Feedstocks: Developing a Successful Plan and Attracting Investors to Your Biofuels Project

Biofuels Digest
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Biofuel Financing - Feedstocks

Introduction

Feedstock Risk

Objectives

Plan & Structure

Align feedstock supply, process technology, project structure, and operations to create financial success!
EQUINOX

Bio-conversion & Agribusiness Consulting

• Biomass Supply Chain Development
• Biofuel Project Development
• Financial Validation
• Feasibility Studies
• Market Analysis
• Economic Impact Analysis
• Due Diligence for Financing

Providing experienced advice, exceptional analytics and strategic development for the bio-conversion and agribusiness industry.

Biofuels
Bio-chemicals

Biomass Feedstocks
Agribusiness
Bioenergy
1. Risk in the Supply Chain

There is typically RISK in many biomass projects regarding:

- Feedstock yield
- Feedstock quality & composition
- Feedstock delivery – quantity and schedule
- Project timeline – plant startup and feedstock scale up
- Process technology capabilities
- Plant operations
- Financing Risk
- Risk Management needs to be integrated into Operations

Establish a comprehensive Strategy that addresses these risks for your project to expand your opportunity for success.
Supply Chain is an Agricultural System

• Agricultural systems are biological, subject to risk from disease, weather, insects/pests, and other factors
• There will be year-to-year variability in cost due to these factors
  • Can lead to plant shutdown
  • Inventory is one option to mitigate
  • Secondary crop is another option to help

Develop a plan that helps to address these risks, re-evaluate as new information is gathered
What are the Risks?

- Failure to Grow
- Failure to Harvest
- Failure to Deliver
- Failure to Operate!
Feedstock Supply Chain Costs:

<table>
<thead>
<tr>
<th>Feedstock Annual Cost</th>
<th>Starch</th>
<th>Cellulose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Size</td>
<td>30 MMGY</td>
<td>30 MMGY</td>
</tr>
<tr>
<td>Unit Cost</td>
<td>$4.00 per bushel</td>
<td>$80 per US ton</td>
</tr>
<tr>
<td>Conversion Yield</td>
<td>2.80 gallons/bu</td>
<td>75.00 gallons/ton</td>
</tr>
<tr>
<td>% of Total Costs</td>
<td>75%</td>
<td>50%</td>
</tr>
<tr>
<td>Cost in $ per Gallon</td>
<td>$1.43</td>
<td>$1.07</td>
</tr>
<tr>
<td>Cost in $ per Liter</td>
<td>$0.38</td>
<td>$0.28</td>
</tr>
<tr>
<td>Total Cost per Year</td>
<td>$42,857,143</td>
<td>$32,000,000</td>
</tr>
</tbody>
</table>

Feedstock is the leading cost in most biorefineries – is the supply chain setup for success?
Risk for Biofuel Projects: Feedstock is Critical to Success

Biomass Feedstock:
• Required to Operate
• 40 – 80% of the cost of production

400,000 dry ton/ 30 MMGY CE
• $108 MM Revenue per Year
• $300,000 Revenues per day

10% change in feedstock at $80/dry ton is $0.10 per gallon on a 30 MMGY plant = $3,000,000 per year

If a biomass supply chain is not developed and managed appropriately, it can cause severe disruptions in operations and result in massive financial losses.

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Feedstock Risk in 1st Gen Biofuels

- 1st Gen corn ethanol industry - Feedstock supply risk was a concern...more so in the early-stages
  - 1990’s – many ethanol plants included requirements for farmer integration in biofuel and feedstock delivery (coops, NCG structures) to mitigate the financing risk of short feedstock supply
  - 2000’s – banks found comfort with 3rd party originators for feedstock
  - Today most corn ethanol plants are financed with on existing corn feedstocks – availability and economics are usually determined as commodity
  - Commodity risk – price of corn may not trade inline with ethanol
Crop Residue Supply Chain

Grain Harvest
- Cut/Windrow
- Bale
- Stack

Residue Harvest
- Transport
  - Load
  - Transport
- Storage
  - Unload
  - Stack
- Delivery
  - Transport
  - Unload
- Biorefinery

Direct Harvest
- Stored Biomass
Feedstock Risk in 2nd Gen Biofuels

• 2nd Generation fuels are evaluating new feedstocks
  • Cellulosic crops like switchgrass, miscanthus, new oil crops, plus crop residues
  • Feedstocks may not widely available today – not a commodity
  • Feedstocks have risk with development, inventory, cost, quality, and delivery
  • Some feedstocks offer opportunity for longer term contracts to mitigate cross commodity price risk of 1st Gen biofuels like corn and wheat
Biofuel Financing - Feedstocks

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Align feedstock supply, process technology, project structure, and operations to create financial success!
Successful projects mitigate risk in these 3 areas by developing an economic and environmentally sustainable Feedstock Supply Chain.
Supply Chain Objectives

Develop & operate economically competitive and sustainable Feedstock Supply Chains

Quality
Cost
Delivery

RISK

Bio-conversion operations must be capable of mitigating and managing risk in each of these categories
Supply Chain Objectives

QCD
1. Quality
2. Cost
3. Delivery
   • Quantity
   • Schedule

Example:
Our process economics are optimized and can operate sustainably using a:

- Herbaceous feedstock at < 60% moisture with under 5% acids
- < $80 per dry ton at 55% carbohydrates
- Using existing collection methods delivered year-round at 2000 dry tons per day.
- Can be achieved with high regard to safety and morale for internal team, partners, and external stakeholders.
Feedstock Quality

- Carbohydrate
- Energy Content/BTUs
- Moisture
- Dirt
- Other contaminants
- Ash
- Lignin
- Inhibitors
- Artifacts from Storage
Feedstock Cost Analysis

- Feedstock(s)
- Cost of Production
  - Land Rental
  - Establishment
  - Crop Growth & Production
  - Harvest
  - Transportation
  - Storage
  - Delivery
- Crop Yields
- Inventory

- Startup Costs
  - Working capital
  - Assets
- Competing Markets
- Variability in Feedstock and Plant Operations
How Competitive is Your Feedstock?

- Land Rental
- Establishment Costs
- Cost of Production
- Harvesting
- Transportation
- Storage
- Crop Yields

$0.10 per gallon on 100 MMGY plant is $10,000,000 per year

Projects may have 10-30 Year Fixed Assets – how will markets change?
Feedstock Impacts Crush Margins

The location of a bio-conversion project has major implications on its feedstock price, end-product pricing, transportation costs and crush margin.

- Crush margin analysis of US Corn Ethanol industry reveals the critical importance that location can have on feedstock cost*.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Iowa</th>
<th>South Dakota</th>
<th>Kansas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>$0.99</td>
<td>$1.09</td>
<td>$0.91</td>
</tr>
<tr>
<td>2013</td>
<td>$0.68</td>
<td>$0.76</td>
<td>$0.62</td>
</tr>
<tr>
<td>2012</td>
<td>$0.35</td>
<td>$0.42</td>
<td>$0.40</td>
</tr>
<tr>
<td>2011</td>
<td>$0.66</td>
<td>$0.67</td>
<td>$0.67</td>
</tr>
<tr>
<td>2010</td>
<td>$0.55</td>
<td>$0.62</td>
<td>$0.49</td>
</tr>
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</table>

*$0.10 per gallon on 100 MMGY plant is $10,000,000 per year

* Average crush margins calculation – actual margins dependent on location, markets, technology, management, operations
Feedstock Price and Supply

Pricing of commodities in a specific region changes over time based on production and demand.

One Year does not establish the Baseline
What Feedstock is Least Cost?

The answer depends on several factors - whether supply chain can harvest directly or requires storage, and what distance the land is available by each crop.

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Why create Supply Chain Models?

• Create a framework for evaluating strategies for timelines, budget, and goals within project development
• Evaluate business scenarios to optimize the operations
• Financial representation to management, investors and debt providers
• Understanding of key drivers to financial returns & risk
• Assist in decision making for Board and Management
• Sensitivity analysis can identify potential risks and actions to consider
Feedstock Delivery/Supply

• Evaluate local and regional potential
  • Existing availability
    • Historical changes
  • Potential availability
    • Resources required

• Develop assurance for long term supply
  • Contract direct with farmers, harvesters, and/or coop
  • Vertically integrate upstream in the supply chain
  • Partnerships
# Feedstock Supply Chain Volumes

<table>
<thead>
<tr>
<th>Biorefinery Volumes</th>
<th>US</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biorefinery Output Size</td>
<td>30 Million gallons</td>
<td>114 Million liters</td>
</tr>
<tr>
<td>Equivalent Size</td>
<td>714,286 barrels</td>
<td>89,635 Metric tons</td>
</tr>
</tbody>
</table>

**Corn Grain**

| Corn Starch Feedstock                          | 10,909,000 bushels        | 277,000 Metric tons     |
| Corn Starch Land                               | 72,727 acres              | 73,000 hectares         |

**Cellulosic Feedstock**

| Cellulose Feedstock Size                       | 400,000 dry US tons       | 362,878 metric tons     |
| Dedicated Energy Crops                         | 57,000 acres              | 23,000 hectares         |
| Crop Residues                                  | 200,000 acres             | 81,000 hectares         |

| Truckloads to Plant per Year                   | 19,000 truckloads         |                         |
| Bales per Year                                 | 728,000 bales             |                         |

The supply chain does not appear overnight, and it requires continual optimization once operational.
Risk Assessment & Mitigation

• Integrate Risk Assessment and Mitigation into the Strategy
• Example: Examine options to implement multi-crop strategy to manage inventory on a yearly basis
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Align feedstock supply, process technology, project structure, and operations to create financial success!
3. Supply Chain Plan & Strategy

- Integrate the supply chain objectives into a coordinated plan and strategy for feedstock supply chain to operate while managing risk.

- Use structure(s) that will enable the feedstock supply chain to deliver on the project goals:
  - Business Structure (vertical integration, coops, farmer model)
  - Capital Structure (leasing equipment, rental, ownership)
  - Operational Structure (supplier performance requirements)
What is required in the Strategy?

Strategy for development should address:

• Feedstock yield
• Feedstock quality and composition
• Feedstock delivery – quantity and schedule
• Project timeline – plant startup and feedstock scale up
• Process technology capabilities
• Plant operations
• Financing Risk
• Risk Management

Establish a comprehensive Strategy that addresses these risks for your project to expand your opportunity for success.
Feedstock – What is the plan?

Who will deliver feedstock?

What is the cost of feedstock?

Where will the feedstock come from?

Who will buy the equipment to collect feedstock?

Where is feedstock stored?

Who will produce the feedstock?

When is feedstock harvested?

How much inventory is needed?

How will risk be mitigated?

How will quality be managed?

Does your project have a Feedstock Plan?

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Plan for Plant, Plan for Feedstock

- There are usually detailed plans for Bio-conversion facility development and operation.

- Has a similar approach been used to properly develop the feedstock supply chain and mitigate its risk?
Feedstock – What is the Plan?

- Project & Location description
- Overview feedstock supply chain
- Feedstock supply availability
- Feedstock Production
- Feedstock Collection
- Feedstock storage
- Feedstock delivery to biorefinery
- Preprocessing
- Operations and Logistics
- Feedstock quality control
- Feedstock supply chain management
- Risk analysis
- Government policy & regulations
- Sustainability
- Project Schedule
- Preliminary cost analysis
- Government incentives
- Financing

Feedstock Supply Chain Strategy is critical to project success
## Structuring the Biomass Supply Chain

<table>
<thead>
<tr>
<th>Establishment</th>
<th>Crop Production</th>
<th>Harvest</th>
<th>Transport</th>
<th>Storage</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Establishment" /></td>
<td><img src="image2" alt="Crop Production" /></td>
<td><img src="image3" alt="Harvest" /></td>
<td><img src="image4" alt="Transport" /></td>
<td><img src="image5" alt="Storage" /></td>
<td><img src="image6" alt="Delivery" /></td>
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  - Business Structure (vertical integration, coops, farmer model)
  - Capital Structure (leasing equipment, rental, ownership)
  - Operational Structure (supplier performance requirements)
Structuring the Biomass Supply Chain

Integration of Supply Chain with Biofuel Facility

Independent Suppliers
(farmer model)

Partial ownership/control of supply chain

Vertically integrated supply chain
Integration of the Biomass Supply Chain

- Integration can have several approaches depending on:
  - Objectives of Supply Chain
  - Feedstock Cost
  - Operational Risk
  - Capital Structure of Supply Chain
  - Business ownership structure

- Examples:
  - Capital – equipment & seeds
  - Supply chain management
  - Training – operator & repair
  - Equipment acquisition
  - Seed/rhizome scale up
  - Grower recruitment

“Companies including soup maker Pacific Foods of Oregon Inc. and publicly traded burrito chain Chipotle Mexican Grill Inc. are digging deeper into the supply chain with such moves as **financing farmers**, offering **technical training** and **hiring full-time headhunters** to recruit organic growers.” WSJ – April 6, 2015
Feedstock Supply Requirements

• Feedstock Quality
• Feedstock Price/Cost
• Feedstock Delivery – quantity and schedule
  • Historical and predicted supplies
  • Inventory targets
  • Supply variability – quantity (crop yields) & delivery
  • Replacement cost & availability
Feedstock Supply Considerations

• Supplier integration with Biofuel project
  • Weigh the Benefits & Costs
  • Land contracts – especially for longer tenure crops

• Performance Capabilities and Guarantee
  • Ability to enforce – legal and reputation
  • Credit Quality of Suppliers

• Assurance for long term supply required
  • Contracts direct with farmers, harvesters, and/or coop
  • Vertically integrate upstream in the supply chain
  • Partnerships

• Term of Contracts for Biofuel Off-take
  • how does it impact Feedstock Supply requirements
Factors that Impact Structure

- Establish structure to address supply and price/cost variability
  - Is the feedstock a Commodity or Specialized Feedstock?
  - Understand the risk of price/cost variability
- Capital Requirements
  - Establishing the Feedstock Supply Chain – equipment, seed stock, startup capital
  - Operating Supply Chain – storage sites, equipment, building, offices, working capital
- Equipment Requirements for supply chain
  - Existing or new equipment?
  - Resale value of equipment – who bears the risk
  - Operating requirements – skill level required
- Plant reproduction (seeds, rhizomes, etc.)
  - Availability of seed stock – scale up timeline
  - Capital Cost – upfront, other ongoing fees
  - Operating Cost – who is responsible
- Operations – crop production, harvesting, transport
  - Existing custom operator models or new approach required
  - New equipment requires skilled operators

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Supply Chain Development

- Improve!
- Operate
- Develop
- Design
- Strategy to Execute
- Determine what is Practical
- Define is Possible

Timeline

Pre-Feasibility
Feasibility
Business Plan
Execution

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Conclusion

Biofuel Feedstocks - Financing

1. Understand the Risk for Financing and Operation
   - 2\textsuperscript{nd} Generation Feedstocks are unique and present different financing risk

2. Define the Objectives – Quality, Cost, Delivery (QCD)

3. Develop Strategy to Address Operating & Financing Risk
   - Structure the Supply Chain to meet Project needs
   - Performance Requirements for Supply Chain embedded in structure
   - Evaluate options beyond just Cost/Price impact – think about the impact on long-term success and risk

Developing a successful Biomass supply chain structure has the potential to make or break the financial outcomes of a project.
Let’s Build a Great Project!
Biomass Feedstocks:
Developing a Successful Plan and Attracting Investors to Your Biofuels Project

- Thank You -

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