Solving the Commercial Feedstock Problem:
Past, Present and Future Project Development

Merrick Bioprocessing Conference
Denver, CO
September 10, 2012
A Comprehensive, Integrated Industry Approach

**Energy Crop Production**
- 5,100 acres of switchgrass in Tenn.
- >60 farms under contract, 9 counties
- 5th year of production
- Mature yields ~8 tons/acre

**Feedstock Logistics & Pre-processing**
- Managing 45,000+ ton inventory
- Premier RD&D facilities (BIP)
- $5 million DOE logistics project

**Commercialization**
- Demonstrated, scalable model
- Developing commercial projects
- Strategic partnerships along value chain

**Cellulosic Biorefining**
- 250,000 gal demo plant & PDU in Tenn. in collaboration with DDCE
- Multiple feedstocks: cob, stover, switchgrass
- Operating since January 2010

$70.5 Million Funding from State of Tennessee
“Genera Energy Inc., working with strategic partners, is a supplier of integrated biomass supply chain solutions to satisfy the upstream and downstream needs of the biofuels, biochemical and biopower markets”
Genera’s Business Proposition

Energy Crops

Long-term land leases & easements

Land Owners & Farmers

Biomass Feedstocks

Long-term biomass feedstock supply contract

BCF Owners & Project Developers

Biomass crop services: establish, manage, harvest, collect, store, transport

On-time, sustainable delivery of high quality biomass feedstock
Genera provides a range of biomass feedstock production and supply chain management services

- For a variety of energy crops and feedstocks
- Under a range of self-performance and management arrangements
- Tailored to the needs of a particular Biomass Conversion Facility (BCF) Project or user
The Market for Biomass

Biopower

- 24 states have renewable power mandates, 5 states have non-binding targets
- 17% of current global market is in the US
- High growth European market for biopower
- Market is cost competitive and policy driven

Biofuels

- Federal mandate (RFS2) requires 16 billion gallons cellulosic biofuels by 2022
  - 13.4 Billion GPY expected to come from dedicated energy crops, mostly in Southeast
  - 200 Million TPY of total market. Feedstock value of $15 billion/ year
  - >$80 Billion in biorefinery capital in the SE, some portion funding the project development services Genera provides
- Biofuels projects are commercially viable today, competitive with $90/ bbl oil, without any subsidies

Biochemicals

- Renewable chemicals will replace some portion of the $3 Trillion global chemical market
- Higher value products maximize the value of biomass feedstocks and profitability of conversion facilities
Marketplace Feedstock Needs

• Sustainable biomass feedstock supply
  – Year round supply of substantial quantities
  – Predictable price that supports project economics
  – High quality, consistent product

• Minimize feedstock risk
  – Portfolio of biomass feedstocks (annuals & perennials)
  – Feedstock Supply Guarantee
  – Proven track record
  – Feedstock supply commitment consistent with project timeline
  – Credit worthy supplier

• Maximize feedstock value
  – Long term supply commitment
  – Integrated upstream solution
  – Continuous improvement and innovation
Focus is Sustainable Biomass

- Feedstock opportunities are region-specific
- Imperative that biomass feedstock systems are sustainable
- Feedstock systems must be scalable
- Purpose grown energy crops offer long term scale, sustainability, and affordability
- More than half of the US biomass market expected to be based in the Southeast
Feedstock: A Critical Project Element

- Genera works with project developers to provide a key element of an integrated commercial biomass project.
- Long-term land control (10+ year leases or easements) is essential for developing perennial energy crops and minimizing risk.
- Partnership with industry leading seed companies to supply energy crop seeds using advanced genetics.
- Working with policy makers to develop innovative feedstock guarantee credit enhancement.
- Using Biomass Innovation Park to drive down costs, improve efficiencies.
- Integrated management of entire supply chain maximizes quality, improves efficiency, reduces feedstock cost.

Diagram:

- Technology License Agreement
- Permits & State Incentives
- Investment Grade Biomass Conversion Project
- Feedstock Supply Agreement
- Qualified Project Developer
- Fully Wrapped EPC Contract
- Fuel Offtake Contract
- Qualified Project Developer
# Feedstock Project Development

## Turnkey Feedstock Supply Solutions

<table>
<thead>
<tr>
<th>Bankable</th>
<th>Flexible</th>
<th>Integrated Approach</th>
<th>Continuous Cost Improvement</th>
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<tbody>
<tr>
<td>• Complete turnkey biomass supply plan tailored to financial due diligence needs</td>
<td>• Technology - Biochemical - Thermochem</td>
<td>• Identify feedstock processing specifications and potential energy crop improvements</td>
<td>• Comprehensive plan to reduce delivered cost</td>
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<tr>
<td>• Vetted with existing financial partners</td>
<td>• Biomass type - Switchgrass - Sorghum - Miscanthus - Energy Crops</td>
<td>• Full project impact analysis and optimization</td>
<td>• Increasing energy crop yields</td>
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<tr>
<td>• Supply Guarantee Program</td>
<td>• Geography - Southeast - All US</td>
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<td>• Leverage cost improvements during project development</td>
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Bankable Feedstock Solution

**Land**
- Land use review
- Historic production
- Preliminary DEC feedstock mix

**Process**
- Preliminary operational design, resource requirements, schedule
- Process confirmation and improvement
- Equipment O&M requirements
- Detailed Process Design Plan

**Finance**
- Review of historic cost data
- Preliminary Integrated Cost Model
- Refine Integrated Cost Model, engage financing partners
- Preliminary credit assessment

**Phase 1**
- Field trial campaign
- Land owner outreach
- Acreage acquisition plan

**Phase 2**
- Land acquisition and contracting
- Finalize DEC feedstock mix plan
- Integrated land control

**Phase 3**
- Feedstock supply organization staffing plan
- Feedstock Supply Agreement
- Equipment acquisition plan

**Balance of Project**
- Final Cost Model
- Financing plan and participants
- Financing Due Diligence

Overall Project Development Effort

Bankable Feedstock Supply Solution

Bankable Project Plan
Typical Perennial Biomass Project Schedule

2012
- Project development & structure
- Site selection & permitting
- Development of feedstock guarantee
- Procure seed
- Option land
- Feedstock planning
- Switchgrass basic data

2013
- Biorefinery construction
- Detailed engineering & design
- Planting: Round A

2014
- Start-up & commissioning
- Harvest & storage: A
- Planting: Round B

2015
- Operation
- Harvest & storage: A&B

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Biorefinery Project Development

● Phase I: Project Feasibility
  ● Project Objectives, Milestones, Deliverables, Business Plan, Financial Plan, **Feedstock Feasibility Study, Site Selection**, Process Technology, Permitting, Plant Configuration

  ● Result: Seed Funding (1-2%)

● Phase II: Project Development
  ● SPE Formation, Resource Requirements and Staffing, Management Strategy, Scope Estimates, PFDs, Risk Assessment and Mitigation Plan, Project Schedule, **Feedstock Plan and Land Acquisition, Seed Procurement**

  ● Result: Initial Project Funding (10%)
Biorefinery Project Development-2

● Phase III: Detailed Scope
  ● EPC Selection and Contract, Engineering, Equipment Selection and Procurement, P&IDs, Permitting, Offtake Agreements for Products and Co-Products, Secure Project Personnel, **Implement Feedstock Establishment Program**

  ● Result: Full Project Funding (88%)

● Phase IV: Project Execution
  ● Complete Detailed Engineering, Procure Materials, Complete Mechanical Construction, Plan Start-up Plans, Develop Resource Plans, Commission Plant

  ● Result: Turnover to Operating Entity
Phase V: Project Operations

- Operate Plant to Generate Revenue

Result: Ongoing financial return for project owners and financiers
## Partnerships & Collaborations

<table>
<thead>
<tr>
<th>Category</th>
<th>Partnerships &amp; Collaborations</th>
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</table>
| **Biomass Production**          | - Seed & Biotechnology Companies  
                                | - Equipment Manufacturers  
                                | - Staging & Densification  |
| **Processing Technology**       | - Biorefinery Technology  
                                | - Biopower Technology  
                                | - Material Conveyance & Handling  |
| **Research & Development**      | - Universities  
                                | - National Laboratories  
                                | - Federal & State Agencies  |
| **Grants & Funding**            | - State Programs  
                                | - Federal Agencies  
                                | - Private Investors  |
| **Sustainability**              | - State & Federal Agencies & Associations  
                                | - Industry Consortia  |
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