions
  • Safe removal of up to 2 tons/acre on fields of 175 bu/acre or more
  • Grain yields, soil nutrient levels not significantly affected
    • No change to N and P application levels
    • Additional 10-15 units of K may be beneficial
DSM thermo-tolerant enzymes

Fast liquefaction – active above 60°C

Thermostability of DSM enzymes enables:

- A higher dry matter content up to 25%
- Improved control of contamination

... significant savings!

**CAPEX** savings due to lower required capacity of process equipment

**No antibiotic costs**

**Increased revenues** because less sugar are lost
On Site Manufacturing of enzymes

- Organism producing enzymes is grown on local C-source and produces the required enzyme cocktail based on local inducers (e.g. the plant’s cellulosic feedstock)
- OSM process fully integrated with the cellulosic ethanol plant maximizing cost-effectiveness
- Enzymes produced as whole broth, directly applicable in hydrolysis

* Picture on slide is skid-mounted OSM pilot plant vessel
Commercialization of DSM Yeast

On track

- ADY RN1016 yeast product produced, transported and successfully trialed
- MCAN for RN1016 granted (US)
- RN1016 Notification in Brazil expected Q4
Glycerol/acetic acid technology

Benefits in relation to enzyme cost

Enzyme Cost Contribution does not take into account additional cost for procurement of glycerol.
Value Proposition- A full service package

**Upfront**
- Site Selection and Regulatory support
- Biomass development
- Financing

**Building**
- Process design, Engineering and Construction
- Enzymes including On Site Manufacturing
- Yeast

**Operation**
- Start up and ongoing technical support.
- Can provide full plant management and ethanol marketing