



# BioRefinery Economics

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**Harvesting Clean Energy**  
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- A Research, Development, Manufacturing and Marketing Company
- Focused on Maximizing Biobased Products from Agricultural and Waste Raw Materials
- Based out of Missoula, MT



# Brief History

- Federal, State Grant Funding, Sweat Equity
- Pilot Plant and Market Development
- Strategic Alliance and Relationships



# Biobased Products

- Products that contain a certain specified percentage of renewable or agricultural based material
- Direct substitutes for Petroleum based products
- The USDA in consultation with the EPA, NIST and GSA established guidelines – published in the federal register
- Fuels, Fibers, Inks, Lubricants, etc...

# Additional Info

- Registered with the EPA as a Fuel Additive Manufacturer
- Registered with the USDA in the BioEnergy Credit Program
- Registered with State of Montana and IRS as Fuel Manufacturer and Blender



# Philosophy

- Social Responsibility
- Environmental Responsibility
- Profit Responsibility
- Paul Hawkins – Ecology of Commerce



# Crisis = Opportunity

- Petroleum is a Finite Resource – Peak Production
- Petroleum is not just used for fuel
- Crisis - i.e. business opportunity occurs when production peaks (Hubbert's Theory)
- Ag raw materials and process innovations provide solutions



# Two Development Scenarios

- Commodity Markets
  - Readily Available
  - Boom and Bust
  - At the Mercy of the Market/Broker
  - Disconnection from Consumer
  - Susceptible to Multi-National Agribusiness
- Value Added Markets
  - Must Be Built (Branding)
  - Long Term Steady Revenue
  - Value/Relationship/Technology Driven
  - Tangible Link
  - Insulation from Commodity Markets

# Our Goal

- Maximize revenue per acre for the farmer
- Must compete with wheat/barley
- Enhance sustainable agriculture practices
- Maintain and expand family farming operations



# What We Must Do

- \$200+ per acre gross revenue
- Same plant and harvest equipment
- Enhance existing crops production



# Commodity Economics

- 10 Year Average \$0.10 per pound
- Toll Crush \$0.06 per pound
- Cost of Oil \$0.533 per pound
- Meal Credit \$0.16 per pound oil
- Commodity Oil Price \$0.30 per pound
- **Net (-\$0.073)**
- **Do you want to invest/take a delivery right??**

# Small Scale Commodity Problems

- Revenue per acre – does not compete
- Crush Economies of Scale
- No additional value from the meal
- No additional value from oil
- No Program Credits
- Not Bankable = No Deal



# Lets Make a Little BioDiesel

• Purchase Commodity Oil	\$2.73/gal
• Processing Costs	\$0.60/gal
• Finished Cost	\$3.33/gal
• Glycerin Credit	\$0.12/gal
• Production Credit	\$0.50/gal
• <u>Finished Cost</u>	<u>\$2.71/gal</u>
• Market Price B100	\$2.65/gal???

# Small Scale BioDiesel Problems

- Forced commodity purchase
- No meal opportunity
- Processing inefficiencies
- Glycerin issues – can it be sold (a liability)
- Safety Issues!
- Cannot meet market price points

# Sustainable BioRefinery Economics

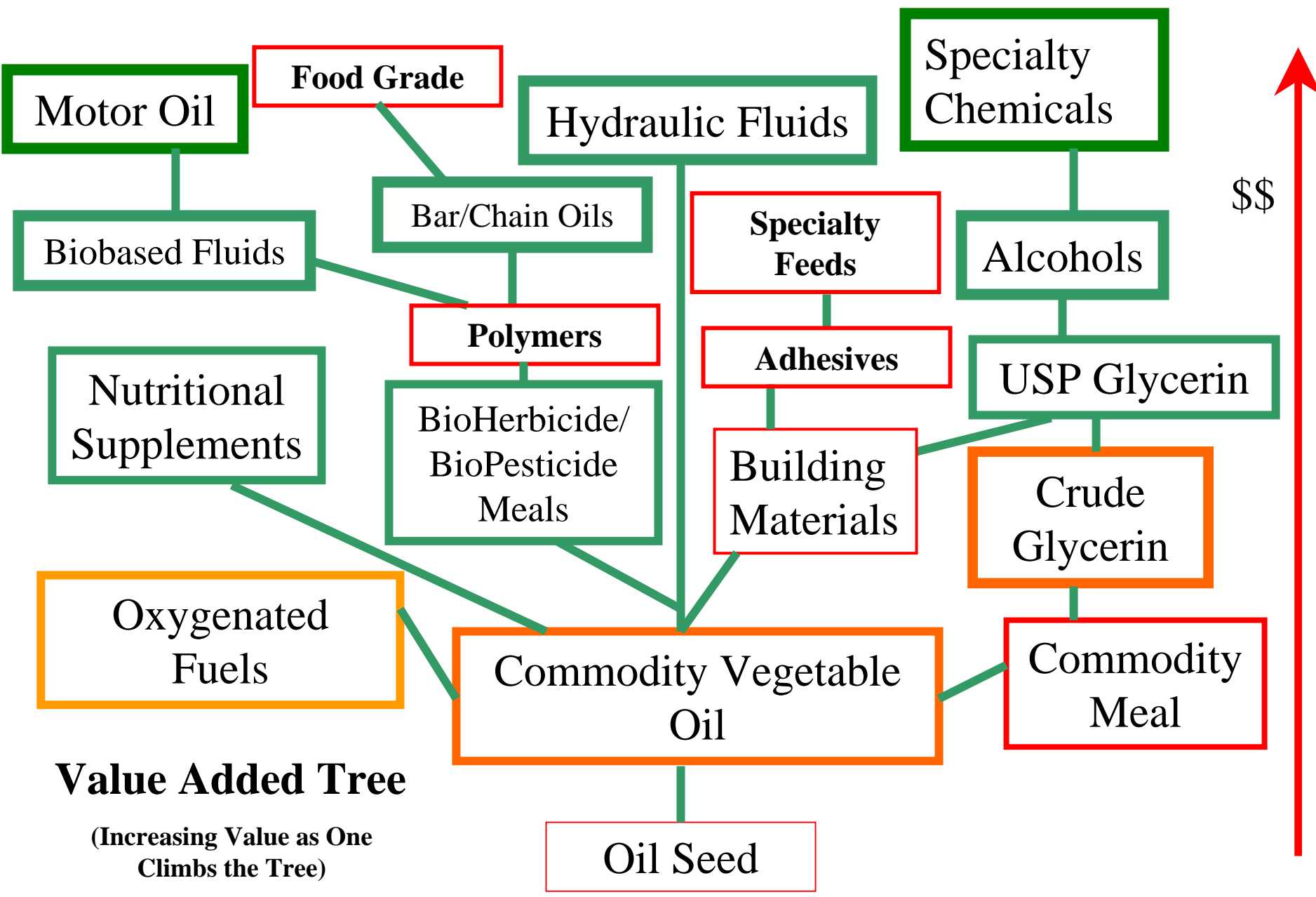
- Weighted Oil Product Cost **\$3.28/gal**
- Meal Revenue \$1.63/gal
- Glycerin Revenue \$0.35/gal
- Weighted Oil Product Revenue \$3.88/gal
- Net \$2.58/gal



- Combine the forces = Beneficial Structure
- Revenue per acre - \$200+
- Array of product streams – Value Diversification
- Maximize the value of agricultural crop

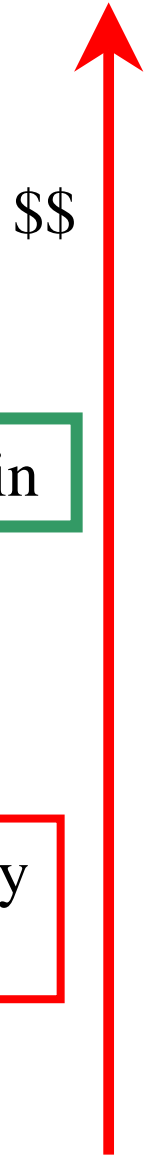
# Economic Potential per BioRefinery

- \$1 per gallon of annual production (30MGPY)
- Green Chemical Processing, Zero Emissions
- Over \$100M in annual revenue per facility
- \$52M in farm gate value
- Duplicate domestically and internationally



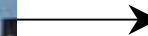
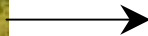
**Value Added Tree**

(Increasing Value as One Climbs the Tree)



# So What is Next

- \$5 M initial equity round
- \$400 M in debt/equity over the next five years
- Minimum 3 plants domestically (MT, WA)
- Global expansion in emerging nations



# Conclusions

- Multiple Value Added Products
- Producer Base and Ownership
- Multiple Product Streams
- Strong Team
- Disruptive Technology
- Excellent Timing



# Initiatives

- FRP – Fuel Reserve Program
- State Legislation (WA, MT, OR, ID)
  - Tax Incentives and Credits
  - Production Incentives and Credits
  - Lubricity Requirements

# Acknowledgements

- U of Montana
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- Montana Dept of Ag
- USDA/EPA