GHG Balances of Canadian Biomass Exports- Wood Pellets

Joint IEA Task 38/40 Workshop

Trondheim, Norway- April 5, 2006

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GHG Balances of Canadian Biomass Exports

- Task 38 Case Study
  - Objectives and Scope
    - Assess dependable long-term biomass supply in BC
    - Review three fibre supply alternatives for a pellet manufacturing plant & export
    - Assess GHG balances of supply options
- Task 40 Supply Chain Study
  - Examine several supply chains for Canada Europe trade; pellets and BioOil, delivery costs

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Contents

- Fibre availability
  - Mill residue
  - Mountain Pine Beetle
  - Afforestation
- Feedstock Mix- pellet plant
- Target Markets
- GHG balances- Project vs Base Case
  - GHG Emissions
  - Carbon Stock changes (including managed forest)
- Supply Chains- Costs, Prices

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Mill Residue Study- Nov 2005

Manitoba & West

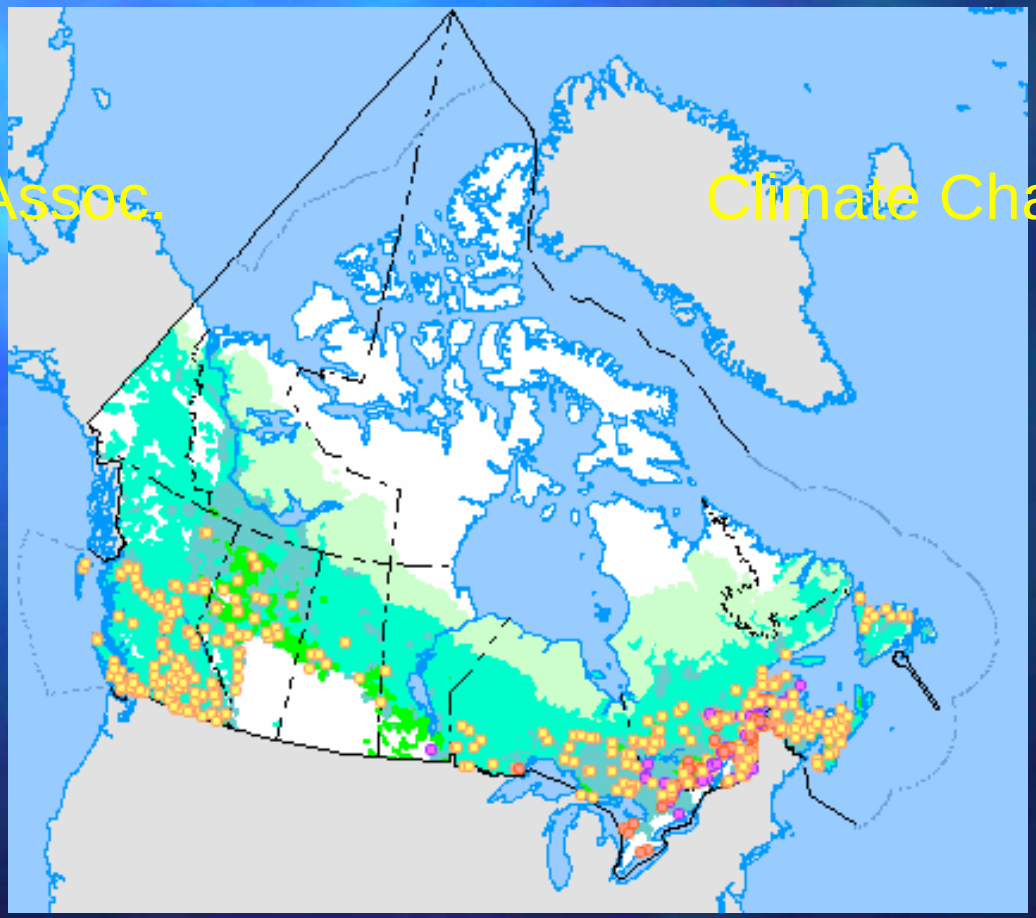
Brian McCloy

BW McCloy & Assoc.

Ontario & East

Doug Bradley

Climate Change Solutions



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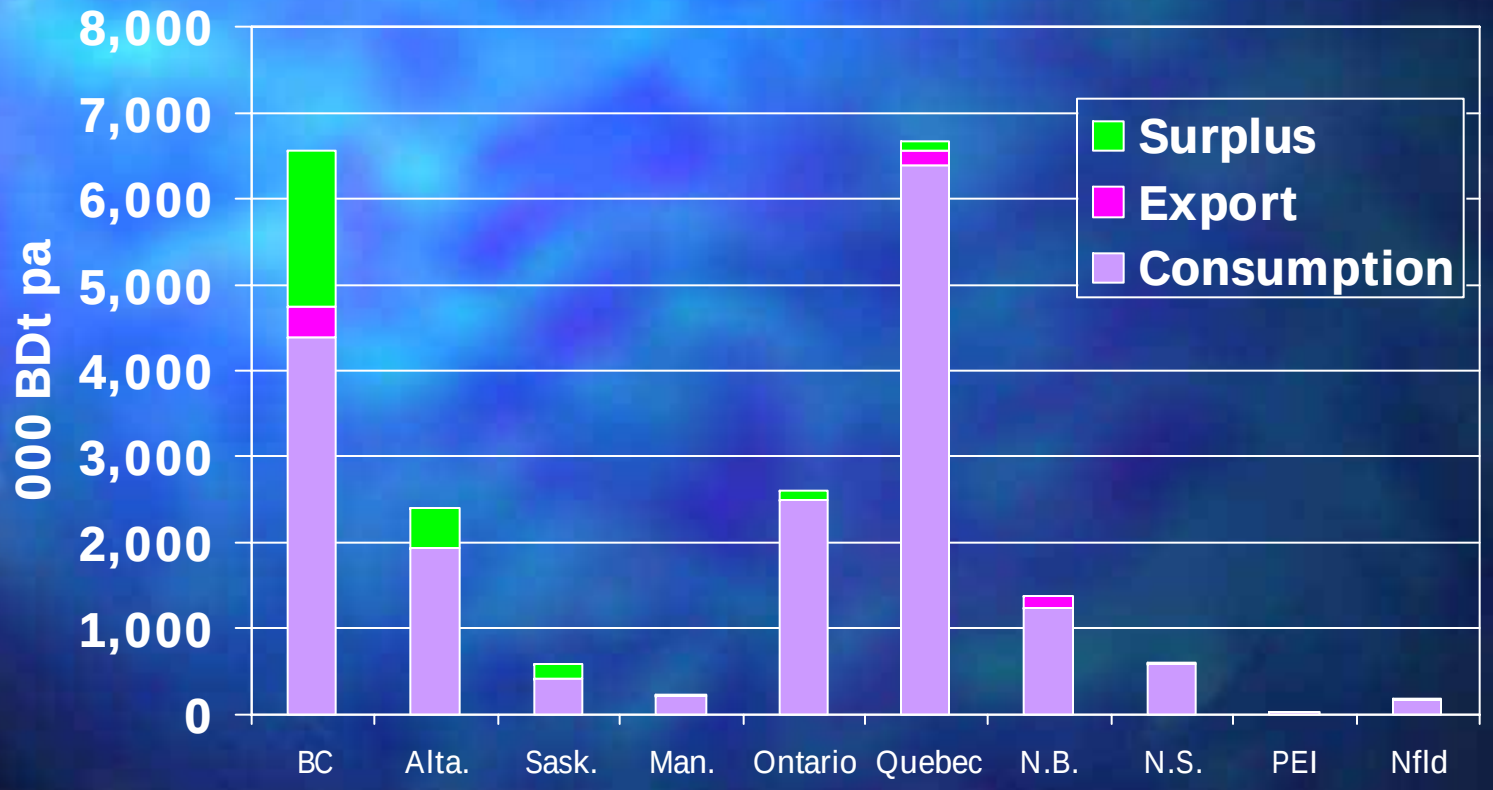
Annual Mill Residue Production and Surplus- Canada 2005



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Residue Disposal

West

Beehive Burners

East + Sask.

Hog Piles

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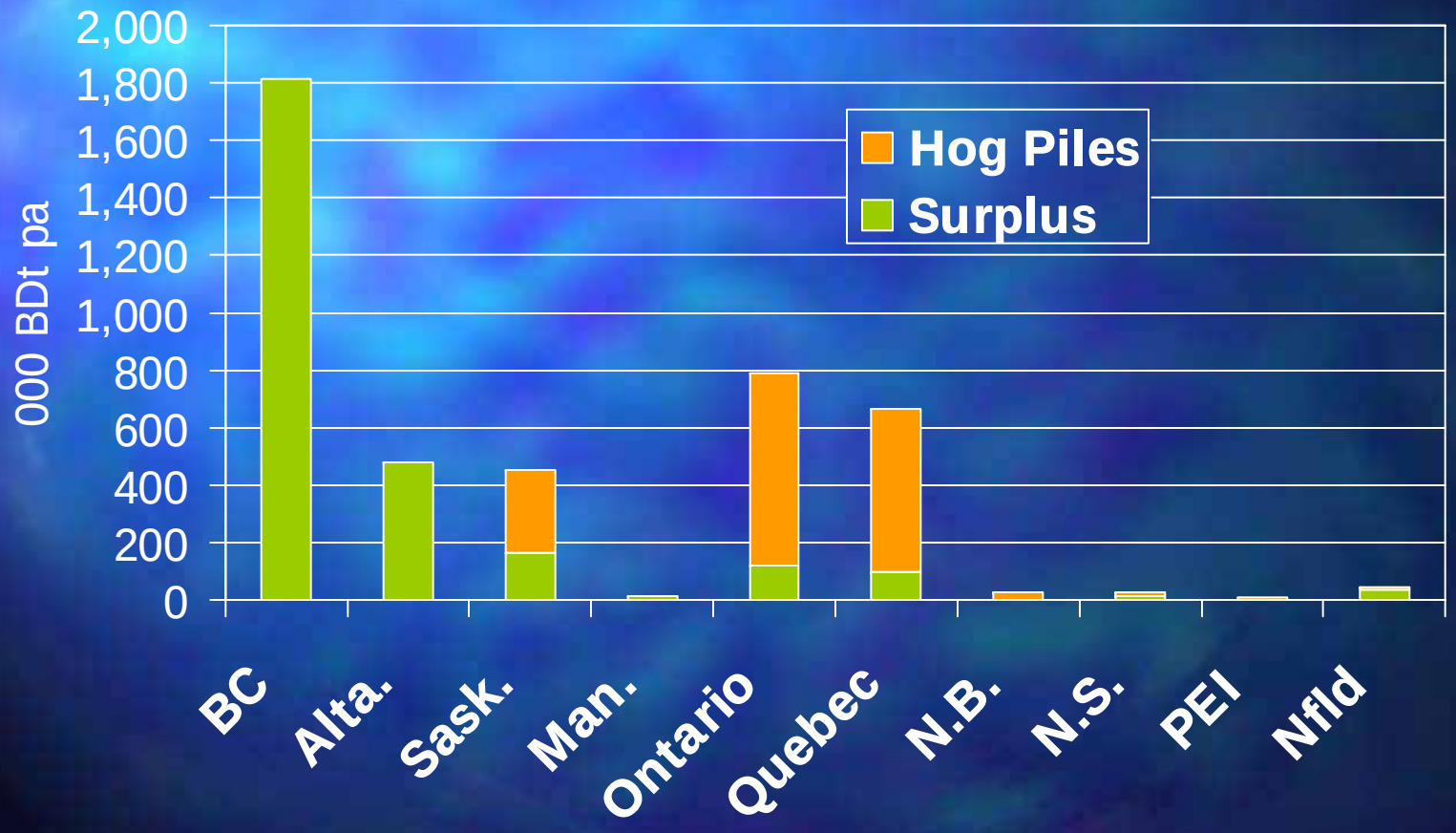
Annual Surplus Including Hog



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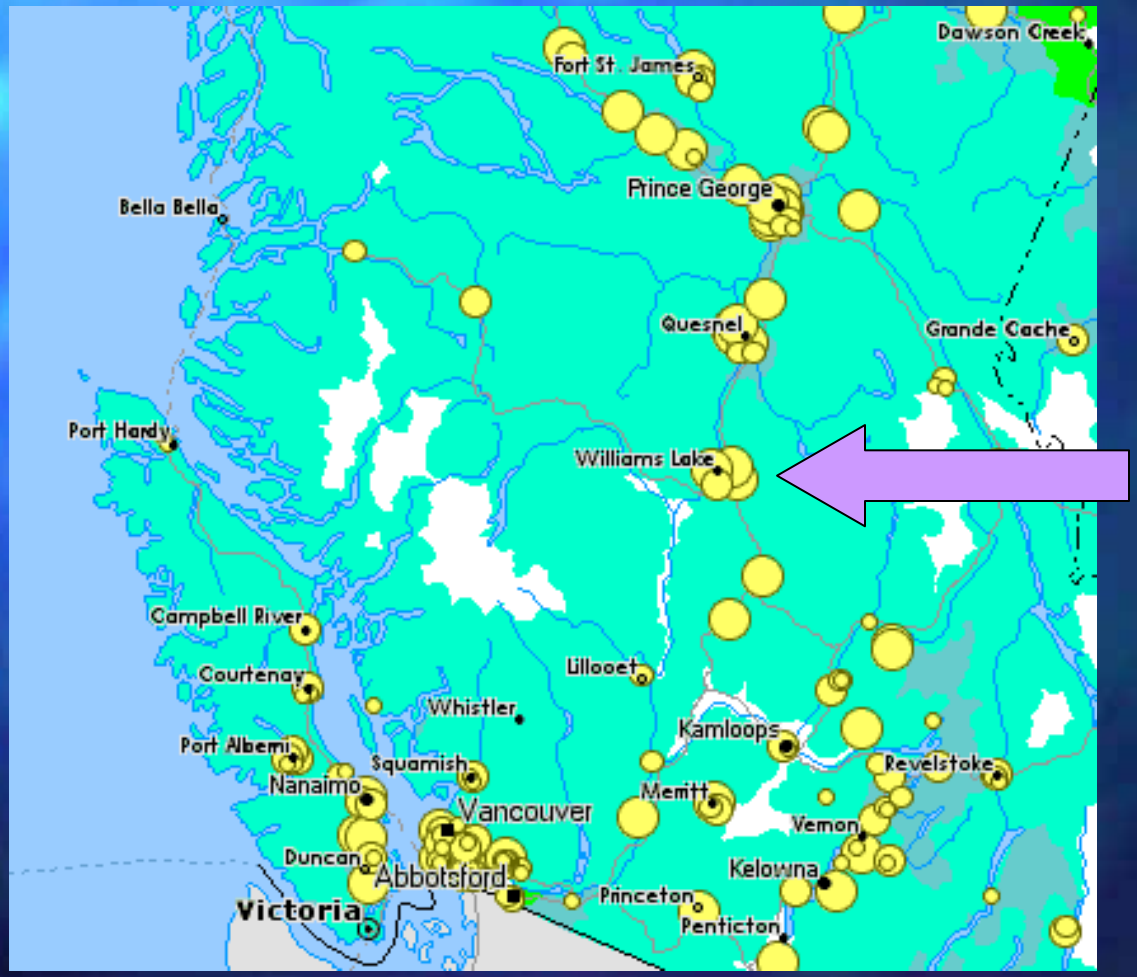
Plant Location- William's Lake, BC

(Yellow circles depict sawmills and size)



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Mill Residue Availability

Wood Residue Surpluses- 2005	
000 BDt	
	Surplus
Caribou (Williams Lake)	206,500
Prince George	1,073,800
Prince Rupert	284,000
Kamloops	204,900
Nelson	45,700
BC total	1,814,900

1 plant = 168,000 BDt

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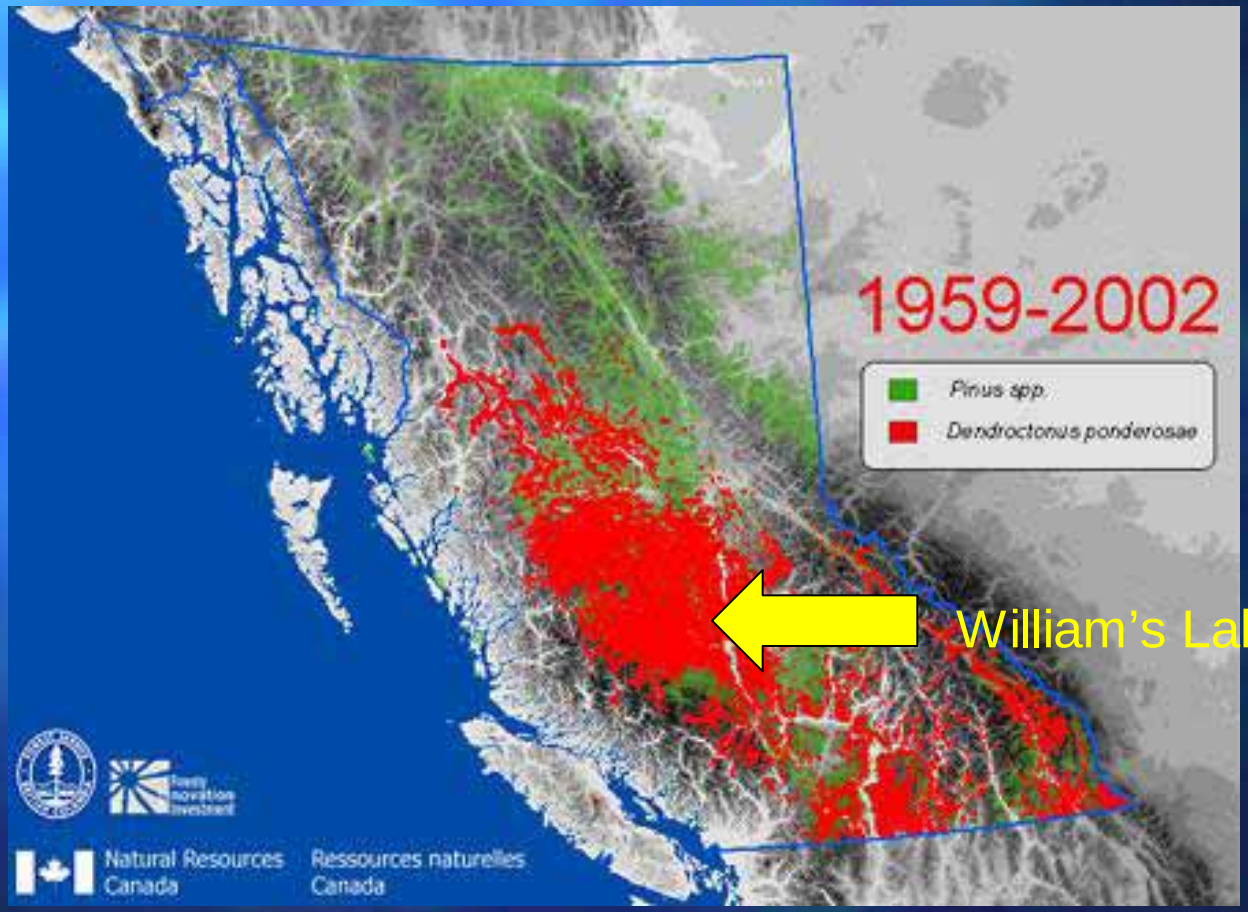
Mountain Pine Beetle (MPB) Infestation



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MPB Volumes

- Will last 10 years, kill 80% of Pine
- 2004- 7 M ha infested, 170 M M^3 dead
- 2008 (Peak)- 450 M M^3 dead
  - (= 8 years of total Finland production)
- 180,000,000 BDt > 1000 pellet plants

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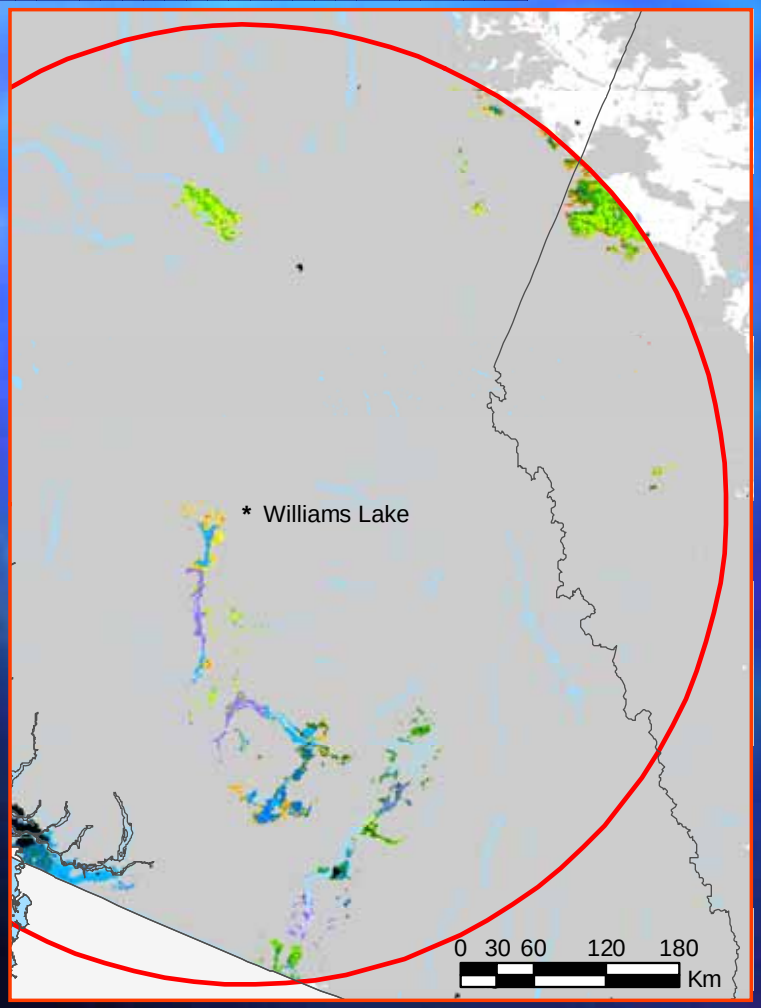
Afforestation Fibre- CFS

Economic Radius of Plantation Fibre



Br.-ev. fibre price, $/m3
- 0
- 0 - 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 80
- 80 - 120
- >120
- Urban areas
- 400km buffer

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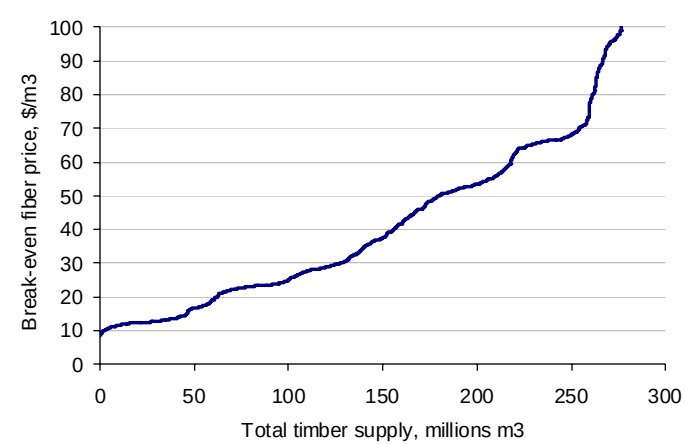
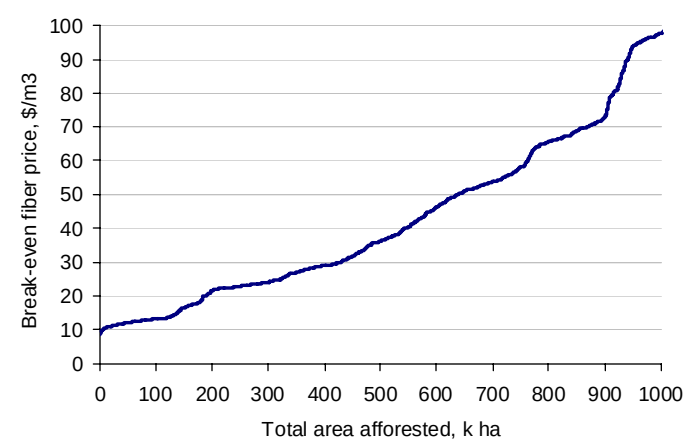
Example-Break-Even Fibre Supply





-Realistic timeframe for afforestation fibre = 15-18 years

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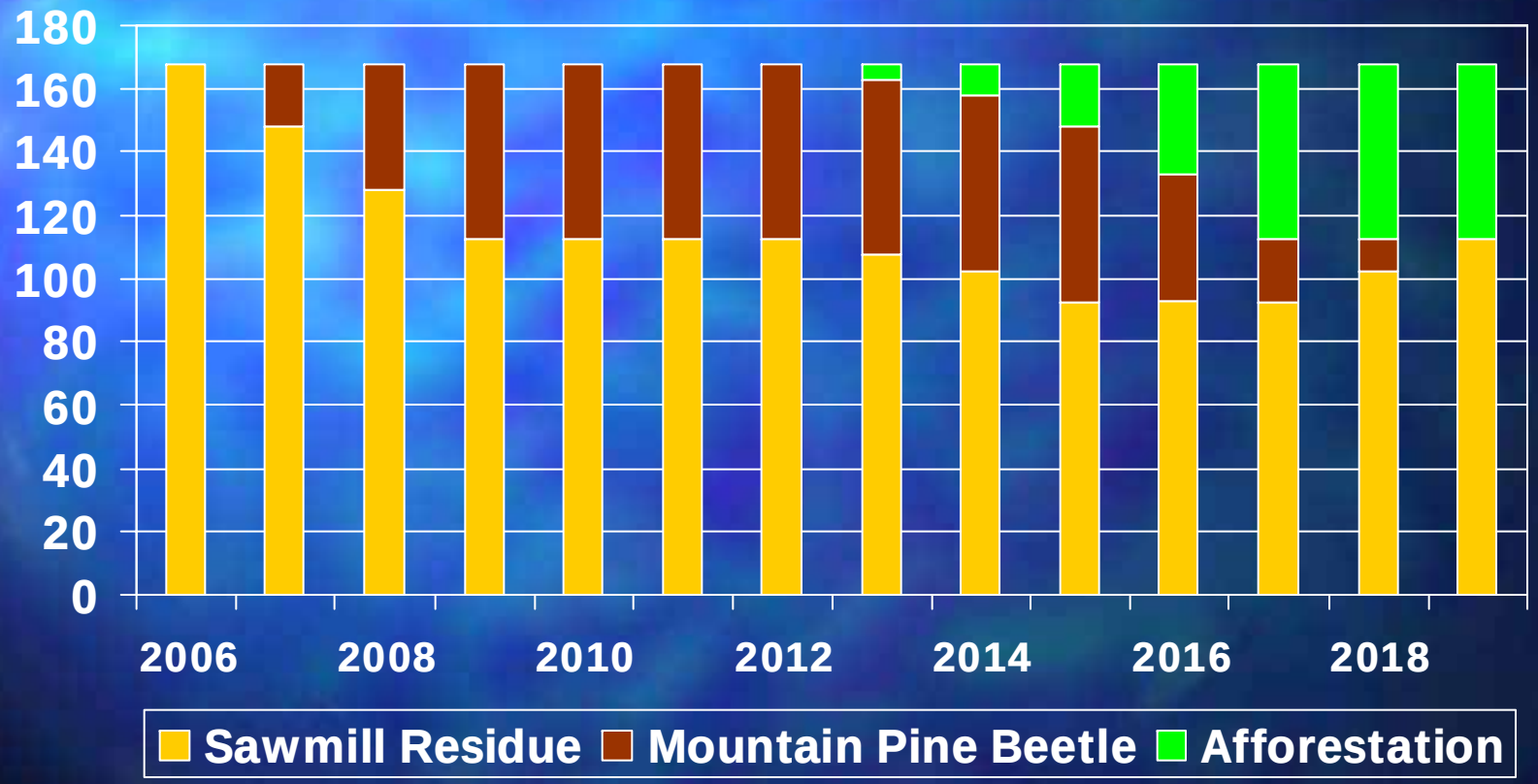
Plan Feedstock Mix



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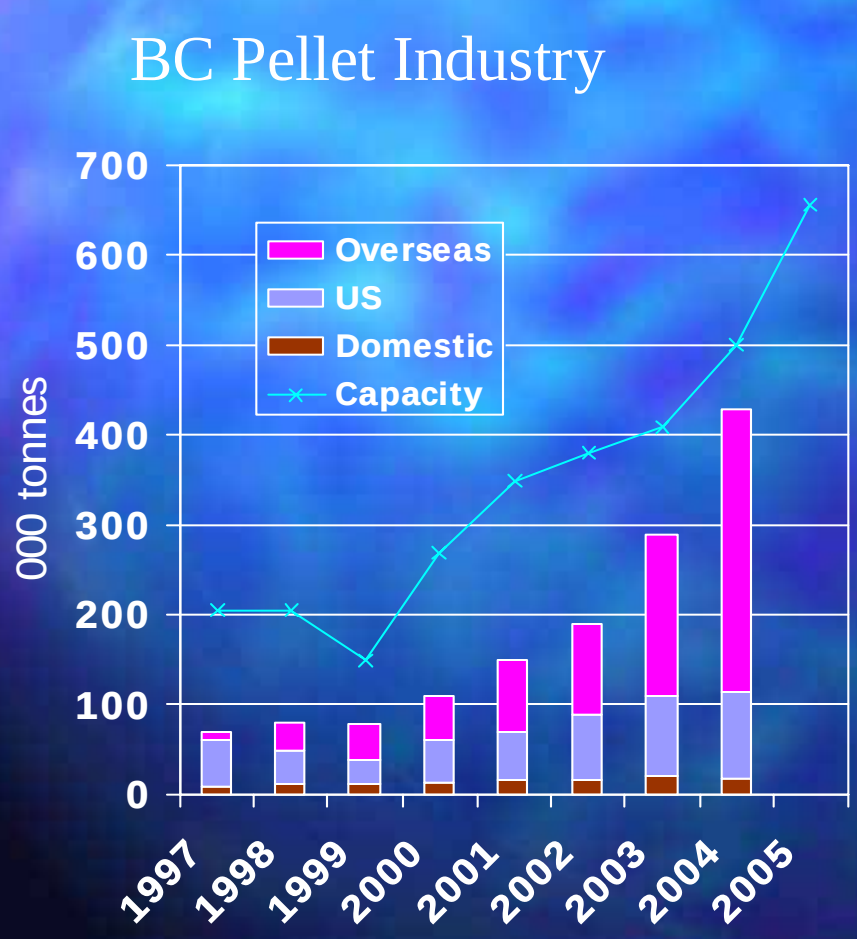
Wood Pellet Industry- BC



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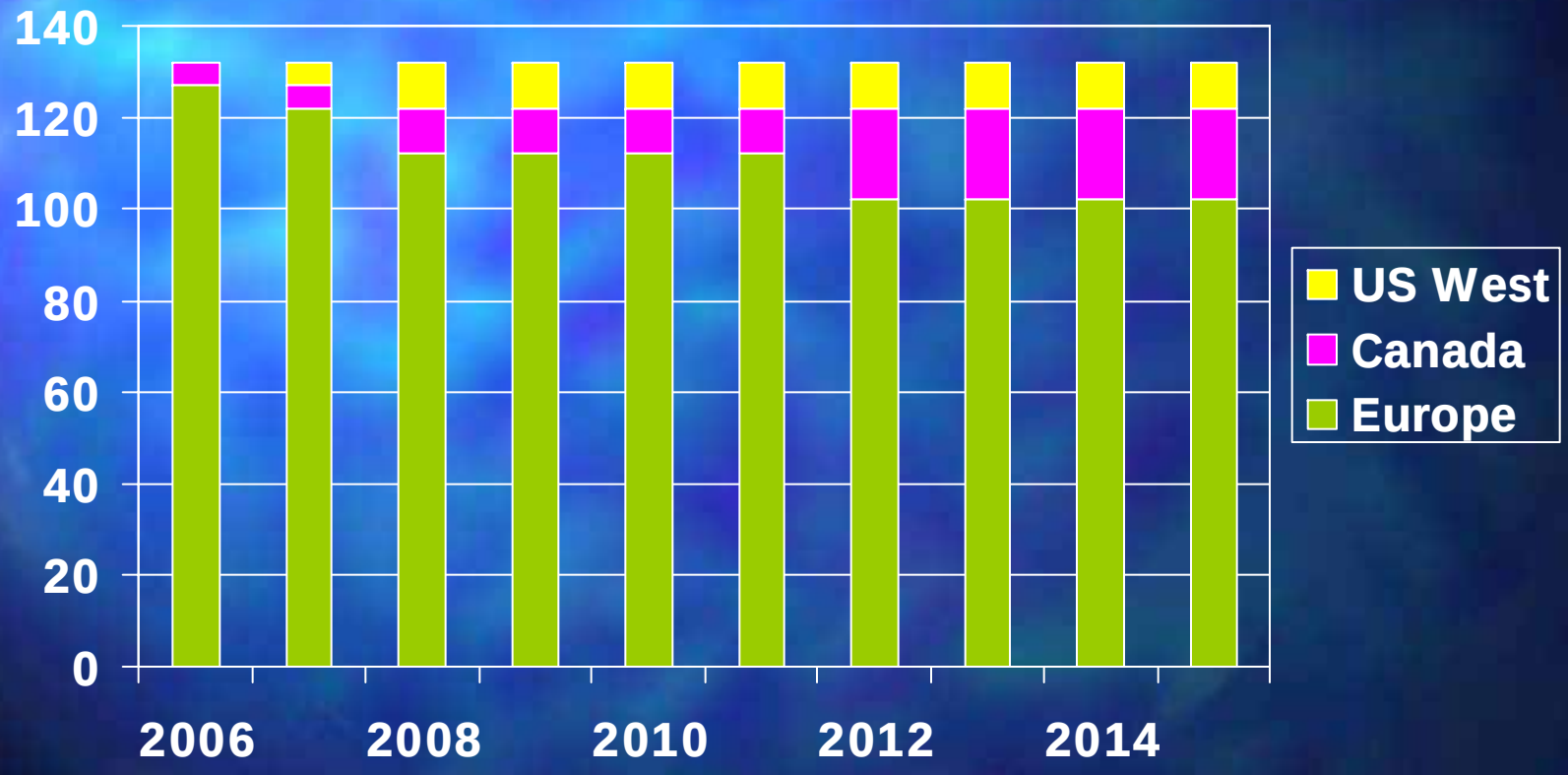
Pellet Target Markets



Greenhouse Gas Impacts

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Base Case

- Coal Fired Power Plant- EU
- Incinerate Mill Residues- BC
- Mountain Pine Beetle- decay

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Project

- Build pellet plant
- Burn mill residues
- Harvest, process and transport MPB & afforestation wood
- Manufacture pellets
- Transport to market
  - ~90% EU
  - ~5% Canada
  - ~5% US

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GHG Emission Balances (tCO_2e)

	2006	2007	2008
Baseline (Coal Power Plant, NA Ngas Heating):			
Bark pile CH4 emission	0	0	0
Gas Heating (incl. Gas Production)	11,606	23,212	46,424
Coal Production	976	976	976
Coal Transport (at 10,000 km)	3,361	3,361	3,361
Coal burned in Power Plant	205,359	197,274	181,104
Total Baseline emissions	221,302	224,823	231,865
Case (Build pellet plant, supply pellets to Power plant for cofiring):			
FF- Build pellet plant	9,870	0	0
Truck Mill residue to pellet plant	608	489	370
Process & Truck MPB fibre to plant	0	580	1,160
Process & Truck Afforestation fibre to plant		0	0
Pellet Manufacturing	7,763	7,763	7,763
Rail- pellets to port	124	119	110
Rail- pellets to US North West	0	9	18
Truck pellets Alta and BC	80	80	159
Ocean Transport (Van-Rotterdam)	5,730	5,504	5,053
Barge to Power plant	assume immaterial		
Total Project emissions	24,175	14,544	14,633
Net Fossil Fuel Emissions	-197,127	-210,279	-217,232

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Stock Change- Mill Residue

Base Case

- Incinerate Residue
- Emissions
  - CO_2e not count
  - CH_4 emissions- none
- Stock Change
  - Loss of residue pile

Project

- Incinerate residue
- Emissions
  - CO_2e not count
  - CH_4 emissions- none
- Stock Change
  - Loss of residue pile

Zero net GHG impact

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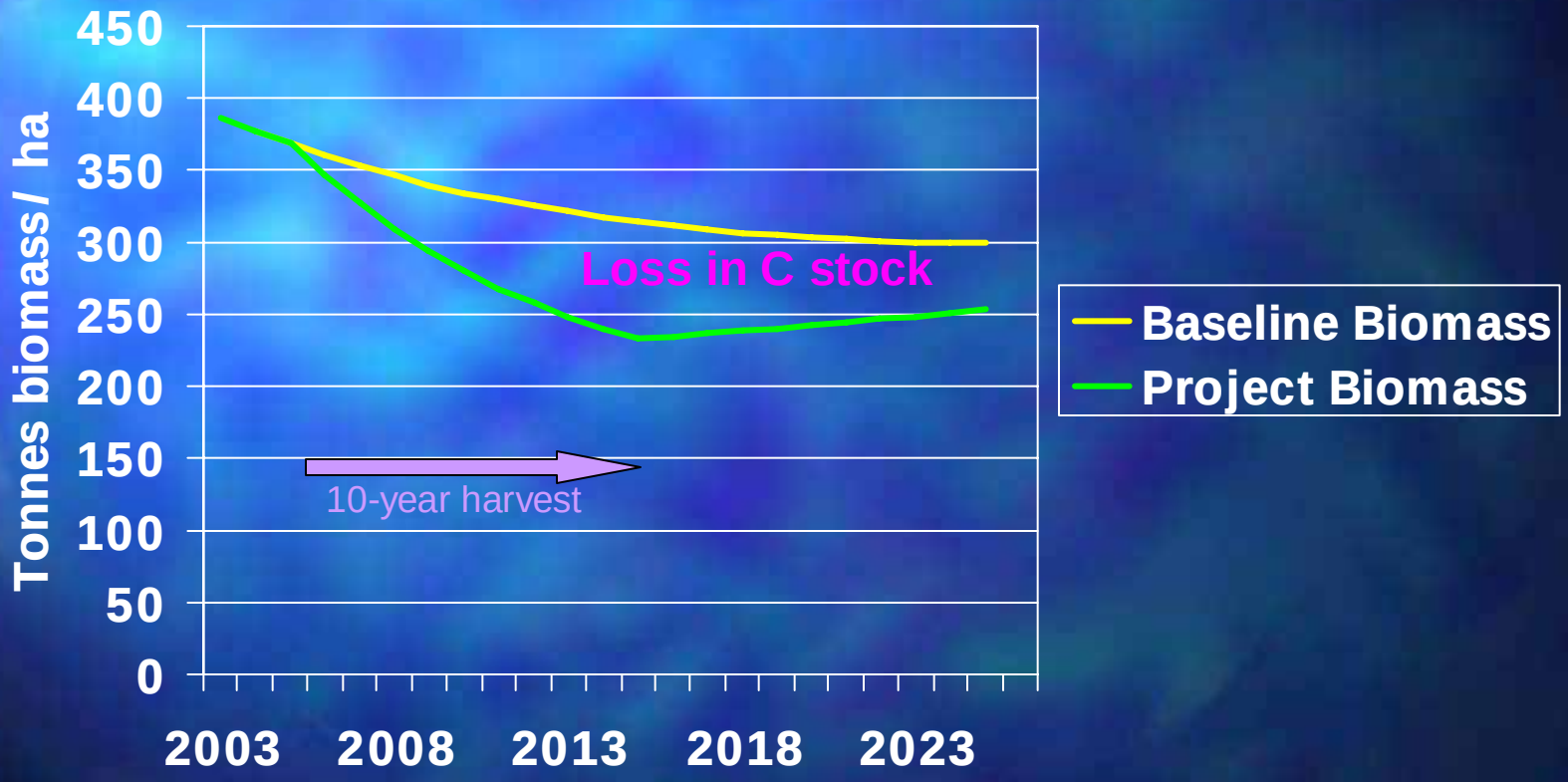
Stock Change- MPB Biomass t/ha*



* Neil Bird- Canadian Case Study on Mountain Pine Beetle (MPB) Pine in BC 2005-08-09

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Stock Change
MPB Harvesting 2007-16

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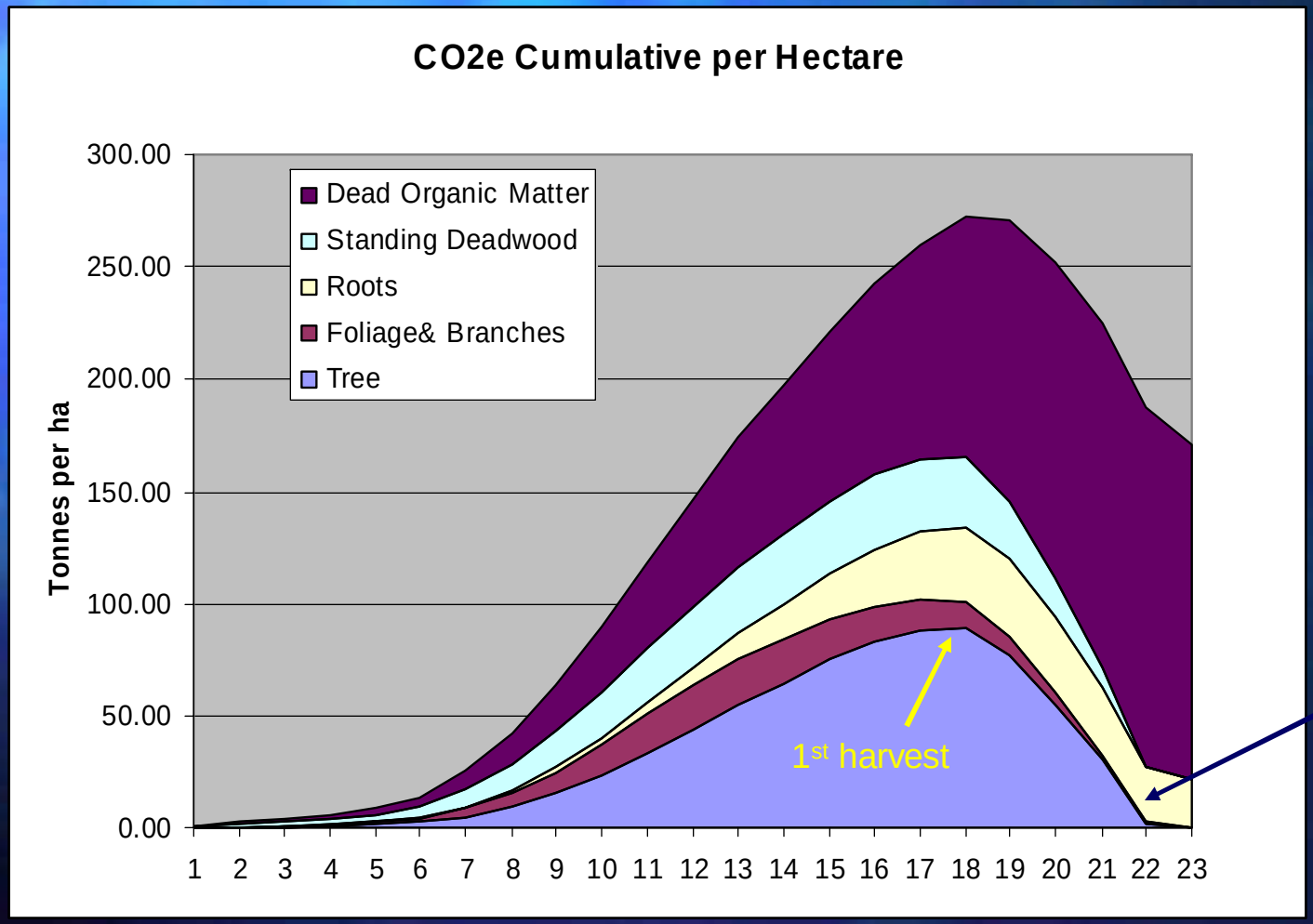
Stock Change- Afforestation



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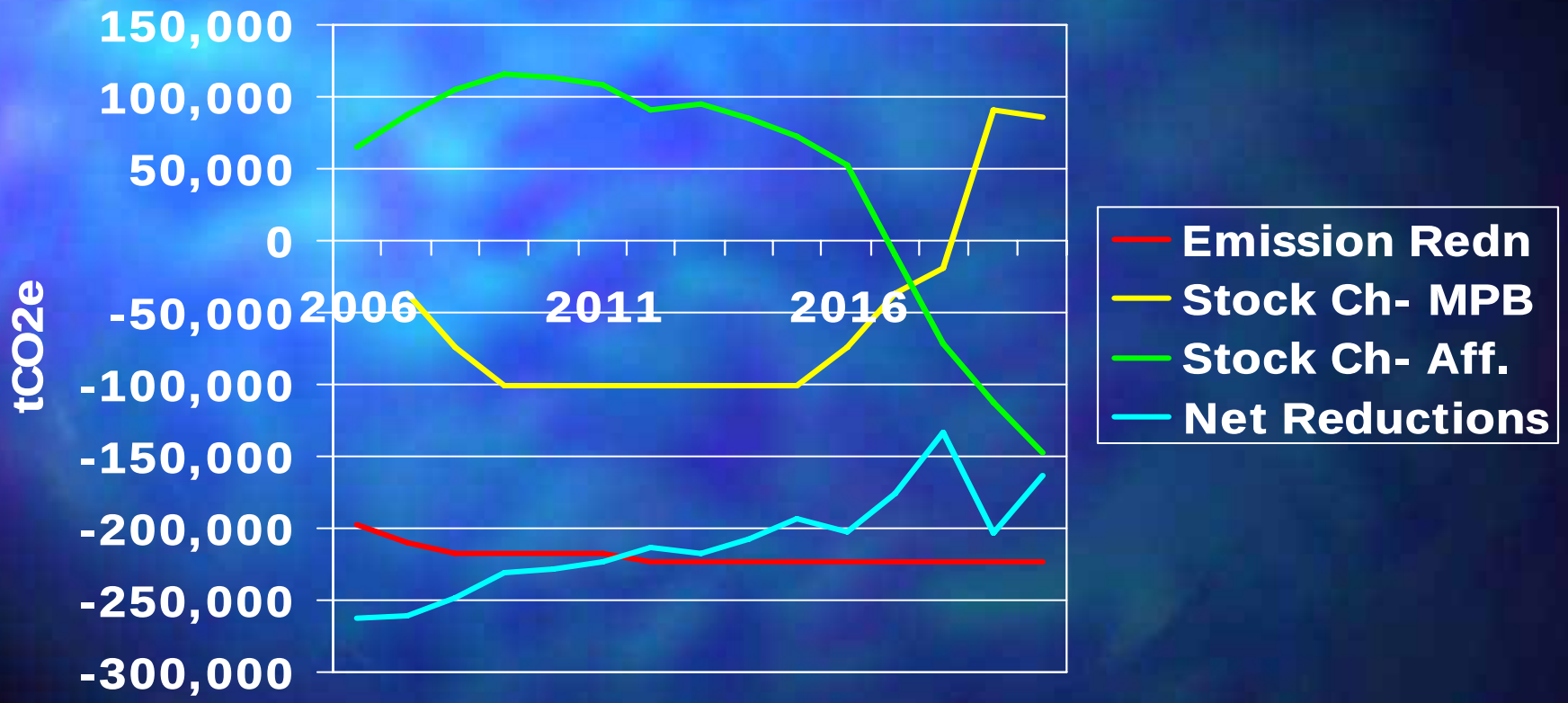
Net- GHG Reductions + Stock Change



Reductions average 211,000 tCO_2e p.a.

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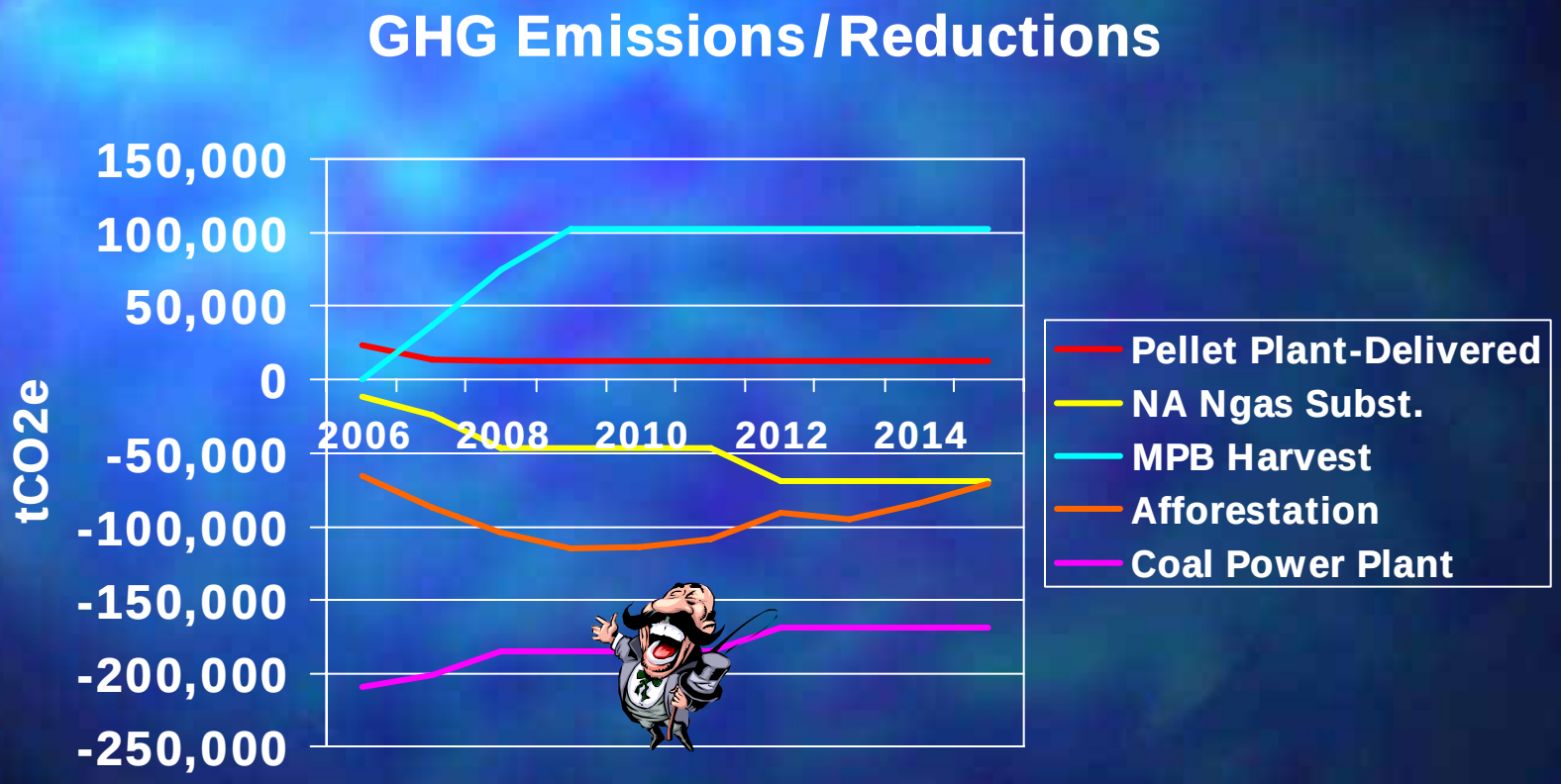
Who OWNS the Benefits?



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Costs of Biomass*

Biomass Costs		
	$/M3	$/BDt
Adjacent Mill Residue		10
Mill Residue Ont		25
Pulp Chips (BC)		40
Mill Residue		40
Harvest Residue- Roadside		?
Roundwood- West	26	66
Salvage Fibre		74
MPB Fibre (BC)		80
Harvest Residue- forest		90
Roundwood- East	67	167

* Draft Supply Chain Study- Canada- Climate Change Solutions

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BC Pellet Mfg Costs

Pellet Manufacturing Costs							
	$/BDt		$/BDt		$/BDt	€/BDt	$/Gj
	Range				Avg		
Raw Material	15	-	25		20.0	14.1	1.11
Drying	0	-	5		2.5		0.1
Labour	8	-	14		11.0		0.6
Electricity	7	-	10		8.5		0.5
Eqt Maintenance	8	-	12		10.0		0.6
Admin	3	-	6		4.5		0.3
Manufacturing Costs					36.5	25.7	2.03
Debt + Equity	0		0		22.5		1.3
Mill Net	15		25		79.0		4.39
Rail to Port	14	-	24		19.0		1.1
Storage/Loading	12	-	15		13.5		0.8
Ocean Transport	55	-	65		60.0		3.3
Transportation					92.5	65.1	5.14
Delivered Price					171.5	120.8	9.53

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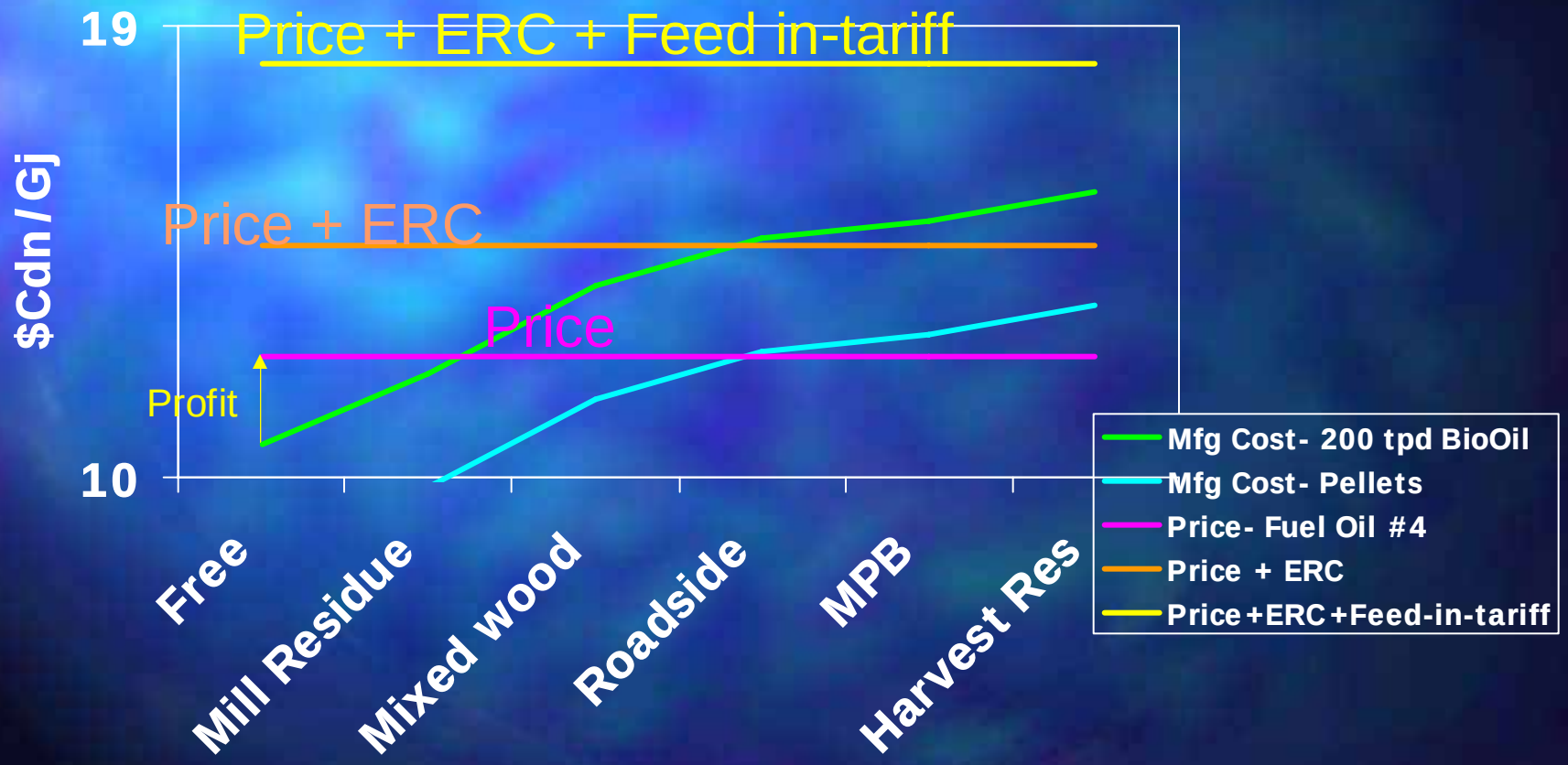
Delivered Cost/Price Comparison



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Summary

- BC- Lots of biomass from many sources
- BC should burn mill residue for energy
- If Canada includes managed forest, MPB harvest detrimental to C balance
- Pellet consumer reaps the GHG benefit
- If pellet consumer shares the financial benefits, everybody wins

Trondheim, April 5, 2006

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