

Commercial Challenges Facing Cellulosic Ethanol

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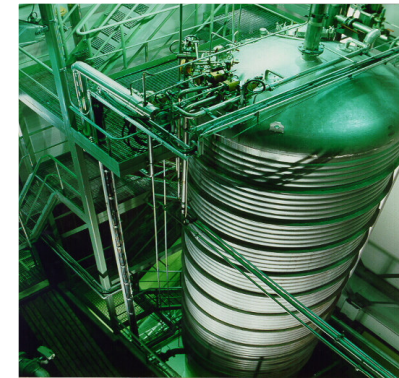
The world's first robust, integrated solution for biomass-to-ethanol



Pretreatment



Enzymatic hydrolysis

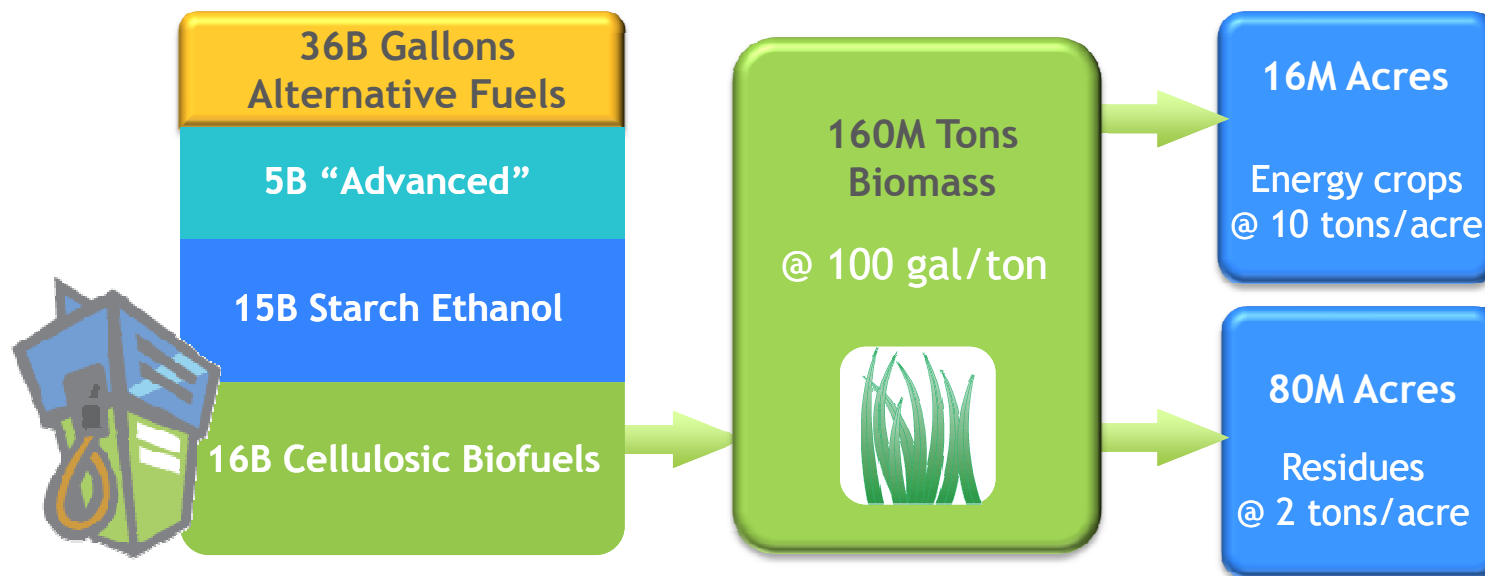


Mixed sugar ethanologen



- Including:
- ▶ >\$100 million invested since 2000
 - ▶ Significant enabling patent estate
 - ▶ Demonstrated capabilities in scale up & design

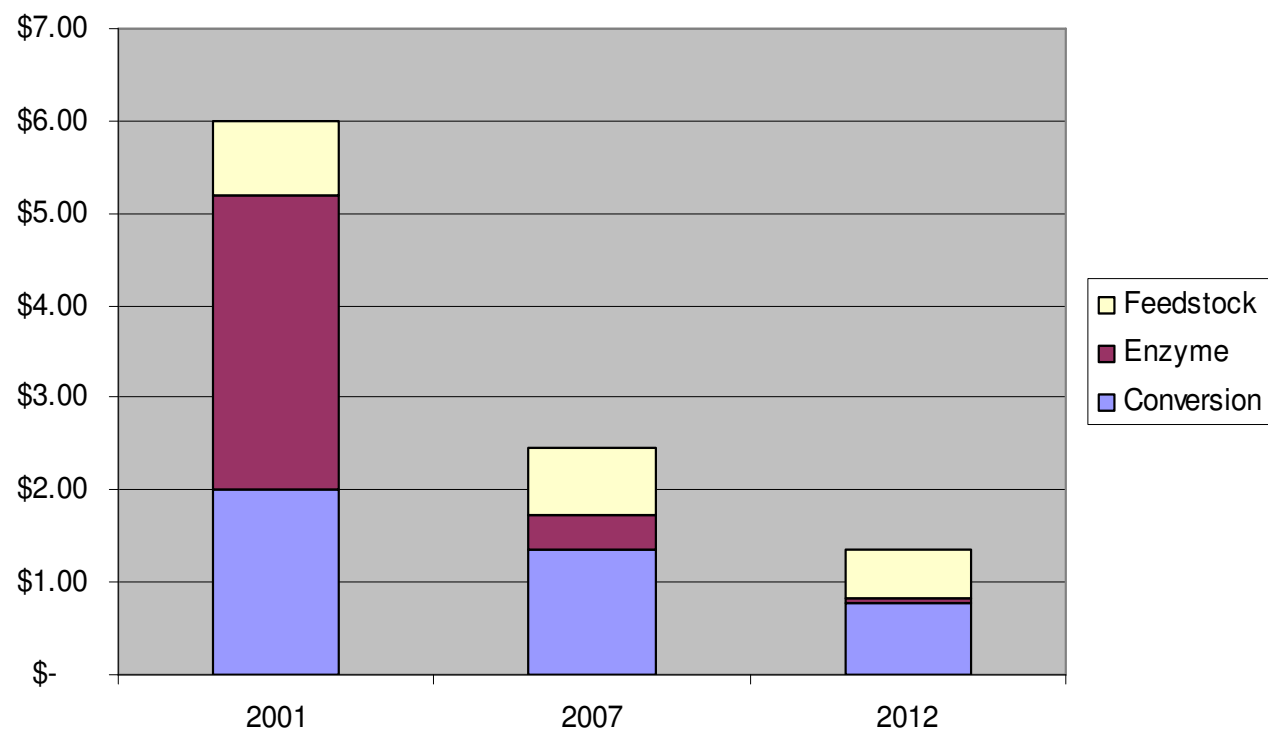
Higher Yield Density Means Fewer Acres



Operating Costs (DOE's MYPP)



Cellulosic Ethanol Costs (DOE)

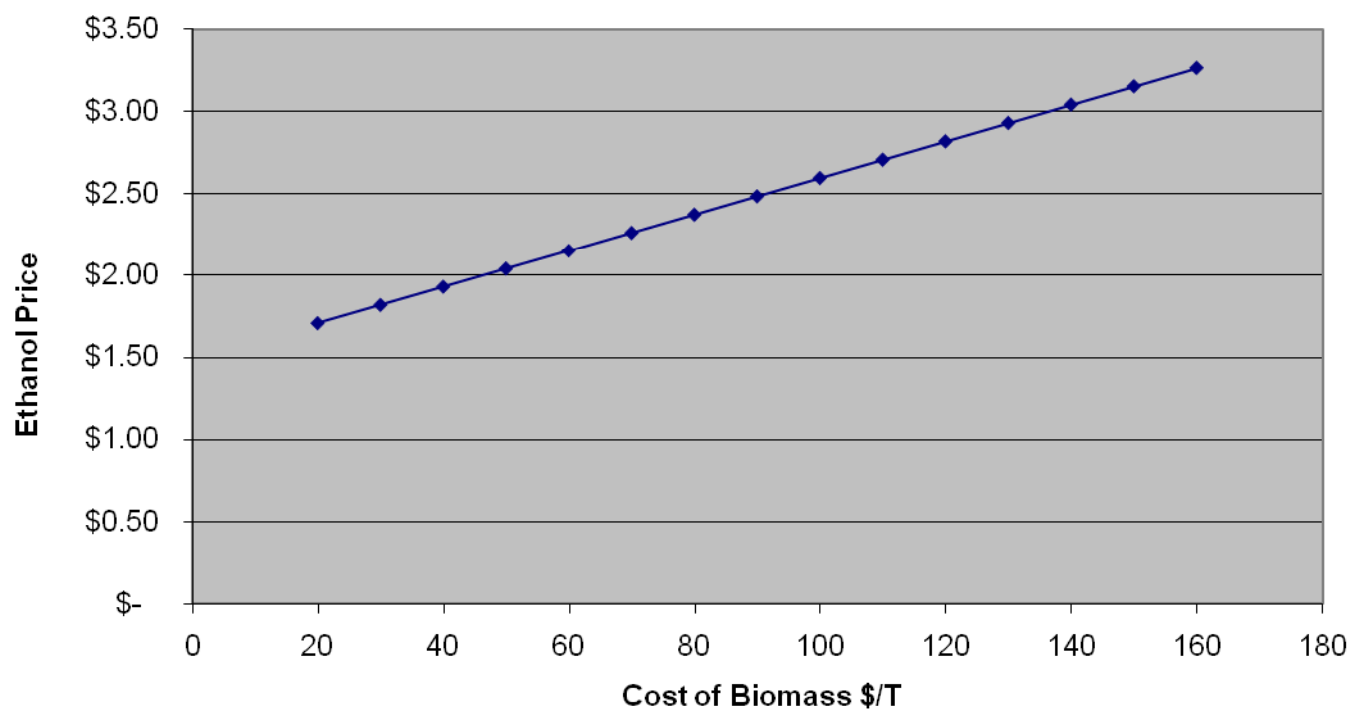


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Break Even Analysis: EtOH vs. Biomass (BDT)



Break-Even Ethanol Price



Basis: NREL, 2012 Nth Plant Assumptions
(incl. Biomass Costs)

The Challenges: Short List



- ▶ Market demand
 - Predictable Government policies
 - ▶ RFS / ILUC
 - ▶ LCFS
 - Blend wall & blender opposition: (15 BGPY @ E10)
 - Where are we going? FFV vs. Plug-in hybrids?
 - ▶ Commercial: objective is to compete with starch ethanol w/o subsidy
 - Pioneer risk capital to profitability
 - ▶ Sharing the reward; Sharing the risk
 - Who will build a biorefinery without a sure supply of feedstock?
 - Who will grow the feedstock without a customer?
 - ▶ Consumer/public acceptance
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