Diversity  Efficiency  Profitability

Neal Jakel
Partner, Strategy and Technology

EPM Project of the Year
2017 ACE – Product Diversification, a Proven Path Forward

What has changed?
Historical Ethanol Performance

Challenges

➢ Lower highs and lower lows
➢ Margin compression
➢ Market deterioration
➢ Lack of confidence
➢ Lack of decisions
Ethanol Industry: At a Crossroad?
Dream is realized today, just not in one location

THE BIOREFINERY DREAM REALIZED

Today
Majority of Dry Mills today, produce only 3 products
Base Wet Mill Plant Operations

Cam wet mills can produce over 200 SKU’s
How do we beat the oil industry?

What is the #1 Cost Factor in Producing Ethanol?
**Net Corn/Net Starch – Start Here**

Cost of starch ($/#) = Corn cost – coproduct value

<table>
<thead>
<tr>
<th></th>
<th>Wet Mill</th>
<th>Base EtOH Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Cost ($/bu)</td>
<td>$3.70</td>
<td>$3.60</td>
</tr>
<tr>
<td>Co-Product Credit ($/bu)</td>
<td>$1.52</td>
<td>$1.13</td>
</tr>
<tr>
<td>Cost of Corn ($/bu)</td>
<td>$2.18</td>
<td>$2.47</td>
</tr>
<tr>
<td>Cost of Starch ($/#)</td>
<td>0.066</td>
<td>0.077</td>
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<tr>
<td>Added Corn Cost</td>
<td>-</td>
<td>(~$17M)</td>
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<tr>
<td>Compared to Wet Mill</td>
<td></td>
<td>($0.13/gal)</td>
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Steps to a Diversification Plan
Technology Selection Process for an Ethanol Facility


1. Ready for Commercial Operations – proven full scale or pilot (scale up issues)
2. Equipment Design and Reliability – novel or not new or operating
3. Marketability of Products – volume and market demand
4. Intellectual Property Rights – FTO an absolute must have
5. Depth of Technology/Experience of Provider – proven record or open promises
6. Risk Adjusted Financial Analysis – proven product sales vs promise of value
Global Trends Impacting EtOH Business
Case for Coproduct (Protein) Diversification Today

➢ Limited products – limited revenue (revenue risk)
➢ Long on energy short on protein – 10MT protein shortfall annually
➢ DDGS is an imperfect feed – square peg into a round hole scenario
➢ Legislative uncertainty – ethanol revenue risk uncertainties
➢ Global ethanol growth – limited export opportunities
➢ FQT’s protein is the industry leading technology – developed extensive market
➢ Provides capital for energy reduction projects – CI score reduction
The Case for Additional Co-Products Tomorrow

- Sugar/carbohydrates, the next big co-product
  - Dextrose shortage as wet mills decline
  - FQT Clean Sugar CST™ Commercial system full scale
- Co-located biochemical/protein production potential
  - Bio-World Congress, super session

Sugar Options
- Industrial/food grade
- Glucose/fructose
- Unrefined/refined
## Optimized Net Corn/Net Starch

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<td>0.058</td>
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<td>$~$12M</td>
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<td></td>
<td>($0.13/gal)</td>
<td>$0.09/gal</td>
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Today

Ethanol plants with FQT technologies are realizing an uplift of +$0.10 - $0.17/gal

Tomorrow

Ethanol plants will see an uplift of +$0.40 - $0.50/gal
Technology & Engineering Expertise

The FQT Team
➢ Corn Wet Milling / Ethanol / Biochemical Industry Expertise
➢ 20+ Chemical and Mechanical Engineers (50 Employees)
➢ Leading Nutritionist, QA/QC, Construction Management
➢ HQ: Cedar Rapids, IA
   ➢ Locations in Brazil and China

Engineering/Design
➢ 2+B gal/yr of Biofuels Utilize FQT Technology Systems
➢ State-of-the-art Greenfield Biofuels/Biochemical Facility Design
➢ Process Optimization / Integration / Commercialization
➢ EPC / Turnkey Provider
Partner Companies

FLINT HILLS resources
Green Plains
Quad County Corn Processors
SJC Bioenergia
SIRE
Center Ethanol Co., LLC
ERGON
Cargill
ZeaChem
CHS
JINPASA
The Andersons
CVEC
BGW
Cardinal Ethanol
Fox River Valley Ethanol
LITTLE SODY CORN PROGRESSORS
GREENFIELD
ADKINS ENERGY
GreenBiologics
Fluid Quip Technologies