Successes in Alternative Use of Residuals

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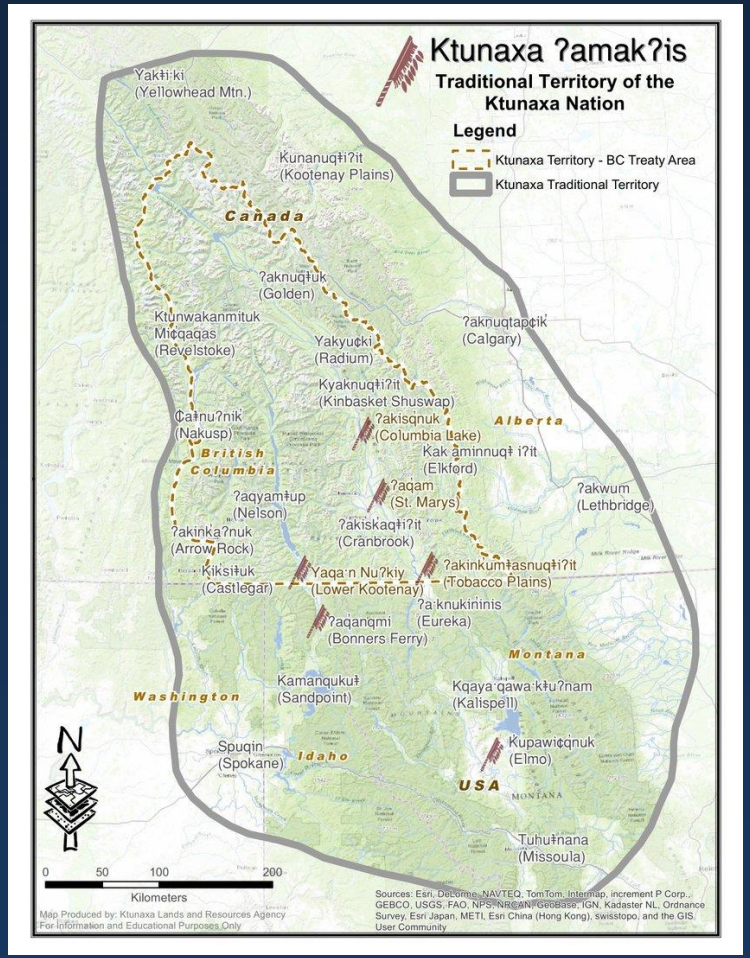
Climate Change and Integrated Planning Branch

March 2, 2021


KIAXA
NAO N


Ktunaxa ?amak?is
Traditional Territory of the Ktunaxa Nation
Legend
Ktunaxa Territory - BC Treaty Area
Ktunaxa Traditional Territory
Yakɬi·ki (Yellowhead Mtn.)
Kunanuqɬi?it (Kootenay Plains)
Canada
?aknuqɬuk (Golden)
Ktunwakanmituk Mɨcqaqas (Revelstoke)
Yakyuɕki (Radium)
?aknuqtapɕik (Calgary)
Kyaknuqɬi?it (Kinbasket Shuswap)
ɕaɬnu?nik (Nakusp)
?akisqnuk (Columbia Lake)
Alberta
British Columbia
Kak ʔaminnuqɬ i?it (Elkford)
?aqam (St. Marys)
?akwum (Lethbridge)
?aqyamɬup (Nelson)
?akiskaqɬi?it (Cranbrook)
?akinka?nuk (Arrow Rock)
?akinkumɬasnuqɬi?it (Tobacco Plains)
Kiksiɬuk (Castlegar)
Yaqa·n Nu?kiy (Lower Kootenay)
?a·knukiɲinis (Eureka)
?aqanqmi (Bonners Ferry)
Montana
Washington
Kamanqukuɬ (Sandpoint)
Kqaya·qawa·kɬu?nam (Kalispell)
Spuqin (Spokane)
Idaho
Kupawɨcqnuk (Elmo)
USA
MONTANA
Tuhuɬnana (Missoula)
N
0 50 100 200
Kilometers
Map Produced by: Ktunaxa Lands and Resources Agency
For Information and Educational Purposes Only
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Overview

Estimated GHG impact of Forest management

GHG Analysis of existing projects

How the GHG benefit is calculated

How we quantify the opportunity – UTOL

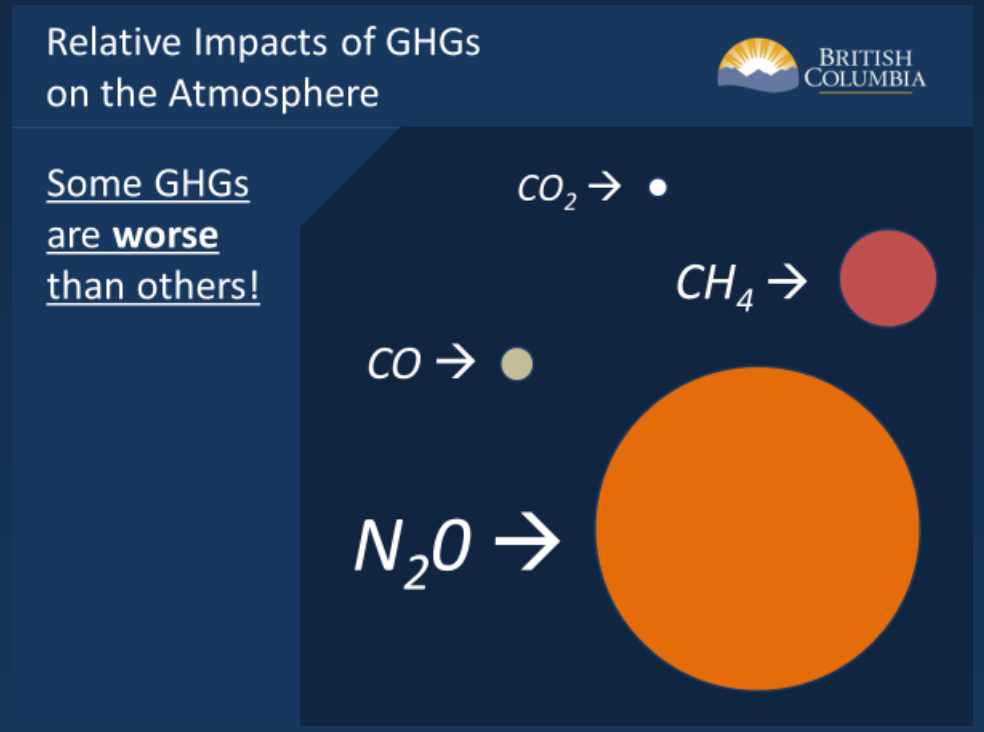
Questions

GHG units of CO_2e

Green House Gas emissions are measured in CO_2e

e = Carbon equivalents

1 Megatonne (Mt) = 1,000,000 tonnes



Perspective

A typical pulp mill produces

– 93% CO_2

– 2.5% Methane

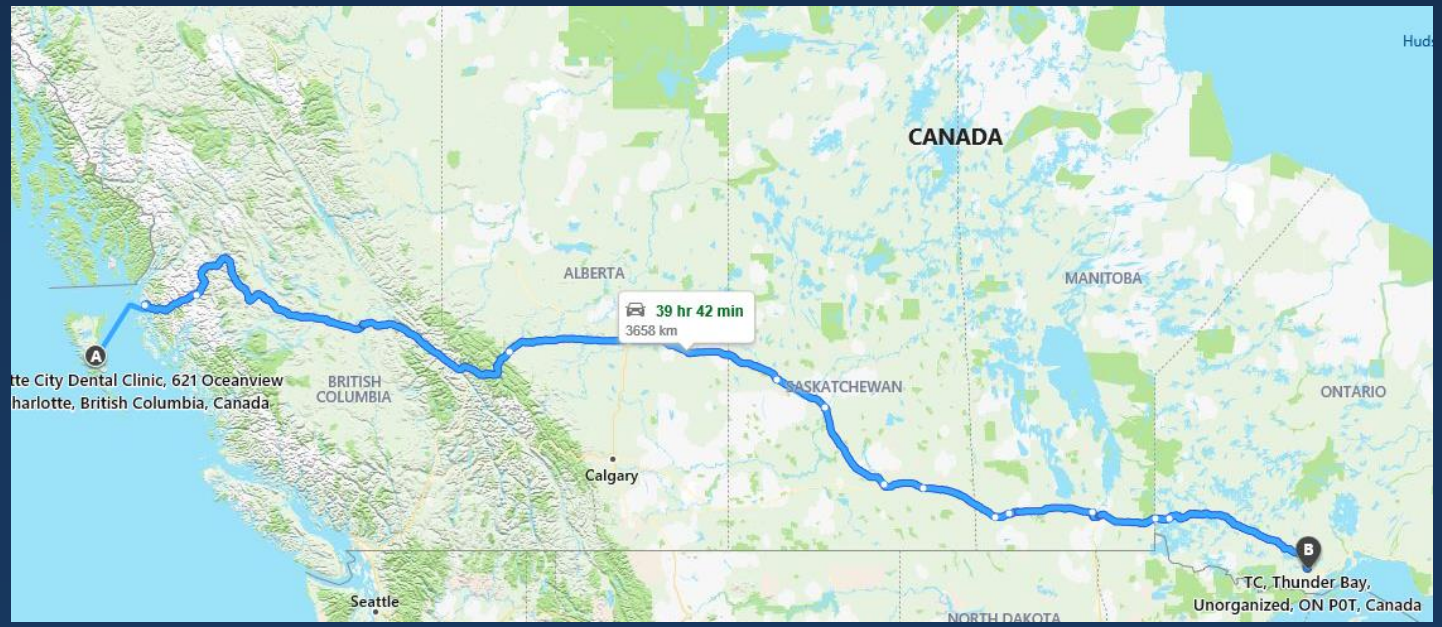
– 4.5% Nitrous oxide

BC Pulp and paper sector reported 2.089 Mt CO_2e in 2018

Perspective

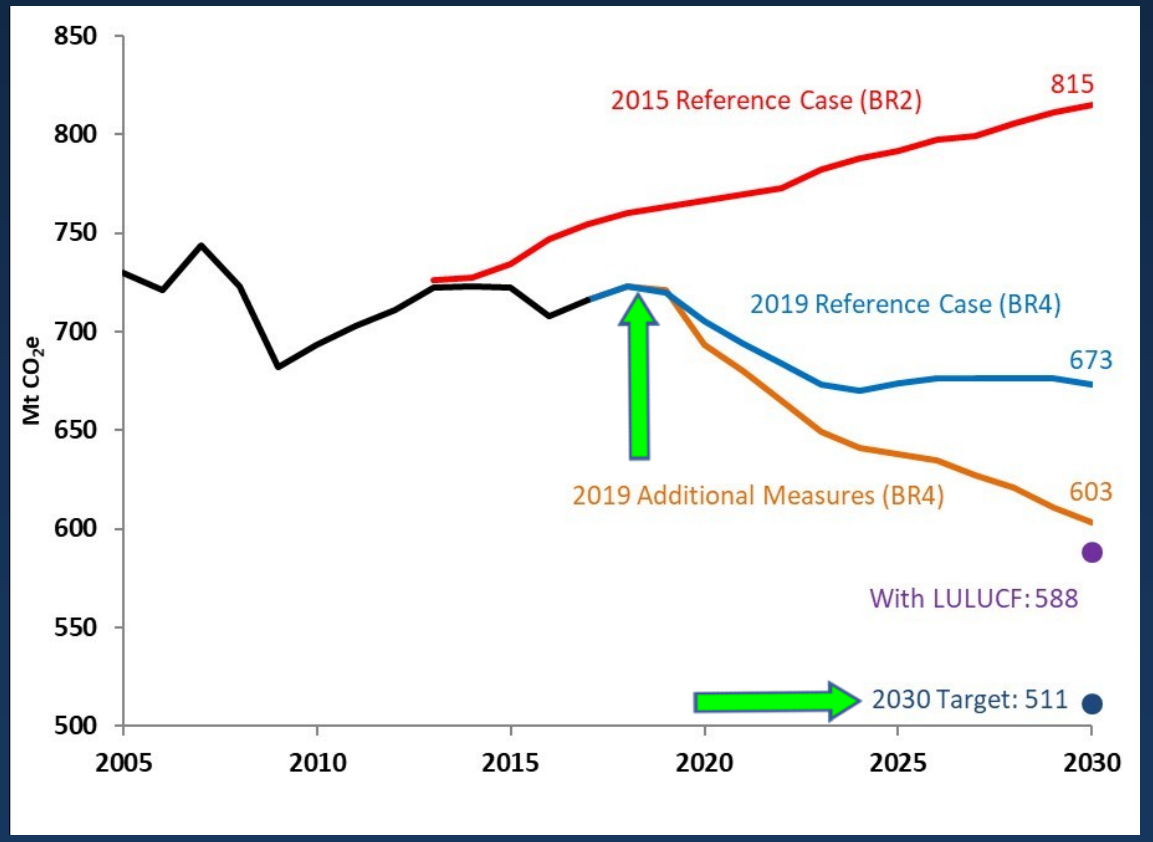
1 m3 burned in a slash pile emits = .9 tCO_2e

Equal to car emissions produced travelling from Haida Gwaii to Thunder Bay

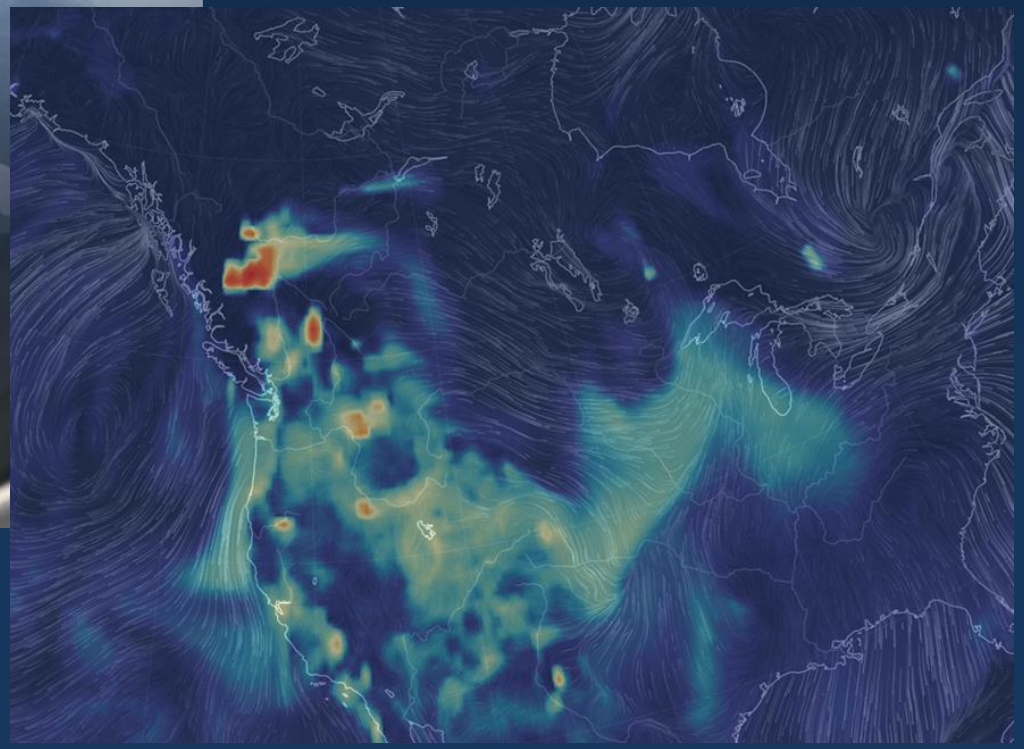


Canada's GHG targets

- Paris Agreement commitment
- Reduce GHG emissions to 511 Mt by 2030
- 2018 reported 729 Mt

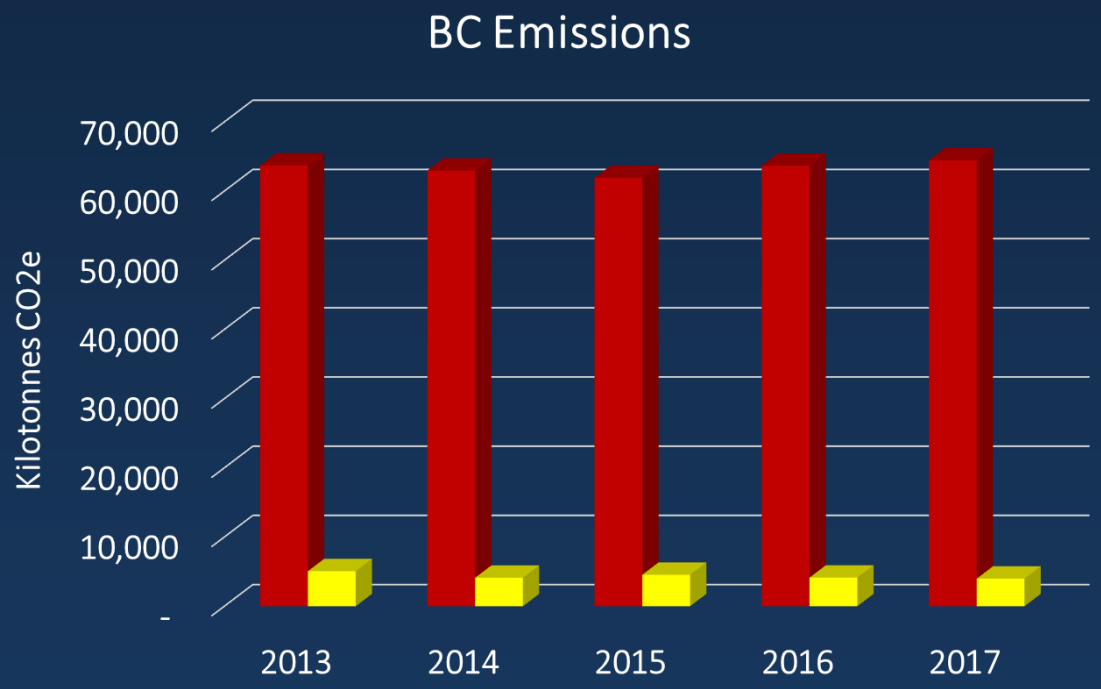


BC Forestry - GHG footprint



Slash Pile burning BC

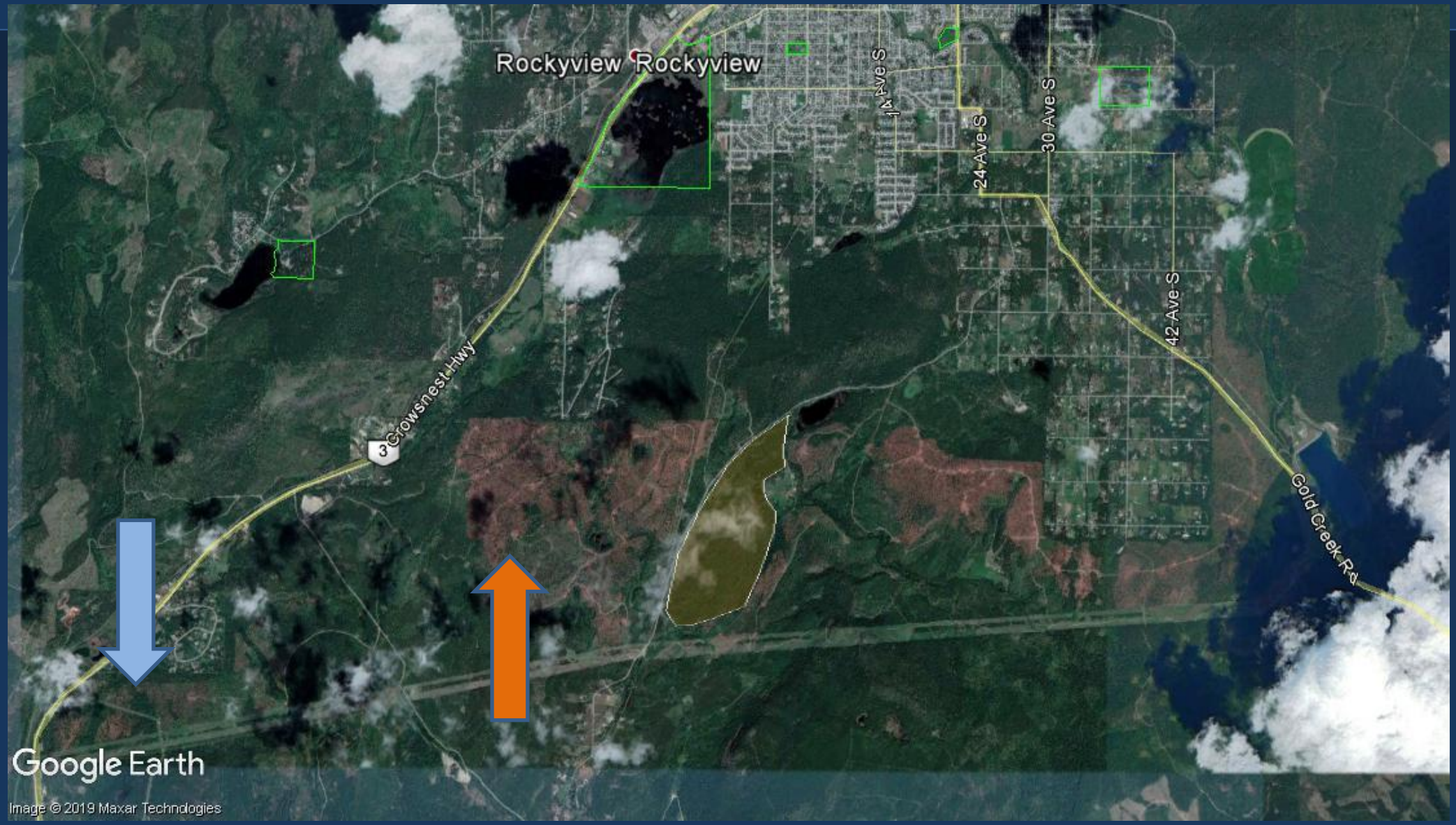
- 1997 to 2018 average 5.491 Mt/yr
- Approximately the same as light duty gasoline trucks 5.542 Mt*



* From the BC greenhouse gas Inventory 2018

A few examples

Scenario 1 – Innovation - WRR projects



The problem

The Base case

Scenario 1 – Innovation - WRR projects

Conventional harvest the site

Employ the techniques Len Marsh spoke of

FLTC/Operational Service Contract

Scaled 10,500 m3 of fibre

Created 2.7 man years of work

Avoided 3366 tCO2e

Scenario 2 – Innovation – FFT Stand Rehabilitation

- FFT restore healthy forests and mitigates the impacts from wildfire and insect outbreaks
- Site Preparation
- Overstory is removed to enable planting
  - Remove Forest Health agents, operational constraints
- Replanted at higher densities
- History of burning piles or windrows

Contract approach

District developed Px's and built knockdown contracts

District applied for FCI Ministry intake funds

3 phases in the contract Schedule B

- Phase 1 Mechanically felling and piling (FFT)
- Phase 2 option (a) Hauling Material (FCI) **OR**
- Phase 2 option (b) Burning of piles (FFT if no utilization)

FCI approach

- FCI contribution capped at $16,800
- Determined cycle time of blocks
- Used UTöL to establish an upper threshold - $12.65 / ODT

Bid Results

- Phase 1 Mechanically felling and piling (FFT) $1000/ha
- Phase 2 (a) Hauling Material (FCI) $3.35/ODT[$16,800]
- Phase 2 (B) Burning of piles (FFT if no utilization) $3609 total

Bid price was $3.35 / ODT (carbon eligible < $12.65)

Burning versus Utilization → $3609 versus $16,800

Outcome

Common Themes

1. Emissions avoidance has to be made an objective
2. Contracts have to be built differently
3. Follow existing
   - Procurement rules
   - Tenures guidelines
   - Pricing rules
4. Most effective where demand exists in close proximity

FESBC

- 2018/19 Actual 233,610 m3
- 2019/20 Actual 864,660 m3
- 2020/21 Forecast 1,436,000 m3
- 21-23 Forecast 1,000,000 + m3
- $47 M total spend
- Average cost of $14/m3

2019/2020 0.16 MtCO2e GHG's avoided

FESBC Forest Enhancement Society of British Columbia

How we calculate GHG benefits

UTöL

- The program is being designed by Garrett McLaughlin
- It is currently available in Beta form for trial purposes
- If you are interested, reach out to CCIPB

UTöL

Informs utilization projects

- Converts used fibre to GHG's avoided
- Determines cost/tonne CO_2e
- Suggests economic zones

2 Modes

Mode 1 - Project Level – operational

Mode 2 - TSA level – strategic

Project Level - WRR

Inputs		
1. Total Biomass Supplied	10,500	
2. Units	m3	
m3	Green Tonnes	Dry Tonnes
3. Primary Species		
lodgepole pine	100%	
Wood Density	0.409	
hybrid spruce	0%	
Wood Density	0.383	
4. Moisture Content (for GT)	30%	
5. Product Types		
Kraft pulp	55%	
Bioenergy	45%	
OSB	0%	
6. Total CCIPB Invest ($)	$ 100,000.00	
7. Select Baseline	Slashburning	
8. Select Start Year	2020	

Outputs	
Table 1: Converted Inputs	
m3	10,500
GT	6,135
ODT	4,295
Table 2: Total Annual GHG benefit (tCO2e/yr)	
2020	**3,366**
Kraft pulp	2,572
Bioenergy	794
	-
2030	**2,827**
Kraft pulp	2,033
Bioenergy	794
	-
2050	**2,382**
Kraft pulp	1,588
Bioenergy	794
	-
Table 3: Average Cost per Tonne ($/tCO2e)	
In 2020	$ 29.71
In 2030	$ 35.37
In 2050	$ 41.98

Table 4: Average Cost per Tonne by Product ($/tCO2e)	
In 2020	**$ 29.71**
Kraft pulp	$ 21.38
Bioenergy	$ 56.68
OSB	$ -
In 2030	**$ 35.37**
Kraft pulp	$ 27.05
Bioenergy	$ 56.68
OSB	$ -
In 2050	**$ 41.98**
Kraft pulp	$ 34.63
Bioenergy	$ 56.68
OSB	$ -

Avoided PM-2.5	23,252
Avoided PM-10	22,086
Trucking emissions (tCO2e)	109

Project Level – FFT

Inputs		
1. Total Biomass Supplied		11,835
2. Units		m3
m3	Green Tonnes	Dry Tonnes
3. Primary Species		lodgepole pine
Wood Density		0.409
4. Moisture Content		20%
5. Product Types		
OSB		10%
Kraft pulp		0%
Bioenergy		90%
6. Total CCIPB Invest ($)		$ 16,800.25
7. Select Baseline		Slashburning
8. Select Start Year		2019

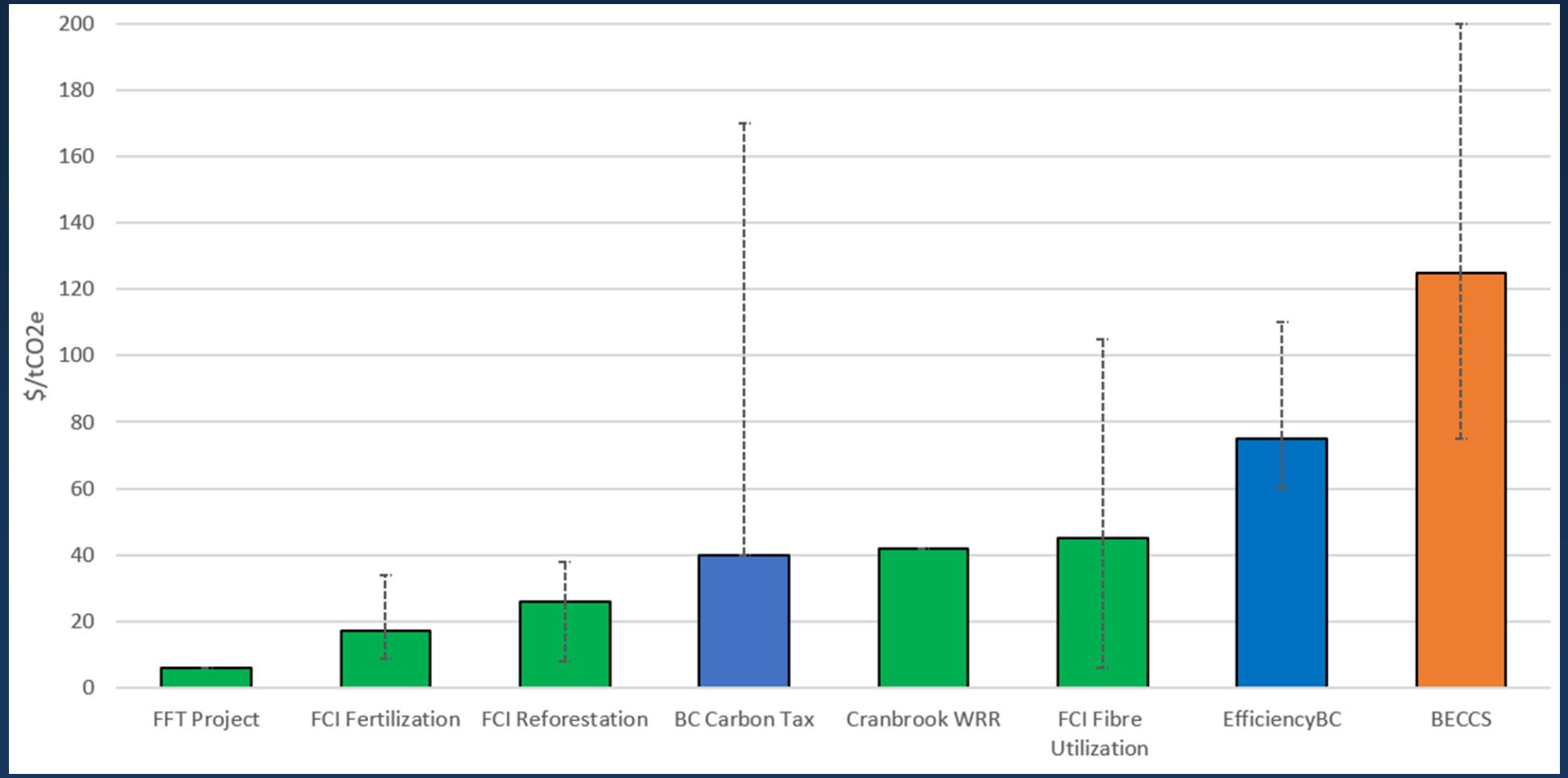
Outputs	
Table 1: Total Annual GHG benefit (tCO2e)	
	tCO2e/yr
2019	2,699.48
OSB	909.77
	-
Bioenergy	1,789.71
2030	2,677.11
OSB	887.41
	-
Bioenergy	1,789.71
2050	2,631.06
OSB	841.35
	-
Bioenergy	1,789.71

Table 2: Average Cost per Tonne ($/tCO2e)		
In 2019	$	6.22
In 2030	$	6.28
In 2050	$	6.39

Table 4: Average Cost per Tonne by Product ($/tCO2e)		
In 2019	$	6.22
OSB	$	1.85
Bioenergy	$	8.45
OSB	$	-
In 2030	$	6.28
OSB	$	1.89
Bioenergy	$	8.45
OSB	$	-
In 2050	$	6.39
OSB	$	2.00
Bioenergy	$	8.45
OSB	$	-

Avoided PM-2.5	22,932
Avoided PM-10	21,782
Trucking emissions (tCO2e)	123

How do these projects hold up?



TSA level


FPInnovations
Using FPInterface to Estimate Availab
Forest-Origin Biomass in British Colu
Prince George TSA
Technical Report no. 5 - January, 2018
Charles Friesen, Senior Researcher, Fibre Supply
fpinnovations.ca
FPInnovations
Using FPInterface to Estimate Available
Forest-Origin Biomass in British Columbia:
Selkirk District
March 2019
Kevin Blackburn, Technician, Fibre Supply
Non-restricted
Distribution
fpinnovations.ca
FPInnovations
Using FPInterface to Estimate Availability of
Forest-Origin Biomass in British Columbia:
Arrowsmith TSA
Technical Report no. 15 - March 2018
Kevin Blackburn, Technician, Fibre Supply
Non-restricted
Distribution

Note

The following is conceptual analysis of what UTöL can do

The information is based on coarse level analysis of fibre studies, cost information, life cycle analysis

For the purpose of discussion only

Cost inputs

INPUTS	
Info Provided by the FPInnovation Report	
Info from the appraisal manual	
Info from CCIPB modelers	
1. Units (Select here)	ODT
2. Primary Species	lodgepole pine
Wood Density	0.409
2a. Secondary Species	hybrid spruce
Wood Density	0.383
Average Wood Density	*0.396*
3. Product Type (select here)	Bionergy
GHG (CO2e) benefit (per m3)	0.36

Costing Assumptions ($/unit)			
4. Costing Assumptions			
☑	Hauling ($/hour)	$	7.75
☐	Barging (fixed cost for now)	$	-
☐	Processing	$	-
☐	Scaling	$	-
☐	Logging	$	-
☑	Comminution Cost	$	31.80
☐	Grinding	$	-
☐	Road Maintenance	$	-
☐	Admin	$	-
	Total Fixed Costs	$	**31.80**
	Total Variable Costs	$	**7.75**

Define the product type (life cycle)

Variable costs

Fixed costs

Defining the economic zone – PG TSA

The cycle time drives the economic zone

Incremental Haul Investment Required from CCIPB ($/ODT)

Hours from Facility		Value ($/ODT)	Hours from processing facilty												Cycle Time	Trans. Cost ($/ODT)
			1	2	3	4	5	6	7	8	9	10	11	12		
0.7	Product value by cycle time	$ 60.00	-$ 10.00												2.3	$ 18.20
1.3		$ 60.00		$ -											3.6	$ 28.20
2.0		$ 60.00			$ 10.00										4.9	$ 38.20
2.6		$ 60.00				$ 20.00									6.2	$ 48.20
3.3		$ 60.00					$ 30.00								7.5	$ 58.20
3.9		$ 60.00						$ 40.00							8.8	$ 68.20
4.5		$ 60.00							$ 50.00						10.1	$ 78.20
5.2		$ 60.00								$ 60.00					11.4	$ 88.20
5.8		$ 60.00									$ 70.00				12.7	$ 98.20
6.5		$ 60.00										$ 80.00			14.0	$ 108.20
7.1		$ 60.00											$ 90.00		15.3	$ 118.20
7.8		$ 60.00												$ 100.00	16.5	$ 128.20
														1 Cycle = (Haul hou + 1 hour loading		$ 73.20

Define the value of the material

Cost per Tonne

Cost per tonne calculation by cycle time ($/tCO2e)

Hours from Facility		Value ($/ODT)	Hours from processing facilty												Cost per tonne
			1	2	3	4	5	6	7	8	9	10	11	12	
0.7	Product value by cycle time	$ 60.00	In economic zone												$ -
1.3		$ 60.00		In economic zone											$ -
2.0		$ 60.00			$ 28.01										$ 28.01
2.6		$ 60.00				$ 56.03									$ 56.03
3.3		$ 60.00					$ 84.04								$ 84.04
3.9		$ 60.00						$ 112.05							$ 112.05
4.5		$ 60.00							$ 140.06						$ 140.06
5.2		$ 60.00								$ 168.08					$ 168.08
5.8		$ 60.00									$ 196.09				$ 196.09
6.5		$ 60.00										$ 224.10			$ 224.10
7.1		$ 60.00											$ 252.11		$ 252.11
7.8		$ 60.00												$ 280.13	$ 280.13
														Average	$ 154.07 / tCO2e

Carbon Tax

TSA – total chance investment

Annual CCIPB investment by cycle time ($)

Hours from Facility		ODT Available	Hours from processing facilty												Total CCIPB Investment	Cumulative
			1	2	3	4	5	6	7	8	9	10	11	12		
0.7	Indicated volume that can be used	13,929	In economic zone												$ -	$ -
1.3		136,418		In economic zone											$ -	$ -
2.0		145,680			$ 1,456,795										$ 1,456,795	$ 1,456,795
2.6		130,351				$ 2,607,018									$ 2,607,018	$ 4,063,813
3.3		55,343					$ 1,660,275								$ 1,660,275	$ 5,724,088
3.9		56,552						$ 2,262,080							$ 2,262,080	$ 7,986,168
4.5		17,080							$ 854,005						$ 854,005	$ 8,840,173
5.2		27,683								$ 1,661,004					$ 1,661,004	$ 10,501,177
5.8		104,743									$ 7,332,003				$ 7,332,003	$ 17,833,180
6.5		84,643										$ 6,771,424			$ 6,771,424	$ 24,604,604
7.1		58,141											$ 5,232,663		$ 5,232,663	$ 29,837,267
7.8		35,014												$ 3,501,370	$ 3,501,370	$ 33,338,637
		865,576 ODT												TOTAL	$ 33,338,637	

From FPI studies

TSA roll up

TSA Summary - Oven Dry Tonnes

TSA	Total Biomass Available (ODT/Yr)	Total Biomass Outside Economic Zone (>$60/ODT; ODT/yr)	% Outside Economic Zone	Comminution Cost ($/ODT)	Total CCIPB Investment ($)	Total GHG Benefit (bioenergy) (tCO2e)	Weighted Average $/Tonne (of all biomass)
100 Mile	110,192	29,436		$ 26.82	$ 357,053	10,508	$ 33.98
Arrowsmith	19,965	16,695		$ 27.55	$ 576,032	5,960	$ 96.65
Bulkley	69,502	64,881		$ 27.55	$ 1,858,436	23,161	$ 80.24
Fraser	75,287	64,209		$ 27.55	$ 1,769,303	22,921	$ 77.19
Kamloops	245,105	127,495		$ 25.89	$ 2,591,222	45,513	$ 56.93
Lakes	277,387	201,261		$ 31.80	$ 10,258,617	71,846	$ 142.79
Mackenzie	266,821	186,962		$ 27.27	$ 7,072,197	66,742	$ 105.96
Prince George	865,576	715,229		$ 31.80	$ 33,338,637	255,322	$ 130.57
Quesnel	337,230	251,376		$ 31.80	$ 9,442,954	89,736	$ 105.23
Selkirk District	153,455	137,741		$ 26.82	$ 4,407,972	49,171	$ 89.65
Strathcona	69,059	54,319		$ 27.55	$ 2,475,305	19,391	$ 127.65
Williams Lake	1,534,830	1,286,451		$ 31.80	$ 52,011,147	459,238	$ 113.26
TOTAL	**4,024,409**	**3,136,055**		***$ 28.68***	**$ 126,158,874**	**1,119,510**	***$ 96.68***

*Only includes Timber Supply Areas; not TFLs, woodlots, CFs, etc.

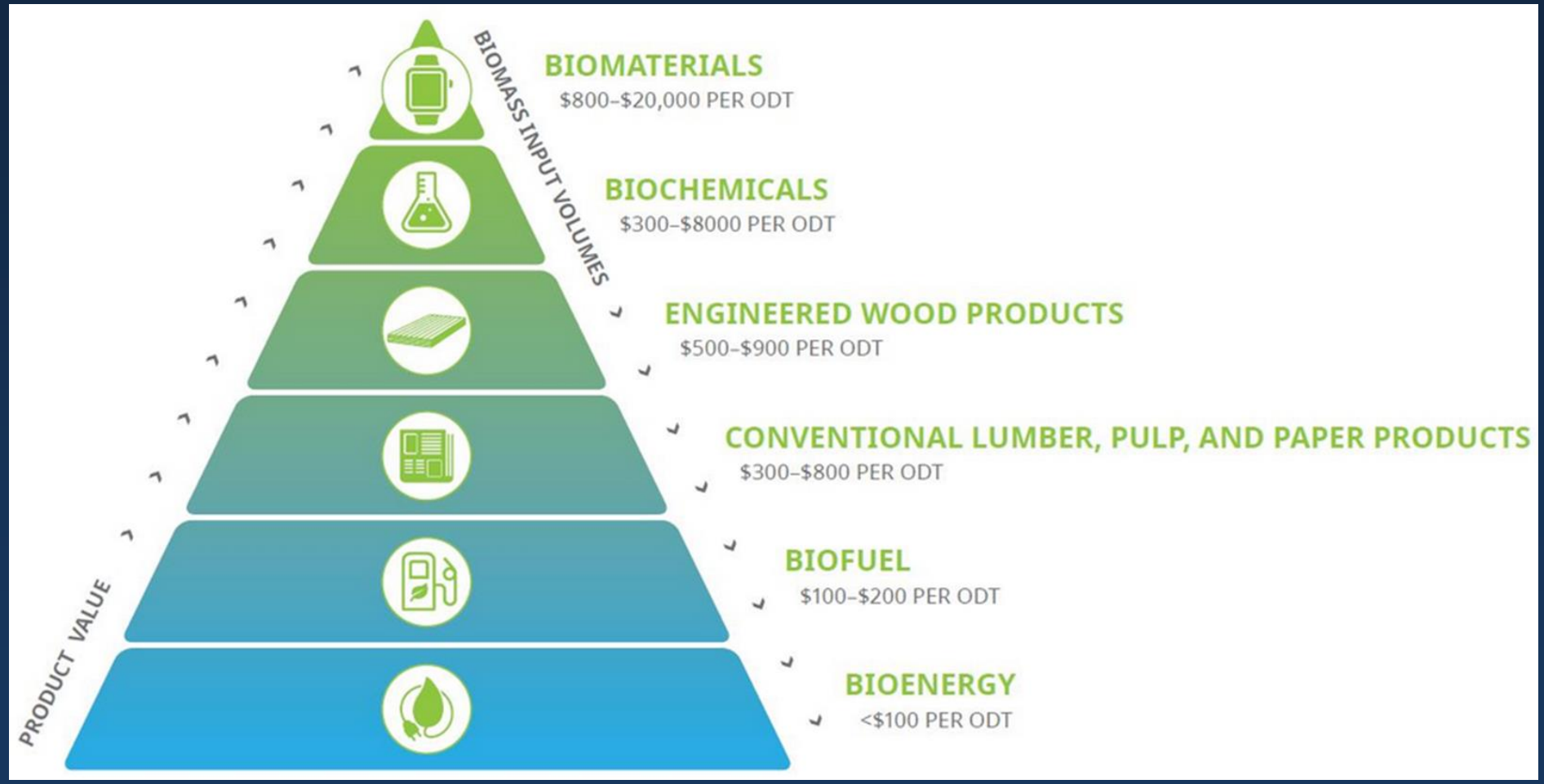
Solver – capping the investment

Solver *Solver to find the least expensive fibre across 12 TSAs studied by FPInnovations*

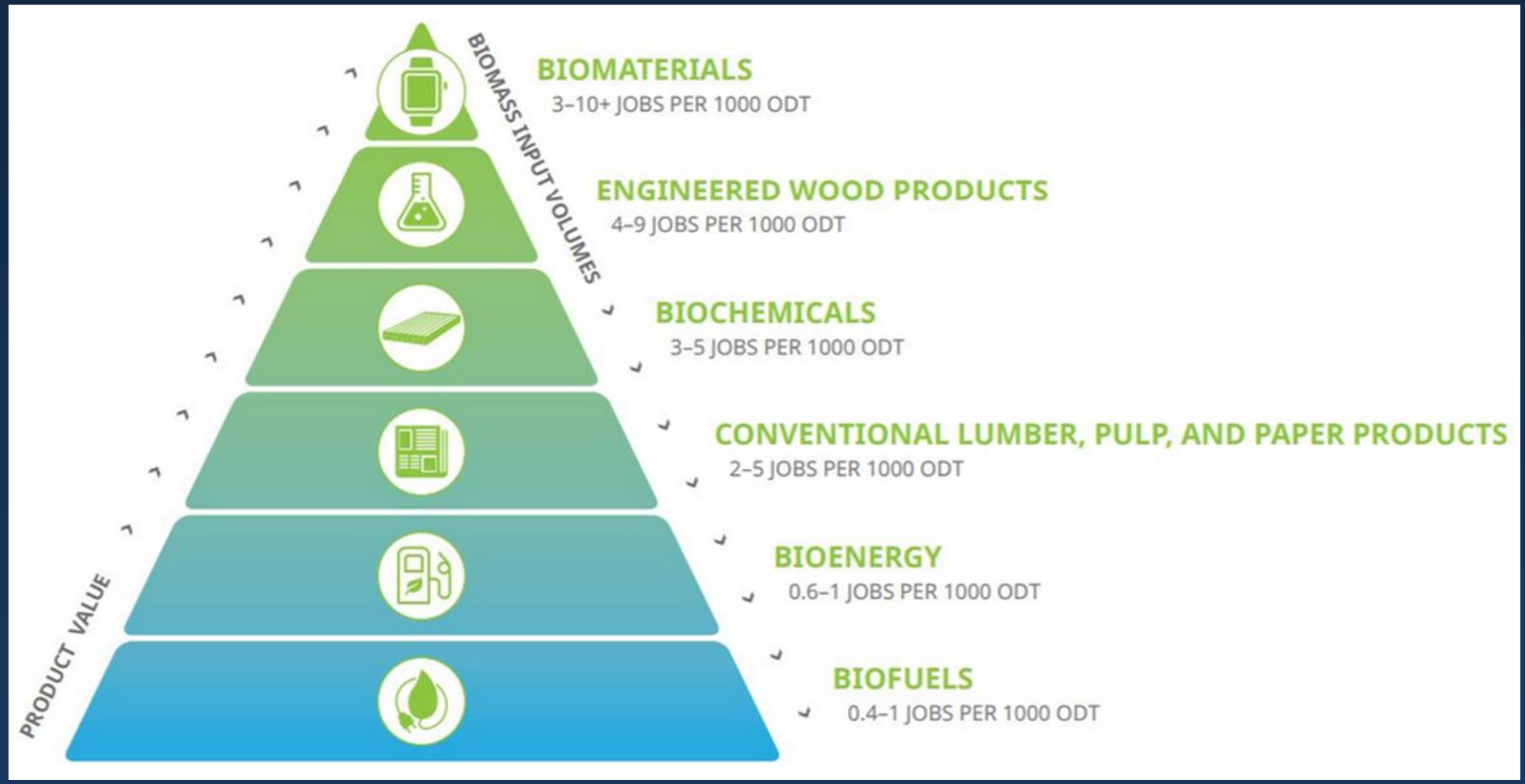
	Biomass Taken (ODT/yr)	% of Total Biomass Available (%)	Person Years Created (See Jobs Tab)	GHG Benefit (tCO2e)	BioFuel (litres)	Total $ Invested ($)	Min $/tonne Paid	Max $/tonne Paid	WtAvg $/Tonne per TSA (of biomass taken)
100 Mile	27,872	95%	6.8	9,950	8,361,724	$ 313,060	$ 28.01	$ 56.03	$ 31.46
Arrowsmith	5,861	35%	1.4	2,092	1,758,307	$ 91,219	$ 28.01	$ 56.03	$ 43.60
Bulkley	30,719	47%	7.5	10,966	9,215,574	$ 478,260	$ 28.01	$ 56.03	$ 43.61
Fraser	36,324	57%	8.8	12,967	10,897,095	$ 523,590	$ 28.01	$ 56.03	$ 40.38
Kamloops	81,465	64%	19.8	29,082	24,439,646	$ 1,114,972	$ 28.01	$ 56.03	$ 38.34
Lakes	57,361	29%	14.0	20,477	17,208,226	$ 636,095	$ 28.01	$ 56.03	$ 31.06
Mackenzie	61,619	33%	15.0	21,997	18,485,672	$ 682,547	$ 28.01	$ 56.03	$ 31.03
Prince George	152,315	21%	37.1	54,374	45,694,592	$ 1,589,511	$ 28.01	$ 56.03	$ 29.23
Quesnel	58,368	23%	14.2	20,836	17,510,342	$ 650,036	$ 28.01	$ 56.03	$ 31.20
Selkirk District	29,146	21%	7.1	10,404	8,743,682	$ 357,814	$ 28.01	$ 56.03	$ 34.39
Strathcona	15,529	29%	3.8	5,543	4,658,563	$ 203,336	$ 28.01	$ 56.03	$ 36.68
Williams Lake	283,805	22%	69.1	101,313	85,141,352	$ 2,904,403	$ 28.01	$ 56.03	$ 28.67
TOTAL	**840,383**		**204.5**	**300,000**	**252,114,775**	**$ 9,544,844**			***$ 31.82***

Solve: in what TSA's would you invest to avoid 300,000 tCO2e with the best ROI

Economic Value of Wood Products



Employment Benefits of Wood Products



The Challenge

If you think this work is tricky

You are right!

Be curious and reach out to people

Questions

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