

# Enhanced Profitability through Technology, Integration, & Diversification

**Presented by:**

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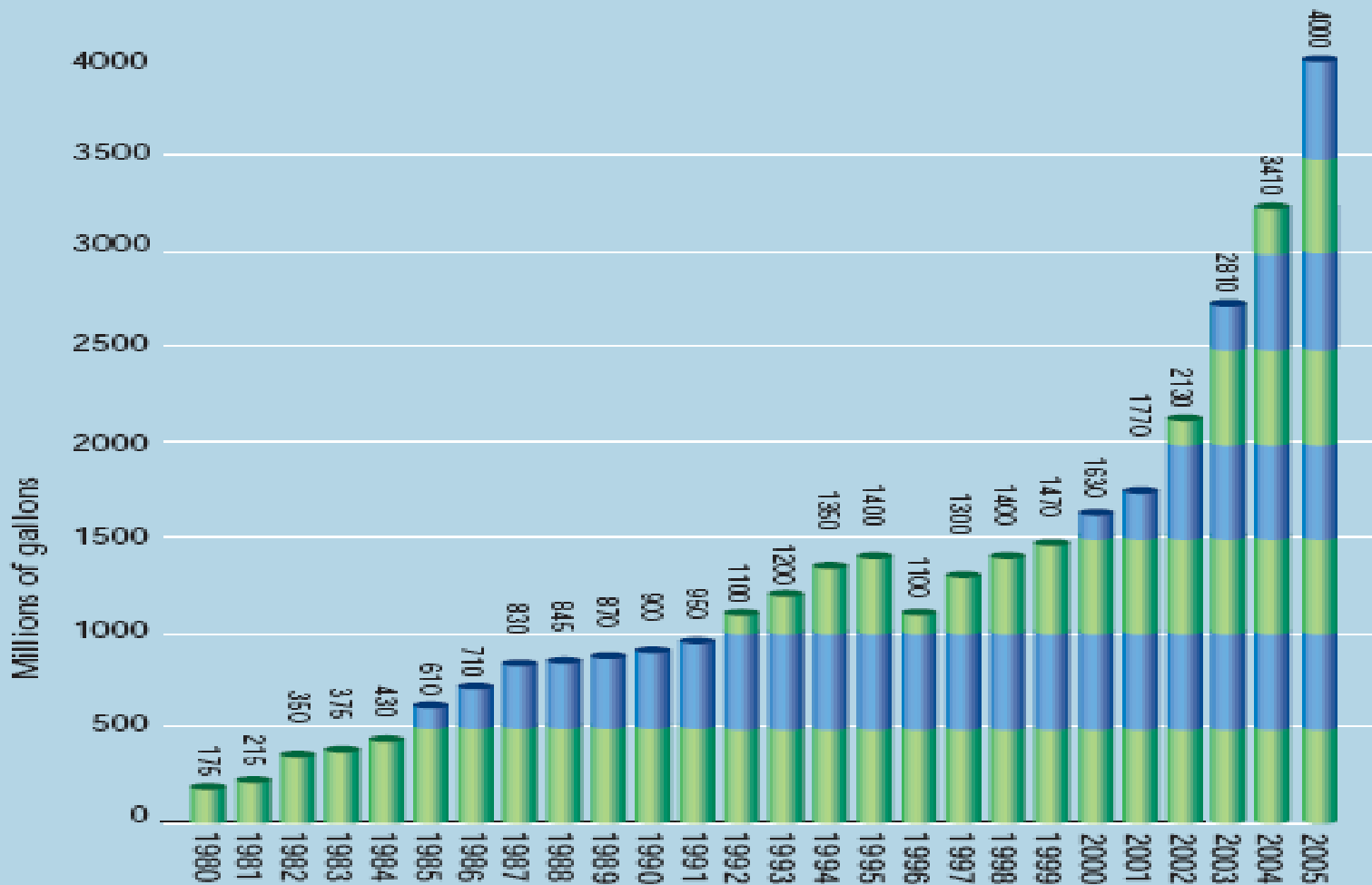
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# Enhanced Profitability through Technology, Integration, & Diversification

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

## HISTORIC U.S. FUEL ETHANOL PRODUCTION



Source: U.S. Energy Information Administration / Renewable Fuels Association

# Historical Impact of Technology

## *Evolution to Current State*

PERIOD	CAPITAL (\$US/gal)*	ENERGY (BTU/gal)*	CO- PRODUCTS	POLICIES
Early 80's	\$7.20	160,000	Preliminary Product Development	<ul style="list-style-type: none"> <li>● Oil Embargo</li> <li>● Fed Incentives</li> </ul>
Early 90's	\$1.60	63,000	Significant Expansion as Cattlefeed	<ul style="list-style-type: none"> <li>● Clean Air Act</li> <li>● State Incentives</li> </ul>
Early 00's	\$1.25	36,000	Excess Supply = Depressed DDGS Pricing	<ul style="list-style-type: none"> <li>● Phase Out of MTBE</li> </ul>

Contributions by Enzyme and Yeast Technology Significant

\* Basis: 40 mmgpy AEtOH plant adjusted to 2002 \$US CPI

# Historical Plant Financial Returns

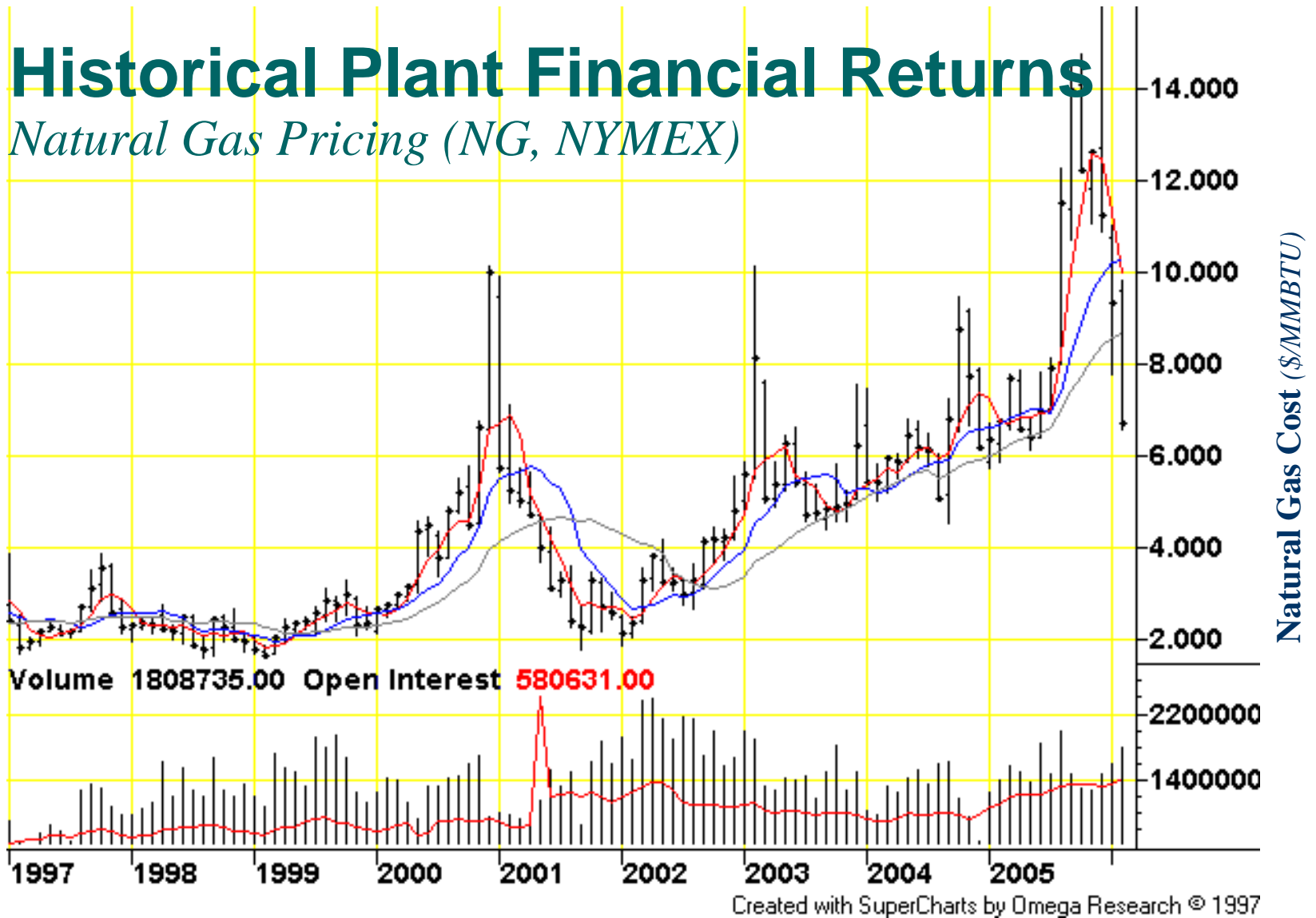
*Total Revenues*

	Jan '03	Nov '05	Jan '06
Ethanol	70.9%	84.9%	88.2%
DDGS	16.8	10.3	8.7
Other	1.6	0.2	0.1
Incentives	10.7	4.6	3.0
<b>Total Revenue</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

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

# Historical Plant Financial Returns

*Natural Gas Pricing (NG, NYMEX)*



# Historical Plant Financial Returns

*Variable Costs (as a % of Revenues)*

	Jan '03	Nov '05	Jan '06
Grain	46.0%	33.6%	36.9%
Additives	6.5	8.4	8.7
Energy	6.3	23.2	23.2
Labor	2.2	2.2	2.2
<b>Total COGS</b>	<b>61.2%</b>	<b>67.4%</b>	<b>70.7%</b>
<b>Gross Margin</b>	<b>38.8%</b>	<b>32.6%</b>	<b>29.3%</b>

*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*

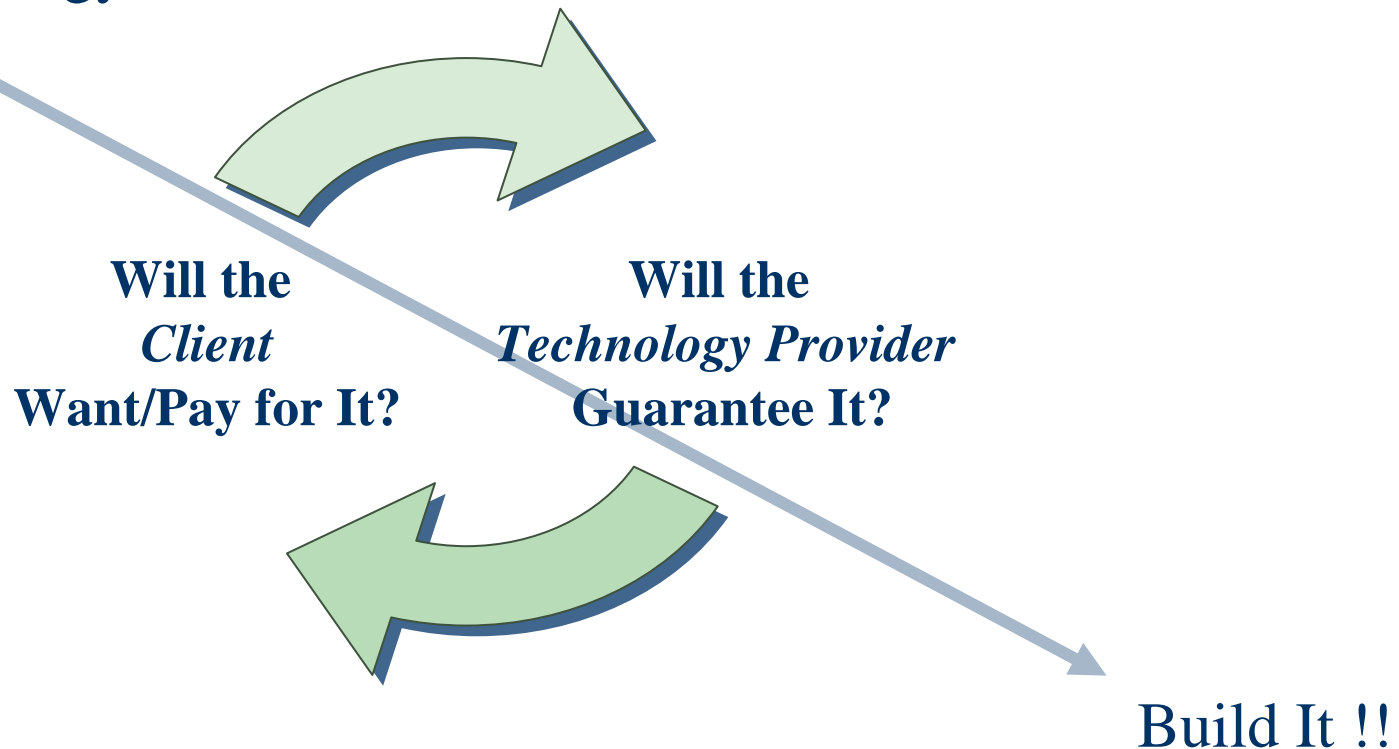
### **Market is demanding Technology Providers to:**

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*

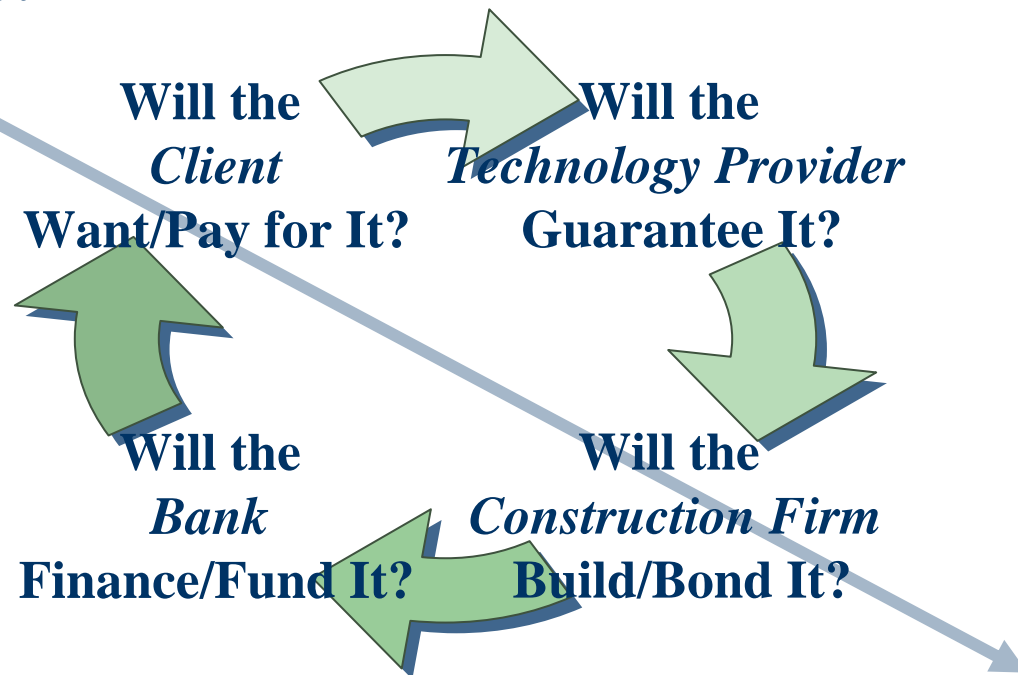
New Technology



# New Technology Commercialization

*Life Cycle Challenges – Today's Low Risk Position*

New Technology



**Build It !!**

# Impact of Technology Today

## *Transition in Marketplace - Change is Coming*

PERIOD	CAPITAL (\$US/gal)*	ENERGY (BTU/gal)*	CO- PRODUCTS	POLICIES
Early 80's	\$7.20	160,000	Preliminary Product Development	<ul style="list-style-type: none"> <li>• Oil Embargo</li> <li>• Fed Incentives</li> </ul>
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Early 00's	\$1.25	36,000	Excess Supply = Depressed DDGS Pricing	<ul style="list-style-type: none"> <li>• Phase Out of MTBE</li> </ul>
Current State	\$1.00 - \$1.75 <i>Technology Dependent</i>	36,000 to << 20,000	New Product Development & Market Diversification	<ul style="list-style-type: none"> <li>• Permanent Energy Policy</li> <li>• Phase Out of Gov. Incentives</li> </ul>

\* Basis: 40 mmgpy 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

# Ethanol Manufacturing

*Traditional Configuration with Retrofit and Integration*



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

## Advantages

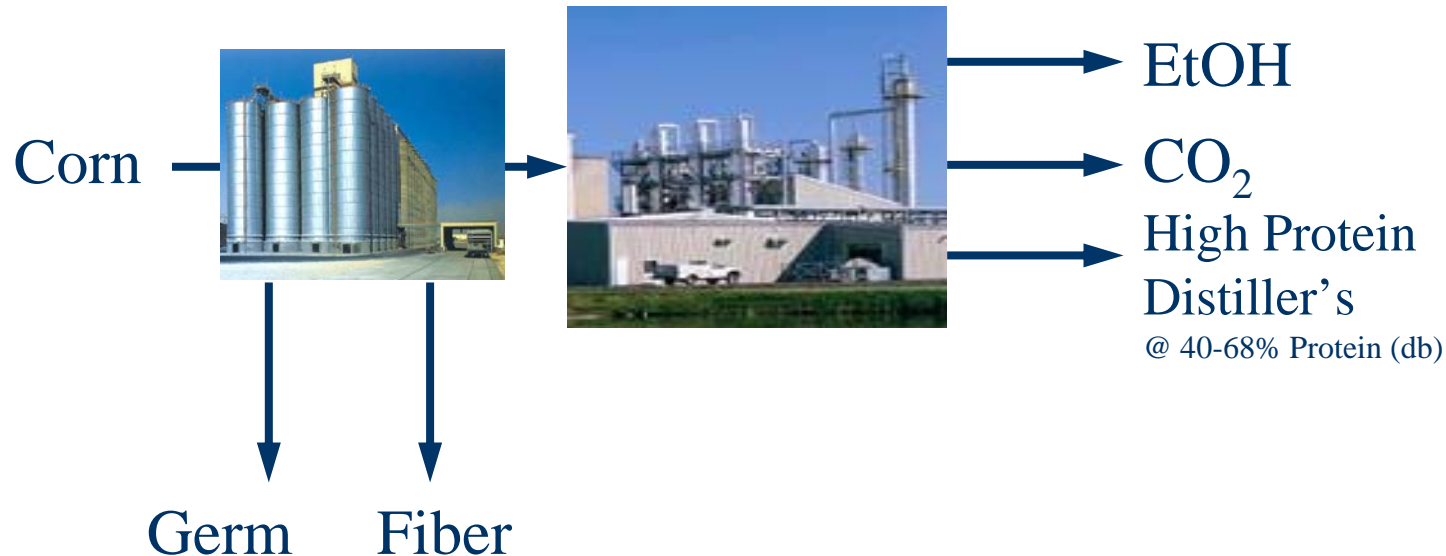
- Reduced energy by 4-6,000 BTU/gal
- Relatively Low Capital.  
Therefore, stays “under the radar”

## Disadvantages

- Reduced Operational Flexibility
- Reduced Operational Robustness

# Ethanol Manufacturing

## *Grain Fractionation*



### Advantages

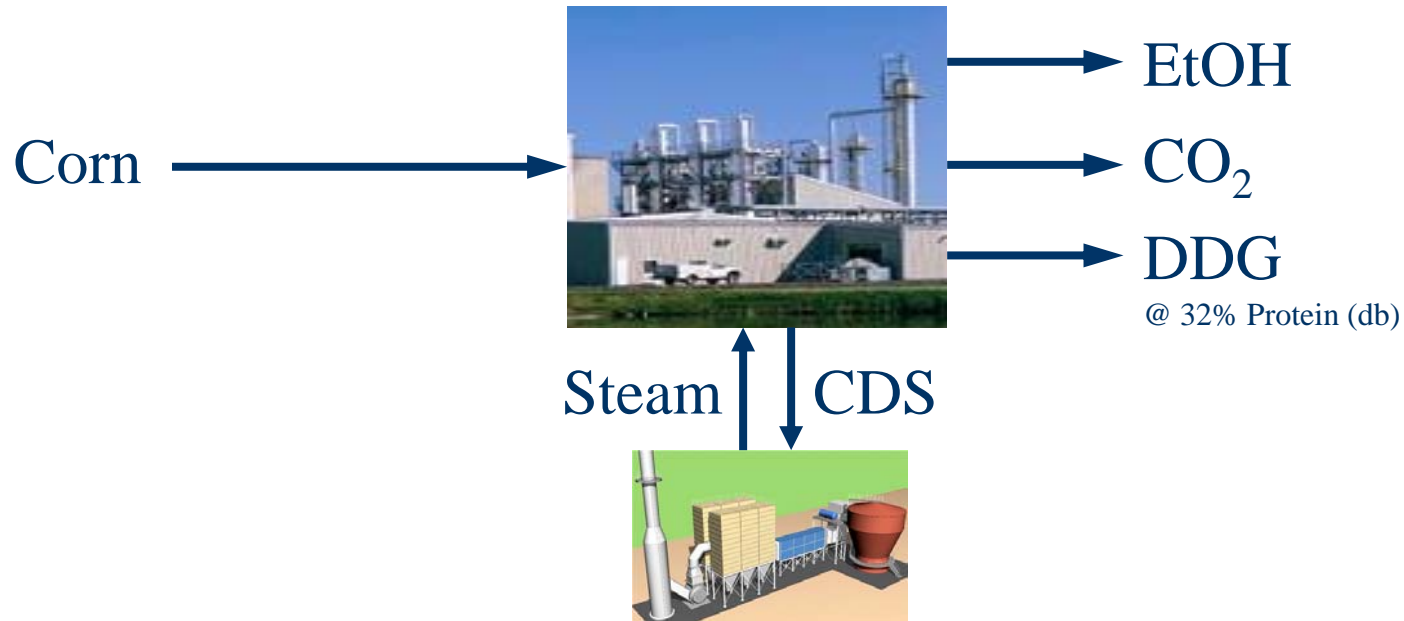
- EtOH Production increased by 10%+
- Thermal Energy reduced by 15-25%
- Increased By-Product Revenues
- Diversify outside of Cattle Feed
- Retrofit with minor process adjustments

### Commercial Demonstrations

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

# Ethanol Manufacturing

## *Co-Generation*



### Advantages

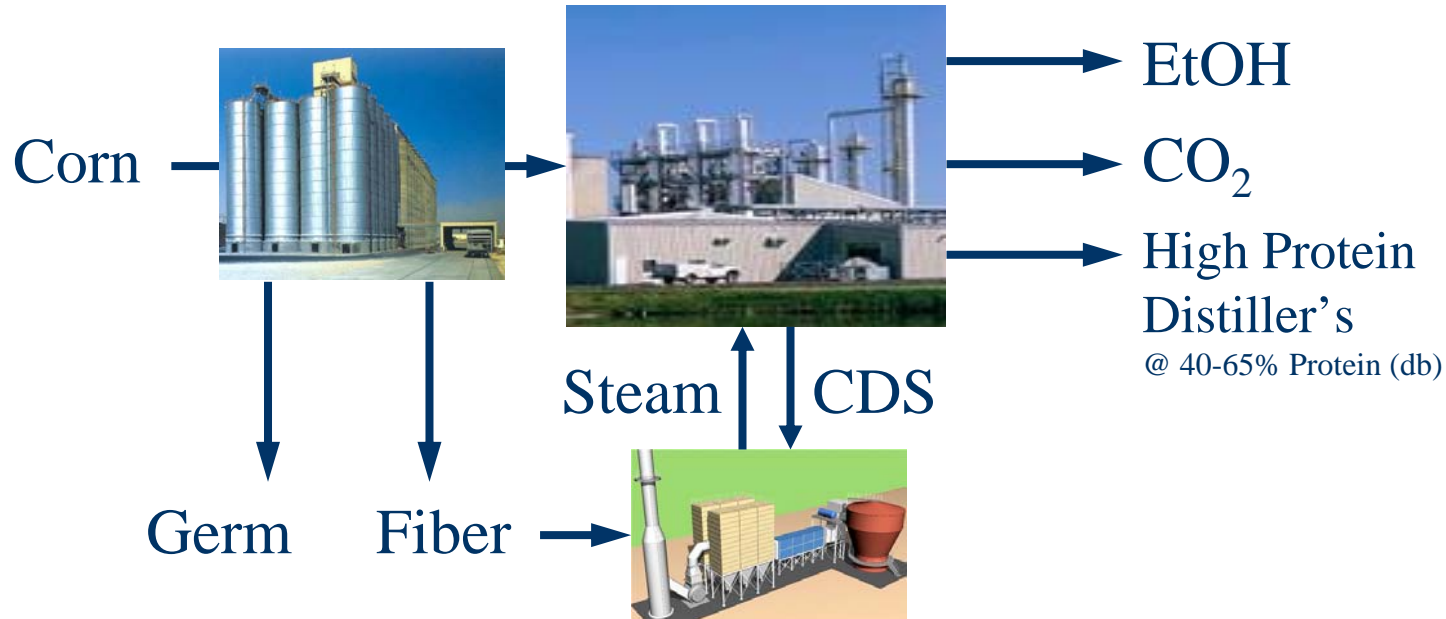
- Thermal Energy reduced by 45%
- 4.5 yr Payback reported

### Commercial Demonstrations

- Corn Plus, LLC

# Ethanol Manufacturing

## *Grain Fractionation & Co-Gen*



### Advantages

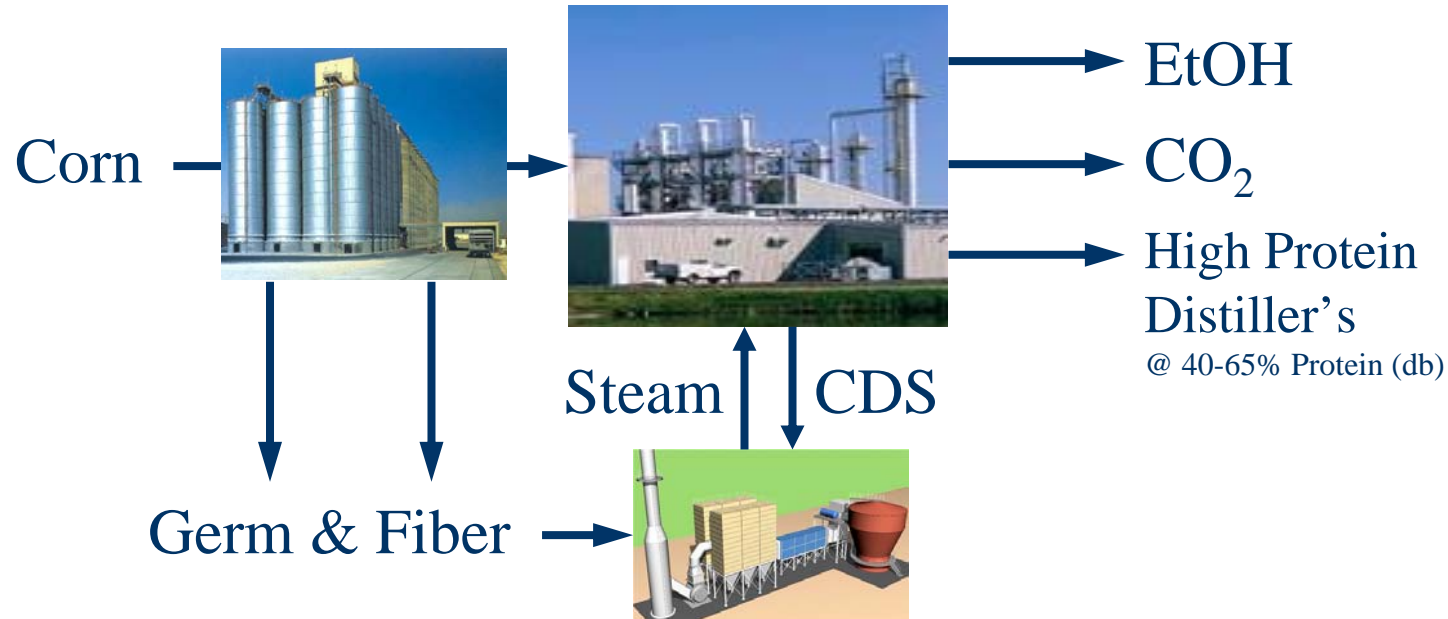
- EtOH Production increased by 10%+
- Thermal Energy reduced by 60-65%
- Increased By-Product Revenues

### Commercial Demonstrations

- None to date
- Being developed

# Ethanol Manufacturing

## *Grain Fractionation & Co-Gen*



### Advantages

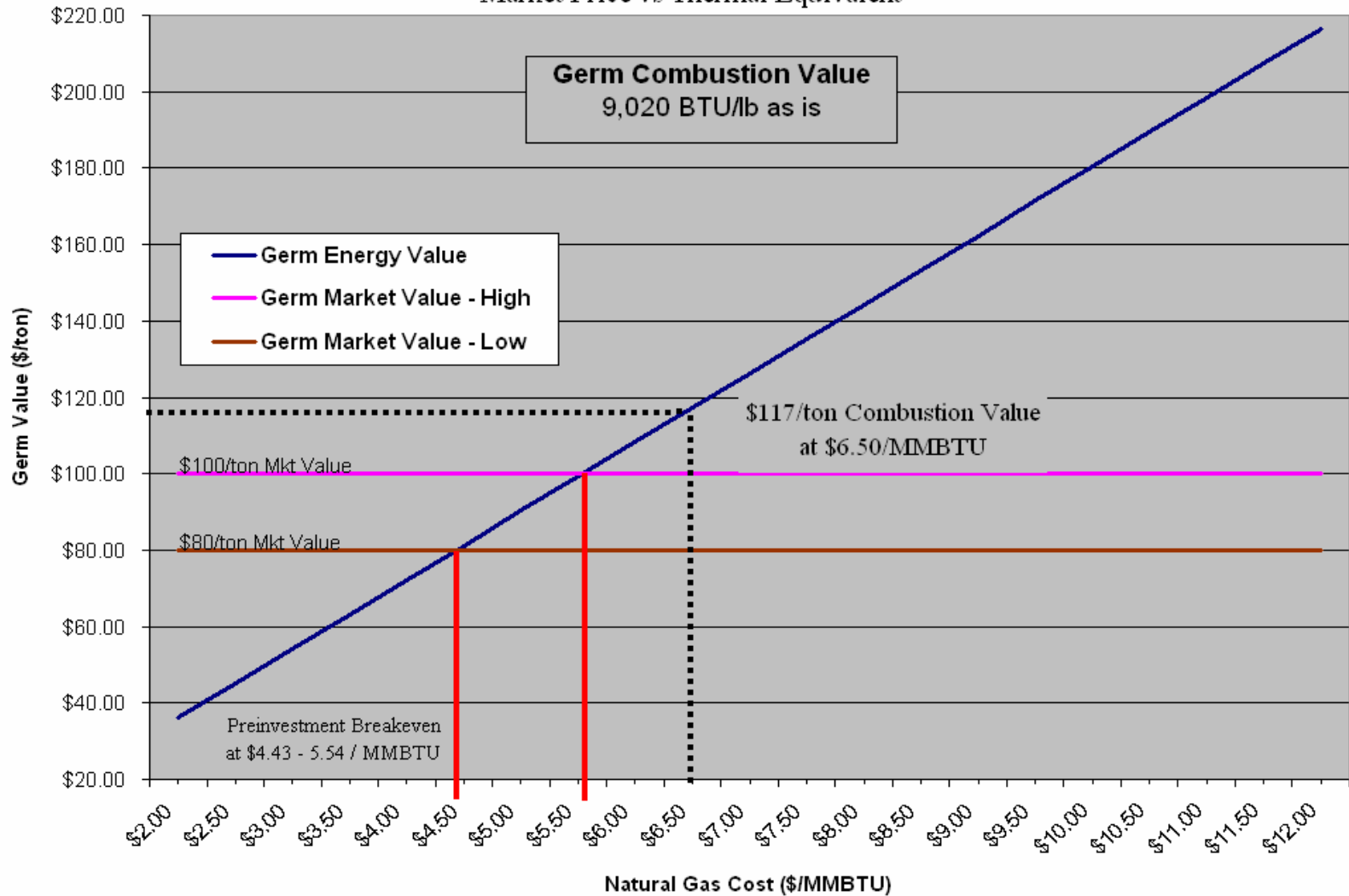
- EtOH Production increased by 10%+
- Thermal Energy reduced by 80-90%
- Increased By-Product Revenues

### Commercial Demonstrations

- None to date
- Being developed

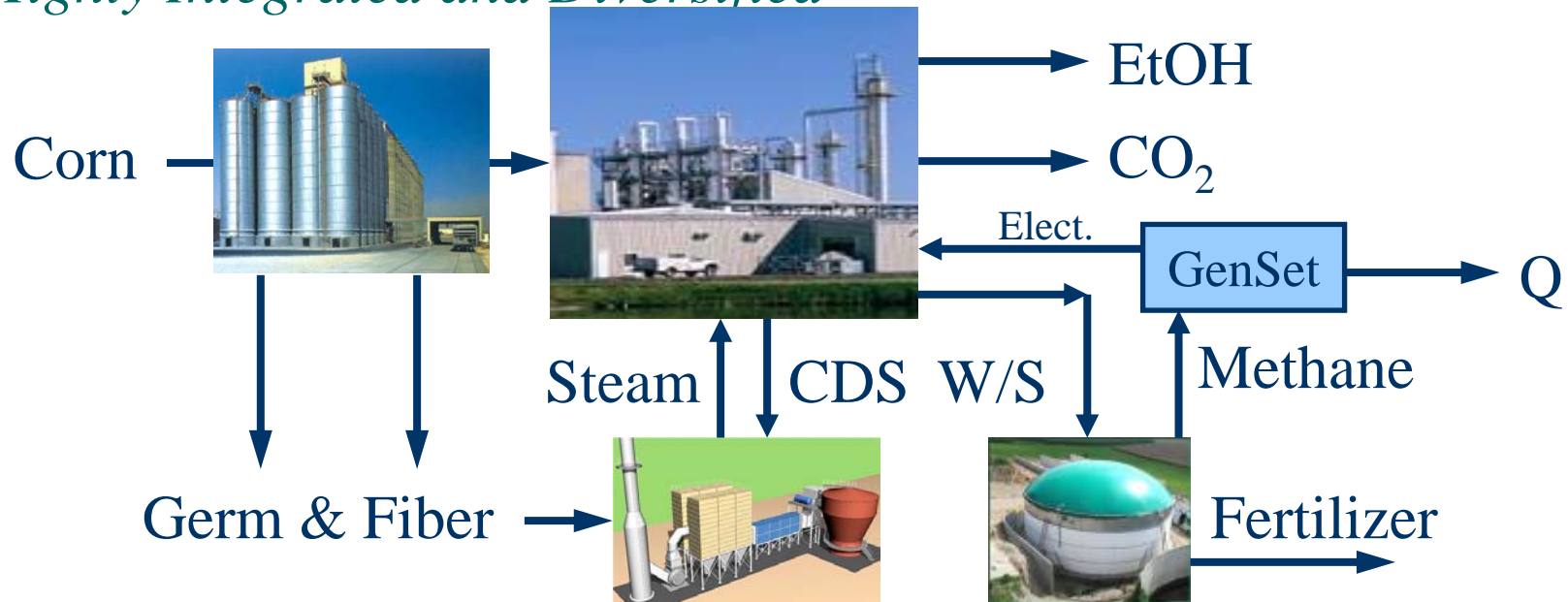
# GF Germ Valuation

Market Price vs Thermal Equivalent



# 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!!