Biomass availability and supply

Charles Friesen, Researcher, FPInnovations
About FPInnovations

- A private non-profit Canadian corporation
- Supports competitiveness of the Canadian forest sector through science, technology and innovation
- Facilitates collaboration between industry, government, suppliers and colleges/universities
- Focused on real business needs and opportunities, for today and for the future – “applied science”
- A proven track record of delivering bottom-line impact and positive return on investment
Supporting over 200 industry members and govt. partners from coast to coast

- **FPInnovations Research Centres**
- **CWFC Research Centres**
- **FPInnovations Field Staff**

- **FPInnovations Vancouver Research Centre**
- **WFORC Hinton, AB**
- **FPInnovations Québec City Research Centre**
- **Pte. Claire Research Centre**
Canadian fiber supply

Canada:
- 400 million ha forest land
  - 8% private land
  - 78% Provincial Crown land
- 140 million m³/a annual cut

British Columbia:
- One of the largest public forests on earth
- Only 5% private ownership
- 10% protected areas
- 63 million m³/a annual cut

Finland:
- 21 million ha forest land
  - 70% private
  - 30% public
- 55 million m³/a annual cut
Canada is the world leader in the large scale production of forest biomass

Grinding/chipping operations

Transport
Biomass availability is NOT the problem

With a cut of 140 M m³ and a biomass ratio of 20% there are 11.2 M dry tonnes available in Canada each year from harvest residue
Economic availability IS the problem
There are currently 12 pellet plants in BC with the annual production capacity of 2.2 million tons.

The annual production level of wood pellets in BC is over 1.7 million tonnes.

Primary feedstocks for pellet production are mill residues (1,185,500 Odt) and low-grade logs (435,750 Odt).

Forest-origin Biomass Sources in Canada

- Two main sources
  - Harvest residues
  - Non-merchantable residuals (non-merchantable, insect- and fire-killed trees)
Feedstock cost is key to competitiveness

- **Delivered wood cost** to mill is the single largest component of final product cost (40 to 60%)
- Failures of bioenergy projects are often due to insufficient attention to the feedstock supply (volumes, costs, quality & fluctuations)
- Currently no high value product for biomass, therefore low cost is expected
Biomass cost ranges

<table>
<thead>
<tr>
<th>Source</th>
<th>CAD$/dry tonne</th>
<th>CAD$/GJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawmill Residues &amp; hog fuel</td>
<td>10 – 60</td>
<td>0.5 – 3</td>
</tr>
<tr>
<td>Harvest Residues</td>
<td>40 – 120</td>
<td>2 – 7</td>
</tr>
<tr>
<td>Roundwood</td>
<td>80 – 120</td>
<td>4 – 7</td>
</tr>
</tbody>
</table>
Biomass type will greatly affect supply costs

From MWD to sawdust and bark to branches and tops to roundwood to small trees to ….
Supply chain costs
Residues from roadside stroke-delimber

Pre-piling
Transport:
- 120 km one-way, live-floor chip van

Comminution
Other:
- roads, supervision, overhead, maintenance, compliance, stumpage
Supply costs– Transport

- Transport constitutes often 40-60% of total delivered cost
- Distance to cut block
  - +/- 17 $/odt for the first 50 km
  - + 10 $/odt per additional 50 km
The basic challenge

Transporting a low-value, low bulk-density material with a high moisture content over a long distance

after Hakkila 1999
Transport energy not water

55%

15 $/green tonne

9.50 $/MWh

5.50 $/MWh

Transport cost

4 $/MWh for transporting water

35%

Little incentive to improve practices with payment on a green tonne basis
New technology development & implementation
Integration of operations
Integrated operations

Trucking

- Introduce new configurations with higher allowable GVWs for raw & finished products

- Work with provincial regulators & industrial members on new configuration initiatives
  - 9-axle log B-trains approved for trial
  - 10-axle chip van approved
  - 2-container hauler currently in R&D phase
Fibre availability in BC

• There is a lot of biomass around but sustainable and economically-viable volumes need to be established
• Biomass Ratio is approximately 30-36% = biomass / merch roundwood (including MPB areas) at any price
• Biomass Ratio is 6-15% at a price of $60/odt
Biomass Availability and Costing

Renewed interest in FPInterface & NCCruise to assess regional level economic availability/costing → increased operational accuracy

Fort St. James - prob. that vol. sawlog > 200 m³/ha
Biomass yield is 20-24 odt/ha in interior BC
Biomass yield is ~31 odt/ha in interior MPB areas
Biomass yield is ~31 odt/ha in coastal areas
In Alberta, forest lands cover about 35 million hectares (Green Area).

Out of which, 13 million hectares (37.47%) are available for timber harvest.

Average AAC and annual timber harvest are 28.31 million m$^3$ and 22.54 million m$^3$ in the period of 2003-2013, respectively.

Ebadian & Jacobsen
Alberta biomass availability study

- 2013 FPInnovations study for CCPC – 300 MW Coal Power Plant
- 100 km and 150 km radius of Edmonton
- Availability based on Alberta Government information
- **Whole tree wood chips** from wood lots (50% owner participation assumed) PLUS unused AAC from FMUs.
- Forest residual wood chips (from FMUs)
  - ~ 400,000 ODt/year within 100 km
  - ~ 2.4 M ODt/year within 150 km

<table>
<thead>
<tr>
<th>Forest Biomass Source</th>
<th>100 km Radius</th>
<th>150 km Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Tree Chips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woodlots</td>
<td>216,526</td>
<td>686,291</td>
</tr>
<tr>
<td>FMU (unused AAC)*</td>
<td>110,542</td>
<td>887,206</td>
</tr>
<tr>
<td>Forest Residuals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMU</td>
<td>76,655</td>
<td>751,821</td>
</tr>
<tr>
<td>FMU (over AAC)**</td>
<td>6,591</td>
<td>60,415</td>
</tr>
<tr>
<td>Total</td>
<td>410,314</td>
<td>2,385,733</td>
</tr>
</tbody>
</table>

*Unused Annual Allowable Cut (AAC) is the difference between the current AAC level and the historical harvesting level
**Over AAC is the amount of woody biomass not harvested within the current AAC
Alberta harvest residue availability

- 2016 FPInnovations study
- A representative site was selected for conversion of forest residues
- Located between Grande Prairie and Grande Cache
- Radius of ~ 100 km around chosen delivery point
Alberta harvest residue availability

- Biomass yield is 18.9 odt / ha
- Biomass ratio is 19.8% (biomass/merch roundwood)
- 2.4 M odt available at $90/odt
- At market rate of $50/odt:
  - 1.3M odt are available over 20 years
  - 65,000 odt/yr
- Average price is $51.11/odt for all biomass
Alberta harvest residue availability

- If 50% of hardwood stems in the area became available for biomass, total available jumps to 225,000 odt/yr, but amount at $50/odt remains the same – because of harvesting cost for full stem
- Average price $81.72/odt
British Columbia & Alberta summary

- Depending on the region, there are large untapped volumes of harvest residues available.
- Certain areas have a tighter fibre supply.
- Existence of established supply chain.
- Existing rail network is a major advantage.
- Burning of harvest residue piles is becoming more challenging.
- Potential sources of residues may become available from thinnings, FireSmart treatments, right-of-ways, road sites, urban forestry.
Nova Scotia Hub Initiative

- Jump-starting the bioeconomy in NS with support from NSDNR, Emera, Innovacorp & ACOA
- In year 1, FPInnovations & BioApplied provided the province with an analysis of:
  - Feedstock availability and costs;
  - Supply chain weaknesses & opportunities (trucking, harvesting, planning)
  - Financial opportunities to benefit the forest sector
- Year 2 currently in discussion (building on results from yr 1)
Conclusions

- There is a lot of biomass but sustainable and economic volumes need to be established on a local case-by-case basis with major tenure holders.

- Development of residue recovery systems
  - Better integration with conventional harvest
  - Tailored biomass supply chains
  - Introduce new truck configurations with higher allowable GVWs

- Plenty of additional untapped resources
  - Harvesting of fire-killed stands
  - Stand conversions
  - Marginal Forest Opportunities

- New breakthrough technologies may be slow in coming:
  - Develop innovative logistic solutions
  - Create clean white wood from harvest residues