



The Bio-Energy Project: Feasibility Analysis – “Go, No-Go or Wait”

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Determining BioEnergy Project Feasibility

- Benchmarking: Internal & External
- Analysis Process
- Acceptable Risks & Uncertainty
- Organizational Prerogatives & Conditions
- Performance: Feasibility Metrics



BioEnergy Project Benchmarking

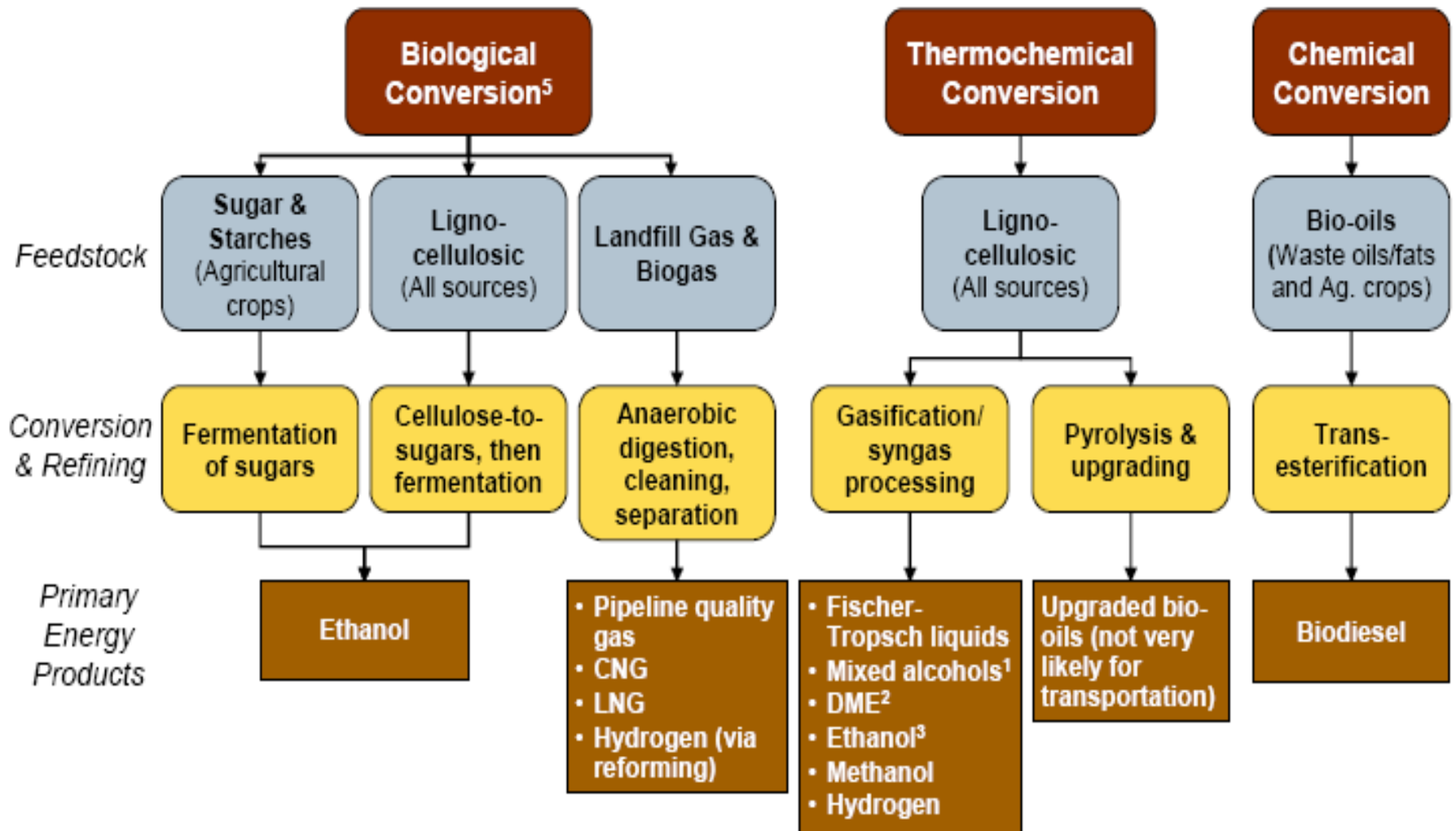
- Organizational Capital Project ROCE or ROI
- Design & Operational Risks
- Capital Investment Constraints
- Collaboration Constraints
- Timeframe Constraints
- Other



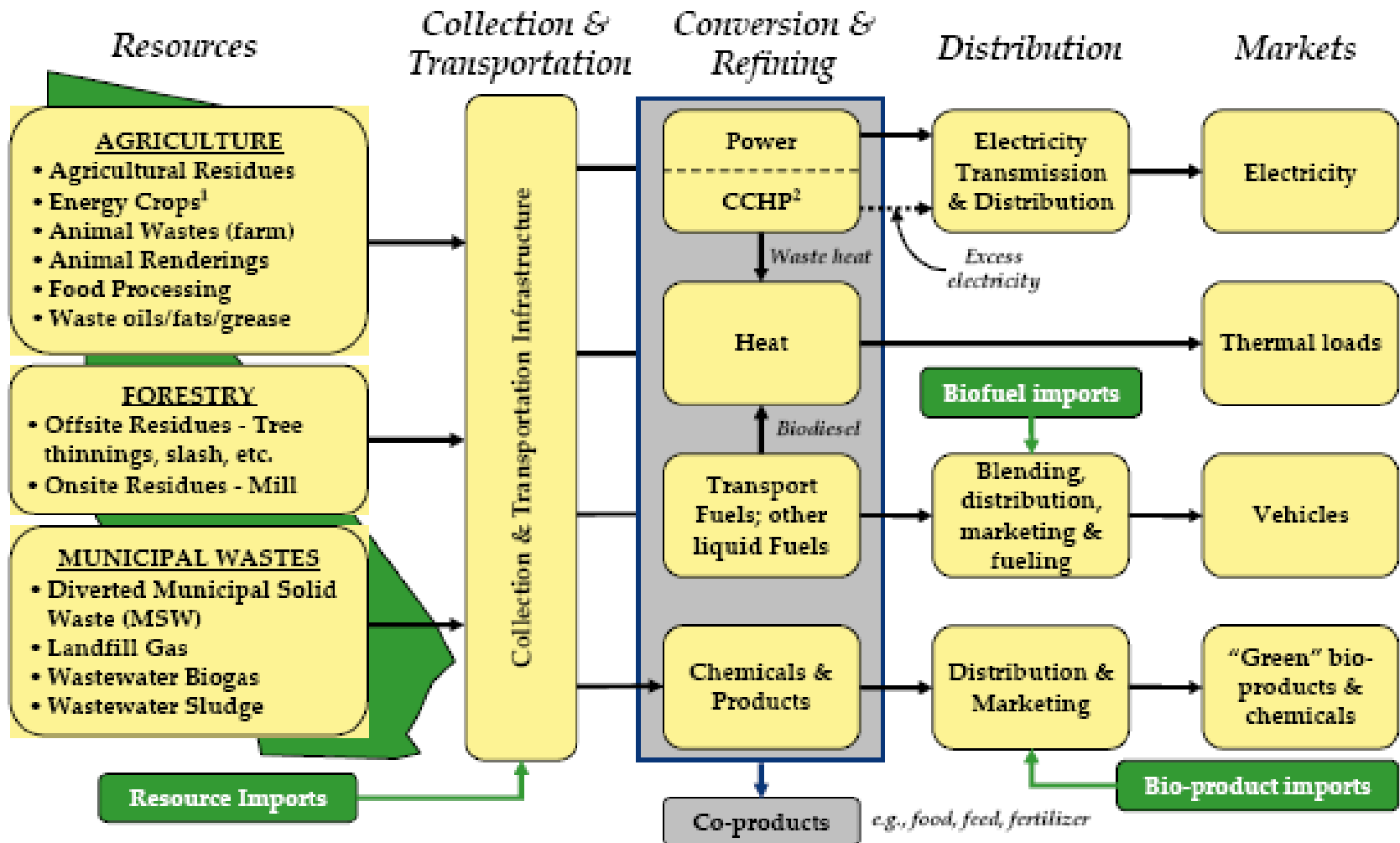
BioEnergy Feasibility Defined

- Economic Feasibility
- Technical Feasibility
- Operational & Site Feasibility
- Feedstock & Off-take Feasibility

Bio-fuel Conversion Options



Simplified Bio-energy Industry Structure





BioEnergy Project Parameters

- Project Definition
 - Concise
 - Outline project and expected benefits
 - Timeframe
 - Design & Technology, including energy/mass balance
 - Internally funded versus off-balance sheet
 - Baseline and/or Comparables
 - “Critical” analysis



BioEnergy Project Parameters

- Project Benefits
 - Cost Avoidance
 - Marketable Products
 - Marketable Services
 - Capacity increase
 - Extension of asset life
 - Strategic Repositioning
 - Compliance



BioEnergy Project Parameters

- Project Benefit Examples
 - kWh or Therms for internal use
 - Fuel Sales or Offset
 - Fertilizer sales (ash, solids, nutrients)
 - Tipping fees
 - Waste disposal cost reduction
 - Avoidance of facility expansion (WWTS)
 - Avoidance of surcharges or fines



BioEnergy Project Parameters

- Project Benefit Forecasting
 - Expected cost/price trends by benefit category
 - Anticipated regulation or compliance fees
 - Image (“Green”) leverage for marketing
 - Raw material (traditional) cost trends
 - Import substitution/Risk Management



BioEnergy Project Parameters

- Project Scope: Internal vs. Regional
 - Does firm have adequate resources (feedstock, funding, etc.) to sponsor dedicated project?
 - Does firm act as catalyst for development of regional project?
 - Ownership, contractual and performance distinctions



BioEnergy Project Parameters

- Project Capital Costs
 - Initial investigation and design
 - Project development
 - Technology licensing and EPC
 - Legal, permitting & inventory (substrate) management
 - Construction
 - Start-up
 - Funding and contingency



BioEnergy Project Parameters

- BioEnergy Capital Cost Examples
 - Feedstock storage facilities and pre-processing (solids densification)
 - Digester tanks, facilities and controls
 - Solids/effluent separation and processing
 - Gas storage and feedstock handling
 - Boilers, generators and facility
 - WWTS modifications



BioEnergy Project Parameters

- Project Operational Expenses
 - Staff, Administrative, etc.
 - Energy load, both base & parasitic
 - Licensing, permitting and reporting
 - Consumables
 - Scheduled maintenance
 - Taxes

BioEnergy Project Parameters

- Project Financial Performance
 - Cash-flows and/or Cost Savings
 - Operational expenses & Debt service
 - Contributions to sponsor and/or distributions to third party
 - Comparison between ownership options
 - Comparison among operational options
 - Suggested: Comprehensive financial/engineering model

Example: Power Plant Summary



Financial Return

	Revenue and Cost Avoidance	EBITDA	CapEx	ROCE %
Electrical Generation	2,523	460	11,820	3.9%
Thermal Power	13,785	11,556	14,136	81.7%

- **Digesters** - Bioscan digesters convert all manure and urine and Ethanol co-product into 2,025,665M btu/year
- **Gensets** - Five Caterpillar 3520 reciprocating engines generate 8.0 MW for on-site use and green energy tax credits
- **CHP** - Combined heat-power captures excess thermal energy for use in Bioscan digester and co-located greenhouse

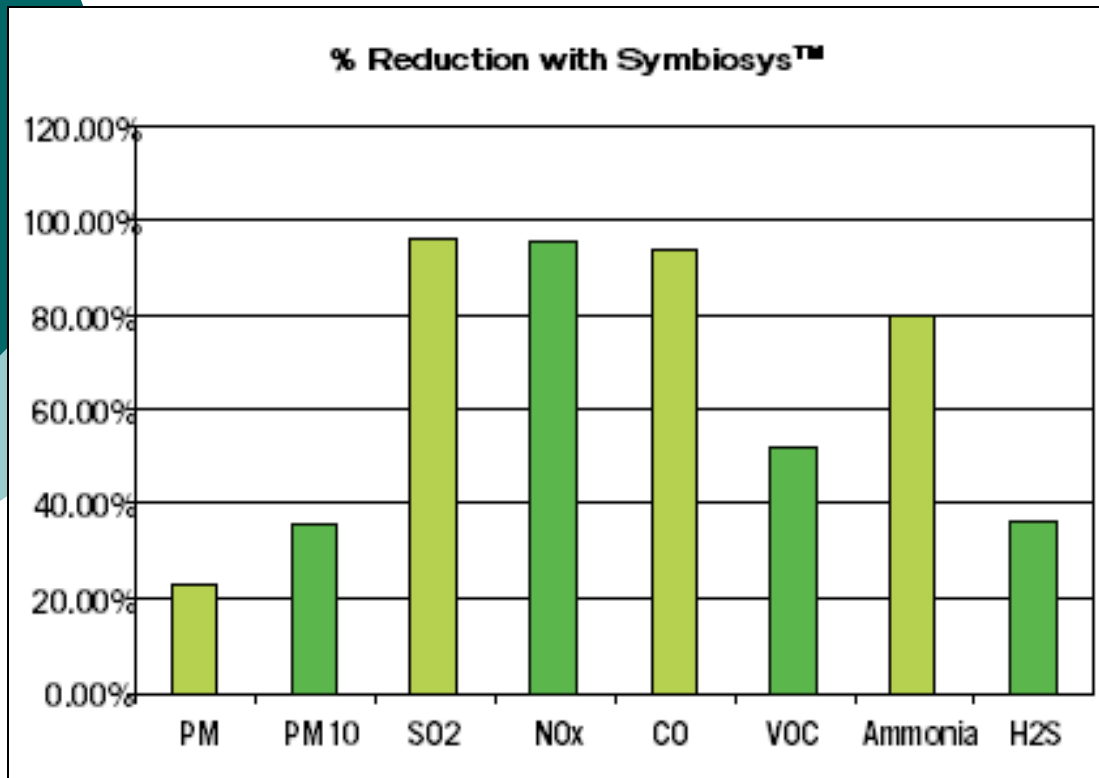
- Cost avoidance \$12.2M in natural gas and \$2.5M electricity; \$2.9 in carbon (Methane only) sequestration credits
- Breakeven on Power Plant is 2.4 years with NG at \$7.50/mcf



BioEnergy Project Risk

- Project Risks & Risk Quantification
 - Technology – vender quality & performance guarantees
 - EPC contract and construction management
 - Benefit price/cost trends
 - Offtake and/or feedstock contracts
 - Operational expenses and trends
 - Regulatory & compliance trends
 - Third party participation
 - Supplier risks, including liability

Example: Reduced Environmental Risks



- No dryer needed – feed and digest ethanol co-products instead
- No land spreading of manure
- Elimination of emissions of typical ethanol plant
- Green energy credits for green performance

PM : Particulate Matter

PM10 : Particulate Matter under 10 micrometers diameter

SO2 : Sulfur Dioxide

NOx : Nitrogen Oxides

CO : Carbon Monoxide

VOC : Volatile Organic Compounds

H2S : Hydrogen Sulfide

Sale of green credits creates \$2.9M additional EBDITA



BioEnergy: Organizational Issues

- Ownership of Facility & Operations
- Sponsor's History & Comfort with technology and business model options
- External Pressures
- Strategic Priorities
- Attractiveness of Investment

BioEnergy Project Performance

- Feasibility Metrics

1. Economic Feasibility

- ? Project meet IRR/ROCE Threshold?
- ? Cash flows adequate for meeting Commercial Debt accelerated payments? Investor exit/return expectations?
- ? Acceptable revenue/cost risks?
- ? Acceptable CapEx per unit output?

BioEnergy Project Performance

- Feasibility Metrics

- 2. Technological Performance

- ? Will process technology reliably perform as promised?

- ? Will technology become obsolete/is it updatable?

- ? What is financial and technical strength of vendors?

BioEnergy Project Performance

- Feasibility Metrics

- 3. Operational Performance

- ? Quality of management team?

- ? Relationships and contracts with supply and offtake?

- ? Financial strength of vendors and customers?

- ? Quality of location and community support?

BioEnergy Project Performance

- Feasibility Metrics

- 4. Permitting

- ?Is permitting process recognizable and is accurate estimate of cost obtainable?

- ?What is probability of community resistance and what are economic implications of overcoming?

BioEnergy Project Performance

- Feasibility Metrics

- 5. Fundability:

- ?Will internal funds and established sources of debt finance the project?

- ?Sponsor's ability to raise outside capital?

- ?Conventional "wisdom" and trends in capital markets?



BioEnergy Project Feasibility

- “Go” Decision
 - Parameters established, reasonable expectation of performance success and meets funding source thresholds
- “No-go” Decision
 - Inverse of “Go”
- “Wait” Decision
 - One or more components of “Go” not yet met

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