Understanding Biomass Supply and Demand

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Northeast Wood Energy Short Course
Penn State

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• Based in New Hampshire and Maine, a region with 25+ years of continuous biomass power experience
• Based in the forest industry
• Focus is on feedstock supply for biomass electric, thermal, pellet and liquid fuel projects
• Clients include utilities, merchant generators, investors, developers, and industries
• Conducted work in all regions of the country – over 100 biomass fuel assessments
• www.inrsllc.com
Why Biomass Energy?

• Environmental benefits
  – Emissions
  – Forestry
  – CO$_2$ lean >> will become HUGE, is controversial

• **Stronger local economies**

• Energy security

• Cost stability benefits often associated with a diverse mix of energy sources

• Only renewable that can be dispatched / base-loaded

Biomass Can Address All Energy Sectors

• **Electricity** – existing and proposed wood-fired power plants around the region

• **Thermal** – industrial applications, pellets, “community scale”, Fuels for Schools, pyrolysis oil, wood stoves, etc.

• **Combined Heat & Power (CHP)**

• **Transportation Fuels** – cellulosic ethanol, levulenic acid, DME, others

• A range of technological and economic maturity
Biomass Thermal

• Using wood to meet space heat and process heat needs
  • A highly efficient use of wood fuels
• Long established practice in forest products industry and cordwood – now moving beyond
• Residential, commercial, institutional, industrial
• National “Fuels for Schools” Program
• New business models emerging
• An area with major growth potential for the Northeast
• Real issues with emissions, particularly PM
• Fuel specifications / delivery requirements often more restrictive than biomass electric

Biomass Feedstock Prices

• Wood pricing highly localized
• Recent biomass fuel prices (electric, truck dumps) in New England have ranged from low-$20s to nearly $40 per green ton, delivered
• Some parts of U.S. are without a market for biomass grade wood
• Other parts of the country have competition on top of one another
• Highly dependent upon geography, specifications, delivery method, transportation network, etc.
Biomass is a Fragmented Supply Chain

- **Landowners**
  - Many small, not in the forestry business day-to-day
- **Foresters**
  - Providing professional advice to landowners
- **Loggers**
  - Own and operate harvesting equipment, generally not landowners
- **Truckers**
  - May or not be affiliated with logging firm
- **Aggregators**
  - Fill a role by coordinating supply, generally unwilling to assume price risk
- **Everybody Wants to Get Paid**

Biomass Fuel Types

- Whole-tree chips (forestry)
- Whole tree chips – land clearing
- Sawmill chips
- Bole chips
- Secondary mill residue
- Pallets
- Pellets
- Paper Cubes
- Construction and Demolition Debris
- Agricultural Residue
Whole Tree Chips

- Generally the tops, branches, and non-merchantable parts of a tree
- Around 9.25 Mmbtu/ton
- 45% - 55% moisture content
- Disruptions in supply during spring and fall mud seasons
- Stems and Off-size materials common
- Purchased from loggers or brokers
- Generally transported in trailers that require truck dumps

Many Products from a Timber Harvest

- Sawlogs and Veneer
  - Highest value, often by far
  - Used for lumber and plywood
  - This is where landowners and loggers make the greatest dollar per ton
- Pulpwood
  - Used in paper making, also now pellets and someday cellulosic ethanol
- Biomass Chips
  - Tops, branches, sweep, crook
  - Some low-grade roundwood, depending upon local markets, etc.
Wood is sorted on a log landing into products, biomass being the least valuable product.
“Biomass chips” usually chipped at landing, taken directly to market

Forest Residues
Green Tons per Acre per Year
Land Clearing and Right-of-Way Chips

Sawmill Chips

- When sawmills make boards, everything that isn’t a board needs a market
- 1,000 to 1,600 green tons per million board feet of lumber
- Around 9.25 Mmbtu/ton
- 50% - 55% moisture content
- Can be screened for size – no branches
- Appropriate transport can be arranged
- A great fuel for your projects
Secondary Mill Residue

- Facilities that take boards and make consumer-ready products
  - Flooring, furniture, manufactured housing
  - A shrinking base
- ~13.2 mmbtu per ton
- ~15% moisture content
- Often heavy to sawdust and shavings – check your fuel handling system

Sawmill and Secondary Manufacturing Residue

Dry Tons per Acre per Year
Bole Chips

- “Bole” – the trunk of a tree
- Around 9.25 Mmbtu/ton
- 45% - 55% moisture content
- Often produced by remote yards for pulp mills
- Sizing ideal and highly consistent
- Look for remote chip yards for pulp mill, export facilities, etc. – a small customer of a big producer

Ground Pallets

- Around 13.2 Mmbtu/ton
- 10% - 15% moisture content
- Sizing ideal and highly consistent
- Look for local pallet recyclers and grinders
- Often available in large quantities near major ports and shipping points
- Must deal with nails – should be captured in processing, but some always get through
Pellets

- Pelletized sawdust (either from mills or created)
- ~14 mmbtu / ton
- ~10% moisture content
- Comes in a number of grades – ash content is the difference, and your projects can handle high ash
- Moving from residential to industrial uses
- Handles very well, and fuel handling system can be notably less expensive
- Expensive compared to less processed fuels, but have significant advantages
- Purchase directly from producer or from a broker
- Need for quality bulk handling and storage

Pellet Manufacturing and Wood Pellet Boiler Building
Construction & Demolition Fuel

- 12.2 MMBTU / ton
- 20% to 30% moisture
- Processed to remove impurities, but can contain some low levels of impurities
- Extremely controversial
  - Banned in NH
  - Can inflame local tensions
- Inexpensive
- Purchase from processors or waste handling companies

Paper Cube Fuel

- ~18 mmbtu / ton >> rocket fuel
- ~10% moisture
- Roughly half of the heat value is from something other than cellulose – e.g., coatings on paper
- Lose some of the social attractiveness associated with biomass
- Limited number of producers
- Potential boiler issues
Agricultural Residues

• Covers a very wide range of products
• Each type has issues associated with it
• Most not readily used for combustion (nut shells the notable exception)
• Extreme seasonality issues >> storage

There is A Lot of Wood

• The US grows significantly more wood than is harvested
• Growing interest in wood as an energy source
• Competitors will include large biomass facilities, pulp mills, wood pellet manufacturers, and bio-fuel facilities
• These competitors can be critical in supporting the supply infrastructure
• The press release is NOT the project >> don’t believe everything you read regarding biomass
General Issues Regarding Biomass Fuels

Live floor trucks allow easy unloading

Live floor trucks can be arranged for a number of fuels, make sure that truck has the ability to back up into loading area
Self dumping trucks come in a variety of sizes

Look Up!
Having a truck contact power lines in bad for everyone involved

Truck Dumps Unloading onto Ground
Truck Scales

• Biomass is generally sold on weight
• You will need to locate a certified truck scale proximate to the customer and arrange for weighing
• Can be done on a sample basis, but requires truck to be weighed on the way in and out, so element of surprise is very difficult to manage

Traditional Ways to Manage Risk

Large Biomass Users

• Diversity of Supply
  – Make sure that you have multiple suppliers with multiple sources of feedstock / fuel
• Surge capacity with existing suppliers
  – Make sure that existing suppliers can “turn up the volume” to account for interruptions from others
• Significant storage capacity
  – Ability to have 30 days is nice, but keeping it full is costly. Supply capacity mitigates short-term risk, but adds expense.
Emerging Price Risk Strategies

• Contract with a Supply Manager
  – Often, a firm in the forest products industry, perhaps as a compatible wood user (e.g., a pellet manufacturer or a pulp mill)

• Risk Sharing
  – Subject to agreed benchmarks and adjustments (e.g., diesel) some type of upside / downside risk sharing split

• These are good, and all move toward a more stable and price known fuel supply, but ...

Biomass and Diesel Prices – New Hampshire 2001 – 2010

Data Source: NH TOA Market Pulse, US DOE EIA Monthly Diesel
Diesel as a Component of Woody Biomass

• Estimate ~2.1 gallons of diesel to harvest, process and transport one green ton of biomass
• Assumptions:
  – 50 mile one-way trip
  – $3.00 per gallon diesel
  – 27 green tons per load
• $6.28 per green ton of diesel cost
• You can hedge your exposure to diesel risk *once you understand it* (is thermal self-hedging?)

INRS Diesel and Trucking Calculator

Developed simple calculator to estimate diesel and trucking costs per green ton of biomass fuel

• Diesel variables
  – One-way distance
  – Diesel ($ per gallon)
  – Tons per load
• Trucking variables
  – Average truck speed
  – Cost for truck and driver
  – Turn-around time
A typical scenario has diesel and trucking at $10.66 per green ton

This is before logging costs, payment to a landowner, profit, etc.

Supply Infrastructure is Critical

- In the Northeast, wood is not the limiting factor – the ability to get wood in a truck delivered is the limiting factor
- Logging workforce shrinking, but not clear logging production is shrinking
- Serious concerns around the “next generation” of loggers
- Under current pricing, biomass NEEDS a healthy solid wood market
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