

Wood Pellet Optimization

**Biomass & Bioenergy Research Group (BBRG)
Clean Energy Center
University of British Columbia**

Faculty (BBRG):

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Pelletization/Granulation

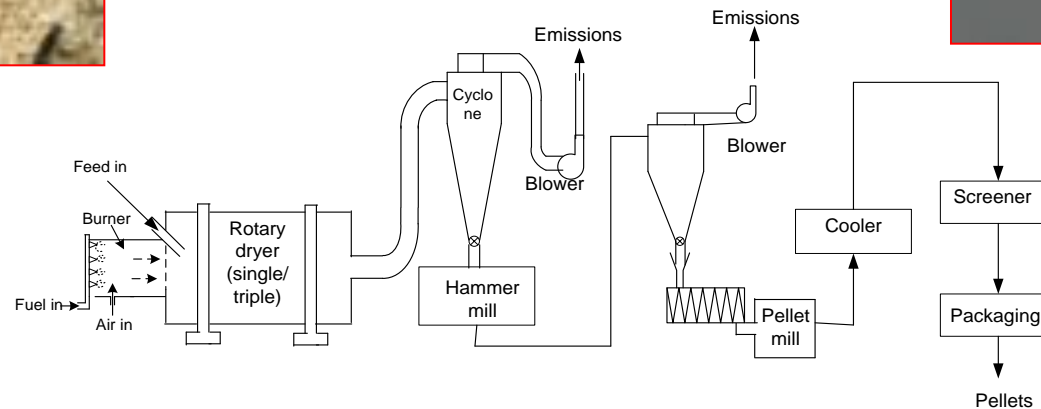
More than 10 fold increase in bulk density



60 kg/m³

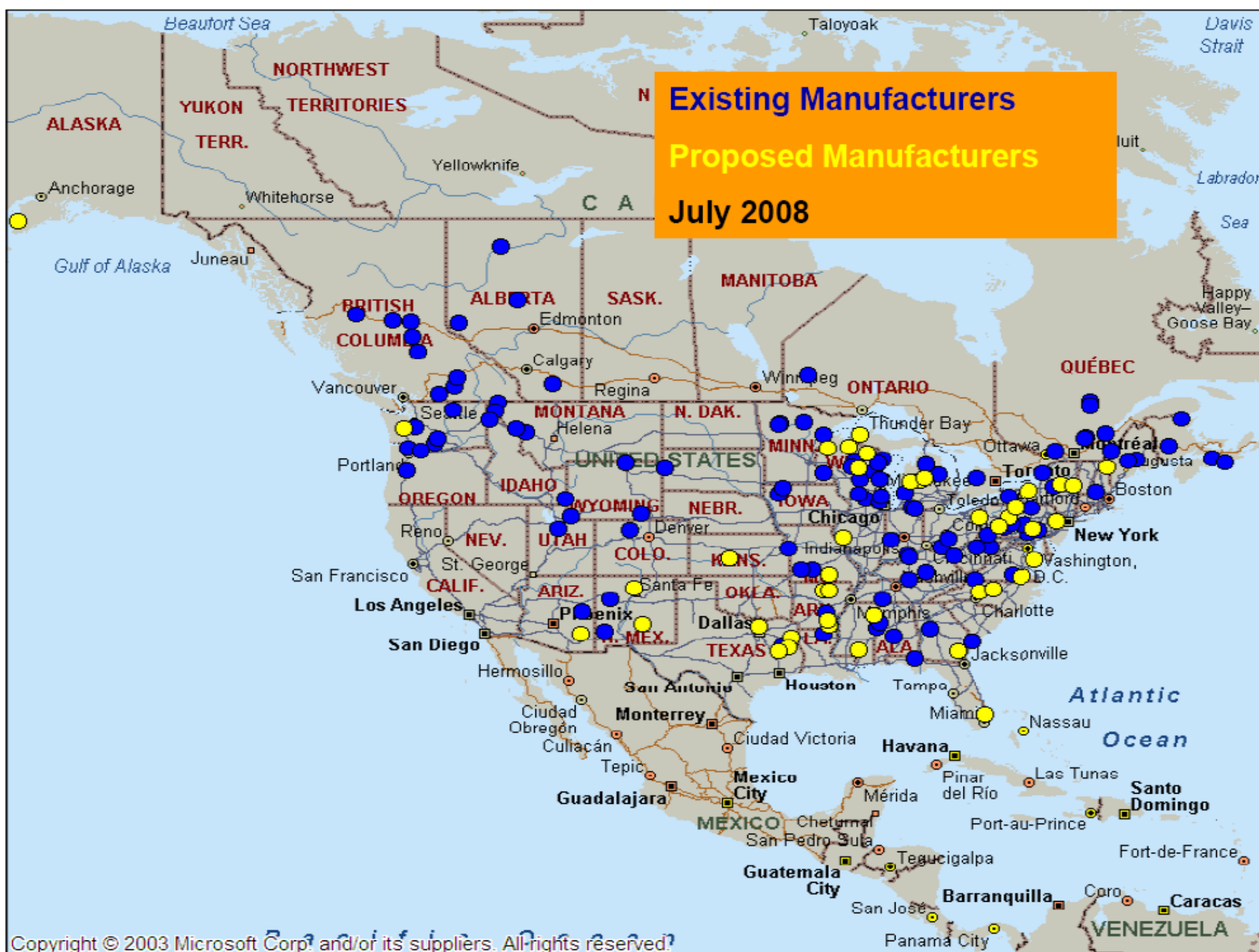


700 kg/m³



This is all done in country side and by locals!





- Economics

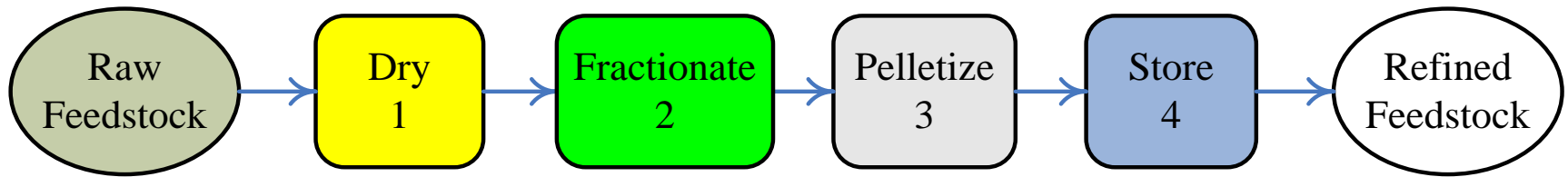
CAD/metric ton of
pellets

– Raw material (incl. transp.)	15 - 30
– Labor	8 - 15
– Electricity	7 - 10
– Equipment maintenance	8 - 12
– Capital cost	8 - 15
– Administration	3 - 6
» FOB pellet plant	76 - 80
– Land transportation	16 - 27
– Terminal	10 - 13
– Ocean transportation	60 - 80
» CIF overseas	170-200

Objectives

- Develop a standard procedure for evaluating pelletability of a biomass (woody, herbaceous, mix)
- Improve the quality of pellets with respect to critical quality factors
- Develop new generation of pellets and pelletization technology

Major feedstock refinement operations (Pelletization)



Process evaluation

1. Drying rate
2. Particle size characteristics
3. Pellet quality
4. Storage stability and safety
 - Energy use in all four processes

Question?

Can it be pelletized?

Example

Pelletability of 10 hybrid poplar and salix
samples

Visual features of the SRWC samples



Hybrid poplar



Salix



Table 1: Species, moisture content and bulk density of as-received samples of hybrid poplars and salix

Species - code	Moisture content (% wet mass basis)		Bulk density (kg/m ³)	
	Average	SD	Average	SD
Hybrid poplar 1	52.0	1.8	101.4	7.9
Hybrid poplar 4	12.1	0.1	22.2	1.3
Salix 5	43.4	0.7	157.8	18.0
Salix 6	13.6	0.2	40.3	3.9

Table 2: Properties of pellets made from SRWC species

Species	Moisture content (%wb)	Durability (%)	Particle density (kg/m ³)	Bulk density (kg/m ³)	Heat value (MJ/kg)	Ash (%)
Hybrid poplar 1	8.8	82.4	1213	672	18.5	2.1
Hybrid poplar 3	10.6	72.2	1164	587	17.6	2.3
Salix 5	10.1	89.7	1202	651	18.2	1.4
Salix 2	13.2	86.7	1137	557	18.0	2.1

Visual features of the SRWC samples



Hybrid poplar



Salix



Ranking of pellets

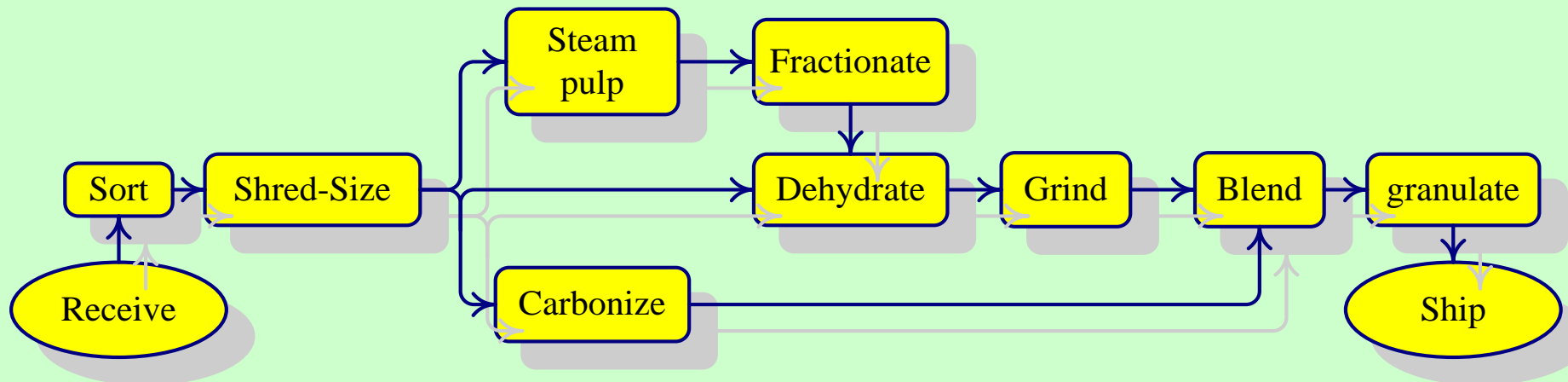
Species	Heating Value	Durability	Rate of Production	Ash	Bulk Density	Particle Density	Darkness
Hybrid poplar 1	4	8	9	8	2	1	1
Hybrid poplar 2	9	5	5	4	4	3	1
Hybrid poplar 3	10	10	2	9	9	6	1
Hybrid poplar 4	2	3	6	1	6	4	3
Salix 1	1	7	8	5	7	7	2
Salix 2	3	4	1	7	10	9	2
Salix 3	8	6	7	6	8	10	2
Salix 4	6	1	3	3	5	8	4
Salix 5	5	2	10	2	3	5	4
Salix 6	7	9	4	10	1	2	4

Ranking results
higher rank = least score

Species	Total score	Rank
Hybrid poplar 4	25	1
Salix 4	30	2
Hybrid poplar 2	31	3
Salix 5	31	4
Hybrid poplar 1	33	5
Salix 2	36	6
Salix 1	37	7
Salix 6	37	8
Hybrid poplar 3	47	9
Salix 3	47	10

The data and rakings have been presented to
Colleagues at the Canada Fiber Center in
Edmonton for further analyses and interpretation

Scope of research at BBRG – Clean Energy Center - UBC



- Resource assessment and supply logistics modeling
- Physical and chemical characterization of biomass
- Simulation and optimization of pellet production
- Steam treatment to produce durable moisture proof pellets
- Carbonization to increase energy intensity of pellets
- Dust and emissions control
- Instrumentation and control
- Life cycle analysis (LCA)

Sample Research Equipment at BBRG



Steam explosion test unit



Storage reactor for measuring off gases



BBRG Family

Acknowledgment

Our research partners are:

Wood Pellet Association of Canada

Natural Sciences & Engineering Research of
Canada

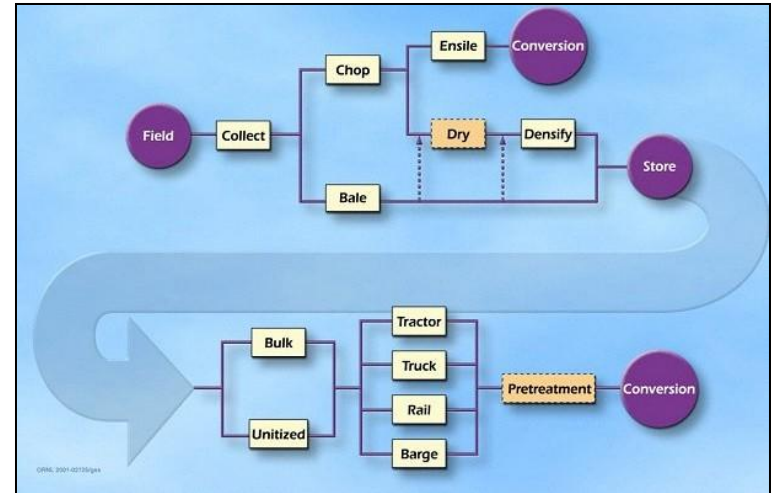
Oak Ridge National Laboratory

Natural Resources Canada

PFInnovations (Feric)

BC Ministry of Forest and Range

Clean Energy Research Center, UBC



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