Enhanced Profitability through Technology, Integration, & Diversification

Presented by:
Jeffrey P. Robert
Delta-T Corporation
Williamsburg, VA USA
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Jeffrey P. Robert
VP – Technical Services
Delta-T Corporation

323 Alexander Lee Pkwy
Williamsburg, VA USA 23185
(757) 220-2955
Enhanced Profitability through Technology, Integration, & Diversification

- Historical Impact of Technology
- Current State of Technology (*Financial Perspective*)
- New Technology Introductions/Developments
- Opportunities/Challenges for Future Technology
## Historical Impact of Technology

**Evolution to Current State**

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>CAPITAL ($US/gal)*</th>
<th>ENERGY (BTU/gal)*</th>
<th>CO-PRODUCTS</th>
<th>POLICIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early 80’s</td>
<td>$7.20</td>
<td>160,000</td>
<td>Preliminary Product Development</td>
<td>• Oil Embargo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Fed Incentives</td>
</tr>
<tr>
<td>Early 90’s</td>
<td>$1.60</td>
<td>63,000</td>
<td>Significant Expansion as Cattlefeed</td>
<td>• Clean Air Act</td>
</tr>
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<td>$1.25</td>
<td>36,000</td>
<td>Excess Supply = Depressed DDGS Pricing</td>
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</table>

Contributions by Enzyme and Yeast Technology Significant

* Basis: 40 mmgy AEtOH plant adjusted to 2002 $US CPI
## Historical Plant Financial Returns

### Total Revenues

<table>
<thead>
<tr>
<th></th>
<th>Jan ’03</th>
<th>Nov ’05</th>
<th>Jan ’06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>70.9%</td>
<td>84.9%</td>
<td>88.2%</td>
</tr>
<tr>
<td>DDGS</td>
<td>16.8</td>
<td>10.3</td>
<td>8.7</td>
</tr>
<tr>
<td>Other</td>
<td>1.6</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Incentives</td>
<td>10.7</td>
<td>4.6</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Total Revenue</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

*Assumes: 40Mgpy Dry Grind Corn Plant in Midwest USA*
Historical Plant Financial Returns

*Natural Gas Pricing (NG, NYMEX)*

Created with SuperCharts by Omega Research © 1997
## Historical Plant Financial Returns

*Variable Costs (as a % of Revenues)*

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<th>Jan ’03</th>
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<tr>
<td>Grain</td>
<td>46.0%</td>
<td>33.6%</td>
<td>36.9%</td>
</tr>
<tr>
<td>Additives</td>
<td>6.5</td>
<td>8.4</td>
<td>8.7</td>
</tr>
<tr>
<td>Energy</td>
<td>6.3</td>
<td>23.2</td>
<td>23.2</td>
</tr>
<tr>
<td>Labor</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Total COGS</strong></td>
<td><strong>61.2%</strong></td>
<td><strong>67.4%</strong></td>
<td><strong>70.7%</strong></td>
</tr>
<tr>
<td><strong>Gross Margin</strong></td>
<td><strong>38.8%</strong></td>
<td><strong>32.6%</strong></td>
<td><strong>29.3%</strong></td>
</tr>
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*Assumes: 40Mgpy Dry Grind Corn Plant in Midwest USA*
Impact of Technology Today
Maturing Commodity Mindset

- Smaller/Older plants *(pre 2002)* will survive in long run
- Newer/Larger Plants *(post 2002)* using “current technology” will struggle financially
- Future Plants, with New Technology & Risk-Embracing Investors, will set the bar for the market

*Survival of the Fittest …*

*ONLY THE STRONG WILL SURVIVE*
Impact of Technology Today
Maturing Commodity Mindset

Market is demanding Technology Providers to:

1. Provide Acceptable Returns to Investor
   
   while …

2. Minimizing Technology/Investment Risk
   
   while …

3. Producing THE Lowest Cost Ethanol on the Market
New Technology Commercialization

Life Cycle Challenges – Previous High Risk/High Return Model

New Technology

Will the Client Want/Pay for It?

Will the Technology Provider Guarantee It?

Build It !!
New Technology Commercialization

Life Cycle Challenges – Today’s Low Risk Position

New Technology

Will the Client Want/Pay for It?

Will the Technology Provider Guarantee It?

Will the Bank Finance/Fund It?

Will the Construction Firm Build/Bond It?

Build It !!
### Impact of Technology Today

**Transition in Marketplace - Change is Coming**

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<td>Current State</td>
<td>$1.00 - $1.75</td>
<td>36,000 to &lt;= 20,000</td>
<td>New Product Development &amp; Market Diversification</td>
<td>• Permanent Energy Policy</td>
</tr>
<tr>
<td></td>
<td>Technology Dependent</td>
<td></td>
<td></td>
<td>• Phase Out of Gov. Incentives</td>
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* Basis: 40 mmgy AEtOH plant adjusted to 2002 $US CPI
Ethanol Manufacturing
Configuration Considerations

Fixed Costs will increase with Increased Technology
Therefore, Technology must reduce Variable Costs

Examples:

1. Energy Consumption
2. Energy Cost
3. Higher Integration
4. Effectively Lower the Cost of the Feedstock
5. Diversification of Non-Starch Components to other markets
Ethanol Manufacturing
Traditional Configuration

Advantages
- "Lowest" Capital per Gallon Produced
- Increased Scale Reduces $/Gallon
- Lowest Technology Risk (Standard US Design)

Disadvantages
- "High" Energy Consumption
- Low-quality, High Volume Animal Feed By-product

Corn → EtOH → CO₂ → DDGS
@ 28% Protein (db)
Ethanol Manufacturing
Traditional Configuration with Retrofit and Integration

**Advantages**
- Reduced energy by 4-6,000 BTU/gal
- Relatively Low Capital. Therefore, stays “under the radar”

**Disadvantages**
- Reduced Operational Flexibility
- Reduced Operational Robustness

Corn → EtOH → CO₂ → DDGS
@ 28% Protein (db)

- High Efficiency Drying (“steam” drying)
- More Highly Integrated DD&E
- Mechanical Vapor Recompression
- Membrane Separations of Whole Stillage
- Vapor Permeation (MolSieve Replacement)
Ethanol Manufacturing

Grain Fractionation

Ethanol (EtOH)
CO₂
High Protein Distiller’s
@ 40-68% Protein (db)

Advantages
- EtOH Production increased by 10%+
- Thermal Energy reduced by 15-25%
- Increased By-Product Revenues
- Diversify outside of Cattle Feed
- Retrofit with minor process adjustments

Commercial Demonstrations
- Broin Companies (installed)
- Delta-T Corp (installed by 2007)
- Cargill/Monsanto (development site)
- Other Commercial Offerings

Corn → Germ → Fiber

Bioenergy Conference - Tomar, Portugal
06 March 06
Ethanol Manufacturing
Co-Generation

Corn ➔ EtOH

Corn ➔ CO₂

Corn ➔ DDG @ 32% Protein (db)

Advantages
- Thermal Energy reduced by 45%
- 4.5 yr Payback reported

Commercial Demonstrations
- Corn Plus, LLC

Steam ➔ CDS
Ethanol Manufacturing
Grain Fractionation & Co-Gen

Advantages
- EtOH Production increased by 10%+
- Thermal Energy reduced by 60-65%
- Increased By-Product Revenues

Commercial Demonstrations
- None to date
- Being developed

Corn → Germ → Fiber
EtOH → CO₂ → High Protein Distiller’s @ 40-65% Protein (db)
Steam → CDS
Ethanol Manufacturing
Grain Fractionation & Co-Gen

Advantages
- EtOH Production increased by 10%+
- Thermal Energy reduced by 80-90%
- Increased By-Product Revenues

Commercial Demonstrations
- None to date
- Being developed

Corn → [Image] → Germ & Fiber

EtOH → [Image] → CO₂

High Protein Distiller’s @ 40-65% Protein (db)

CDS → [Image] → Steam
GF Germ Valuation

Market Price vs Thermal Equivalent

Germ Combustion Value
9,020 BTU/lb as is

- Germ Energy Value
- Germ Market Value - High
- Germ Market Value - Low

$117/ton Combustion Value at $6.50/MMBTU

$100/ton Mkt Value

$50/ton Mkt Value

Preinvestment Breakeven at $4.43 - 5.54 / MMBTU

Natural Gas Cost ($/MMBTU)
Ethanol Manufacturing

Highly Integrated and Diversified

Advantages
- EtOH Production increased by 10%+
- Thermal Energy reduced by 95%+
- Potential for Surplus Energy
- Increased By-Product Revenues

Commercial Demonstrations
- Being Developed
- 2008 - 2010 Start Up?
Opportunities/Challenges for the Future

How will New Technology be Commercialized?

- Alliances/Partnerships will be the Key
- Retrofit Market for New Technology will be Large
- Institutions & Entrepreneurs will Finance ?!!?
- Balance between Technology Advancement vs Risk Management will be Critical
Enhanced Profitability through Technology, Integration, & Diversification

*The Only Constant is Change …*

Think Big!!