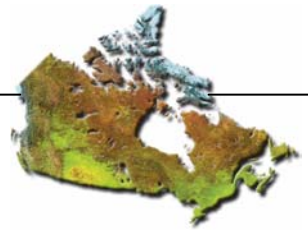
Important Copyright Information

The following content is provided for educational purposes by the workshop presenter. This content may or may not have been peer reviewed.

Information, opinions and recommendations put forward are those of the presenter, and do not necessarily reflect those of FORREX, its funders, or partners.



Biomass Energy Opportunities from Large-Scale Forest Disturbances

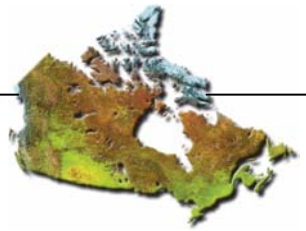
Brad Stennes and Alec McBeath

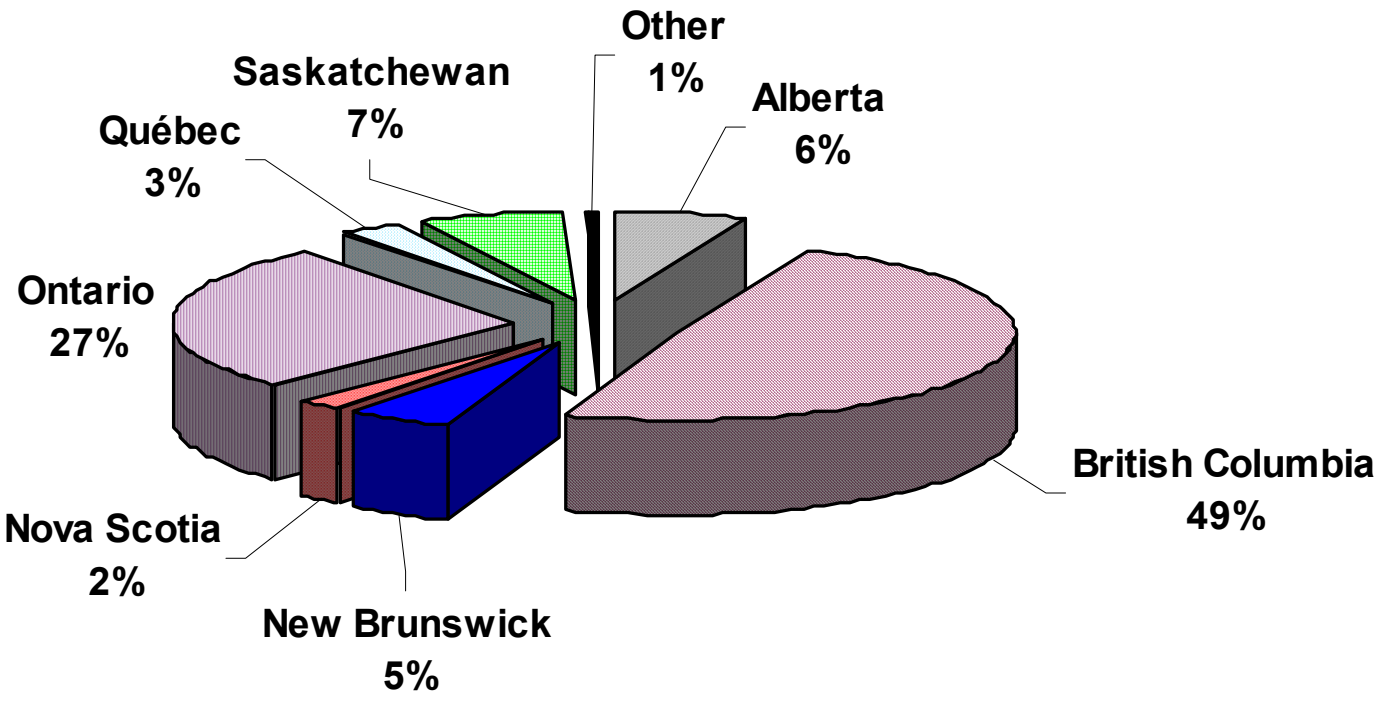
Canadian Forest Service, Victoria

Nov 7, 2005

Outline

- Current biomass use for energy in BC
- MPB feedstock opportunities
- Costs of woody feedstock
- Potential solutions for increased uptake



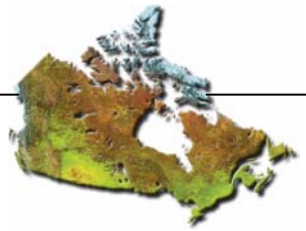


Biomass Energy Installed Capacity by Region 2003

Source: Nyboer *et al.,* 2004 – CIEEDAC, SFU

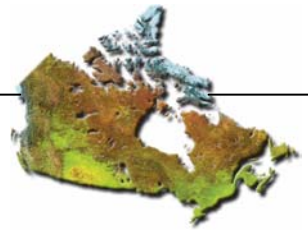
Present Woody Biomass Use in BC for Energy

- >650 MW of provincial woody biomass electric generating capacity using >3 million BDT wood.
- Almost all used internally by pulp & paper mills – using processing residuals.
- The regions affected by MPB have surplus woody residues from processing plants available for energy production – especially post 2001, with increased processing activity



MPB Biomass Energy Drivers

- Traditional processing and/or markets for lpp in the region affected by beetle are at or near “full capacity”
  - ***– US response, trade action***
- Gov’t looking to innovative ways to deal with salvage volumes – energy from biomass fits this well
- BC policy that 50% of all new electrical generation from “green sources” (Renewable Portfolio Strd.)
- **Costs to leaving dead pine in the bush?**

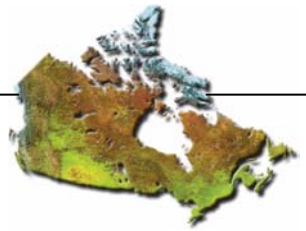


Feedstock Supply Resulting from MPB

- Salvage of standing dead trees – **Costly**
- Additional processing residuals due to increased harvest and manufacturing into traditional products (lumber) – **Cheap**
- **Temporary Supply**

Key Characteristics of Feedstock Supply

- **Short-run supply** – Post 2015, regional harvests will drop by 12 million m3 – residuals will be scarce
- Spread over large area – costly to centralize
- Problem is complicated by both **space and time aspects**

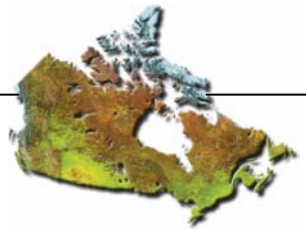


Costs in BC

- Feedstock costs are the critical factor in the economic feasibility of biomass energy production.

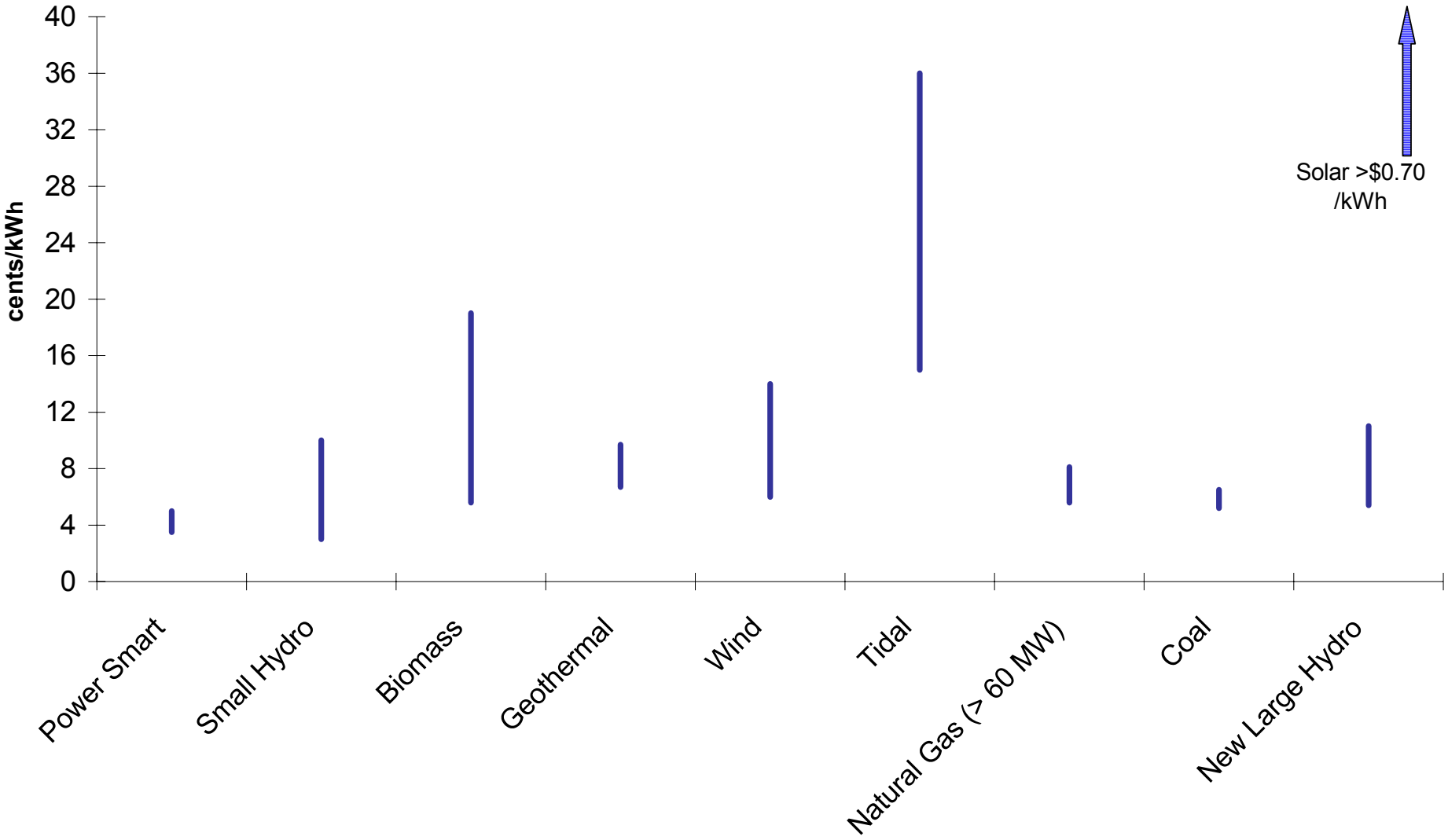
- Supply from dedicated harvest (thinning or salvage) of trees is costly.
  - US studies show range of $55 - $130 per delivered BDt (2002 $Cdn) - mean ~ $90.

  - PG region delivered $80 - $100 per BDt.

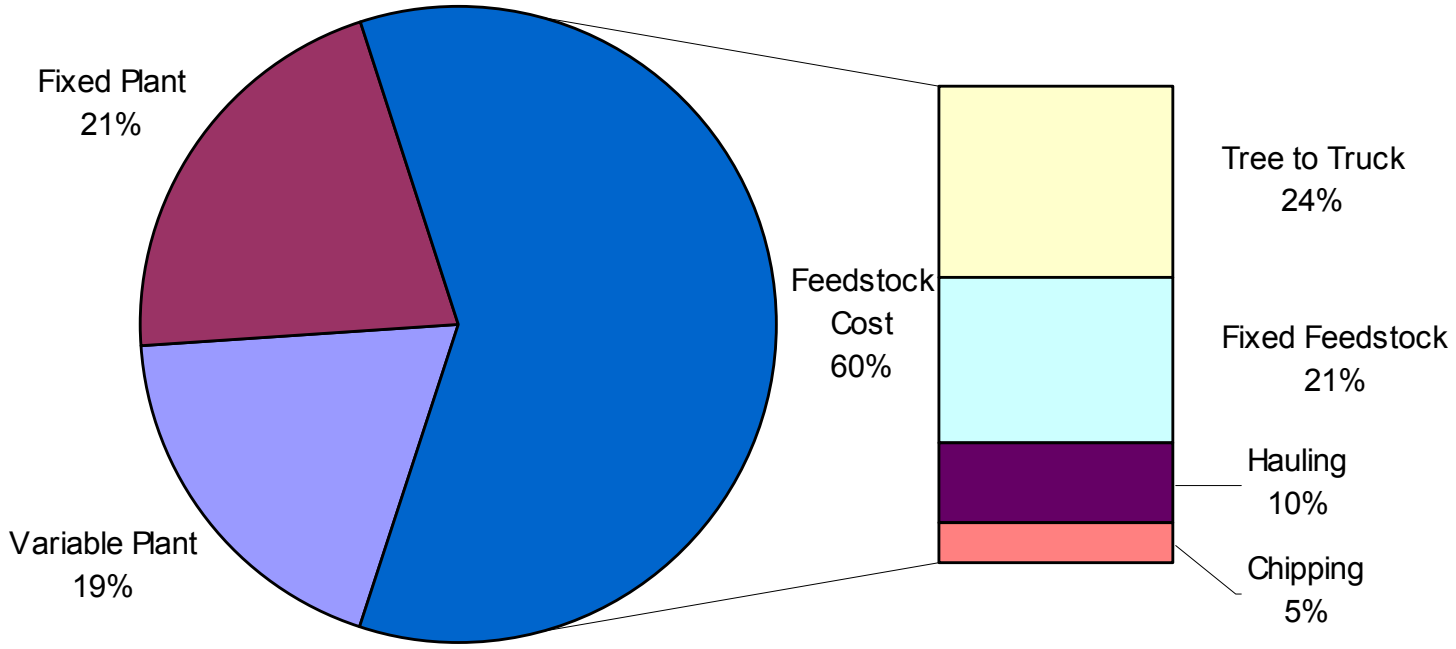


Levelized Costs of Selected Electricity Options (cents/kWh):

BCHydro 2004 Integrated Electricity Plan



Components of Total Costs of Direct Fired Biomass Electrical Production Using Salvage Harvested Pine from Prince George Region,



Note Fixed Feedstock Costs Include Overhead, Road Costs and Regenerating the Harvested Site

Case Studies (I)

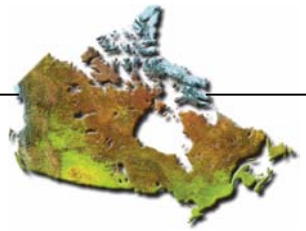
- Compared costs of electricity production from harvested/chipped pine using two case studies:

  1. Building 100 MW plant in BC to burn chips, compare to reference system of large CCNG production.

  2. Displacing some coal in existing Alberta coal-fired plants, transporting chips (< 1000 kms from PG).

Case Studies (II)

- Costed out both systems in each case, examined full life cycle net GHG emissions.
- As wood energy more costly – What level of carbon credit would make biomass systems feasible?
- Biomass energy combustion is treated as carbon neutral, GHG emissions to harvest/haul are counted.



Carbon Credits Required to Equilibrate Costs Between Wood-Fired and Natural Gas Electricity Generation

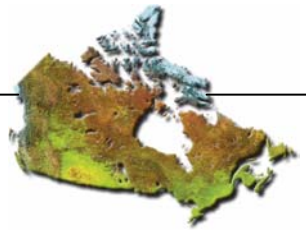
Natural Gas Prices $ mmbtu^{-1}	Feedstock Costs in $ BDT^{-1}				
	0	**25**	**50**	**75**	**100**
	---------- $ tonne CO_2 ----------				
5	-6.7	33.2	73.1	112.9	152.8
7	-33.1	6.8	46.7	86.6	126.5
9	-59.4	-19.5	20.0	60.3	100.2
11	-85.7	-45.8	-5.9	34.0	73.9
13	-139.3	-72.1	-32.2	7.7	47.6

Breakeven Carbon Credits Required to Harvest & Haul Chips from British Columbia to Displace coal Through Cofiring in Alberta

Coal Costs $ tonne^{-1}	**Feedstock Costs in $ BDT^{-1}**			
	25	**50**	**75**	**100**
	---------- $ tonne CO_2 ----------			
25	10	29	48	68
50	-2	17	36	56
75	-14	5	24	44
100	-26	-7	12	31

Ideal Energy Utilization Vehicle Given the Nature of MPB Feedstock Stream

- Works at small scale – Technology w/out significant scale economies
- Efficient – Some of our feedstock will be high cost
- Transportable
- Short window for capital recovery (< 15 yrs)



Potential Solutions

- Create an intermediate product that can enter international commodity markets

- Pellets
  - More efficient for long-distance transport/Storage
  - N. Europe market
  - Phytosanitary considerations greatly reduced

- Bio-oil

- Wood-based ethanol (Enzymes)

Summary & Conclusions

- Is a very large pool of “potential” biomass feedstock created by the MPB epidemic – Temporary
- Aside from increased processing residuals, energy not cost competitive with fossil fuel sources given current prices
- With climate change, range expansion and the continual introduction of exotic pests – technology to use salvage for biomass may be very useful in the future