

Bio Energy Discussion

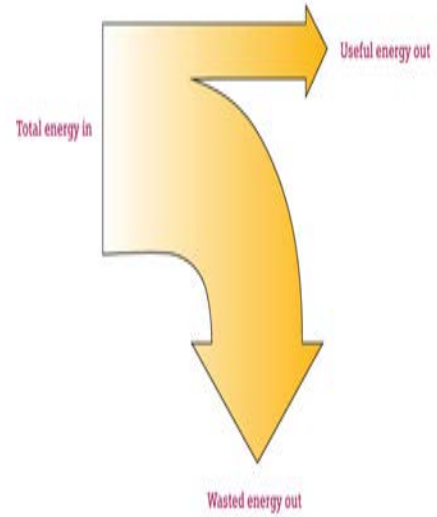


1. What is Bioenergy? What is the current uses and its effectiveness?
2. What is the potential for Bioenergy in Northern Alberta?
3. What business opportunities could there be in Bioenergy?
4. What are the barriers and opportunities to Bioenergy actualization?

What is Bio Energy?



Direct Combustion



40 percent

What is Ethanol?



First Generation

vs

Second Generation



Diesel Replacements?

Bio Diesel

vs

Renewable Diesel



What is BioGas?



According to Virasco Solutions, biogas power produced in Alberta is an average of 89% less greenhouse gas intensive than the current Alberta grid.

What are Wood Pellets?



White Pellets vs Brown Pellets vs Black Pellets

What are BioEnergy Feedstocks?

Agriculture

1. Grains and Oilseeds
2. Organic Matter and Manure
3. Straw and other residues

Feedstocks from Forestry



Trees and Logs

Harvest Residues

Forestry By-Products (bark, sawdust, tall oil, hog fuel, etc)

Municipal Solid Waste?

MEMOIR

The Incinerator Incident

I fell into a burning ring of fire

BY MICHAEL WINTER · PHOTOGRAPHY BY EAMON MAC MAHON · SEP. 12, 2012



News » World News » Europe News » Sweden runs out of garbage, imports from other countries

Sweden runs out of garbage, imports from other countries

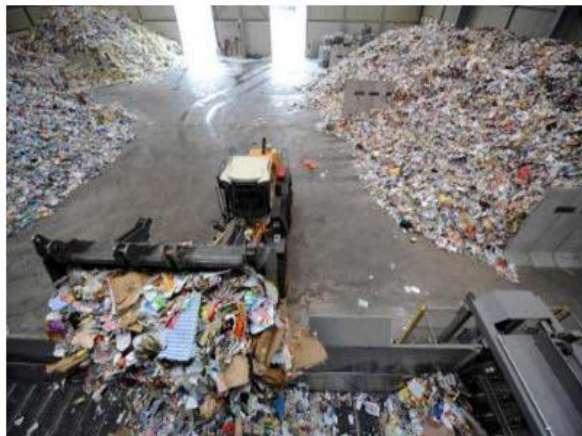
PTI | Updated: Dec 11, 2016, 08:11 PM IST



Crowdfund Indian property

Pre-vetted properties. Top developers. Escrow transactions. Clients in 447 cities : smartowner.com

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(AFP photo for representation)

HIGHLIGHTS

- Sweden has run out of garbage and has been forced to import rubbish from other countries
- Sweden's recycling system is so sophisticated that only less than 1% of its household waste has been sent to landfill last year

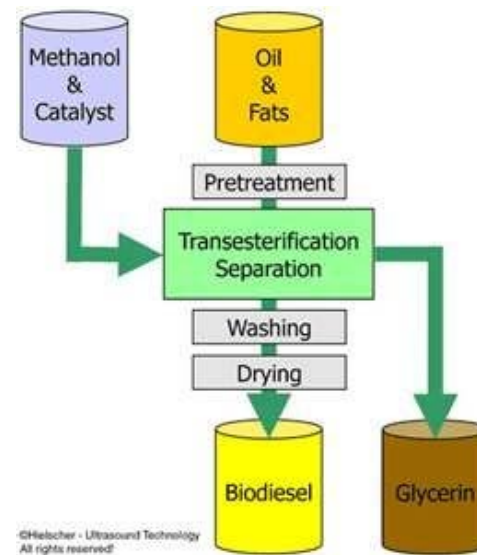
IT BEGAN on the roof. I was up there with a flat shovel, tearing off the old felt. I had studied my neighbour repairing his roof. He's in his fifties and has one leg. I hurt over in the afternoon sun and yanked

How are feedstock converted into energy?

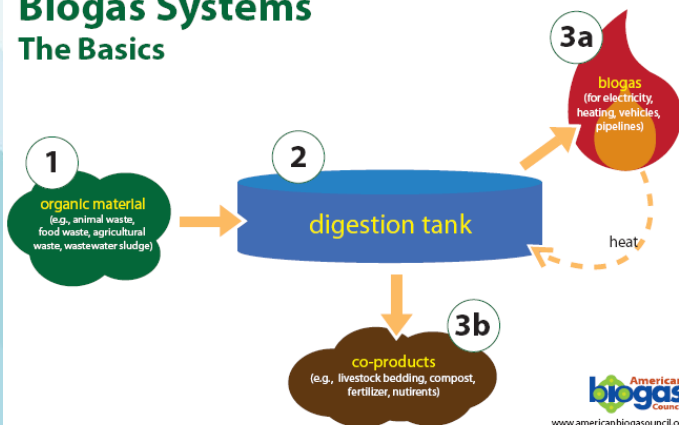


Three fundamental processes:

1. Thermal
2. Chemical
3. Biological



Biogas Systems The Basics



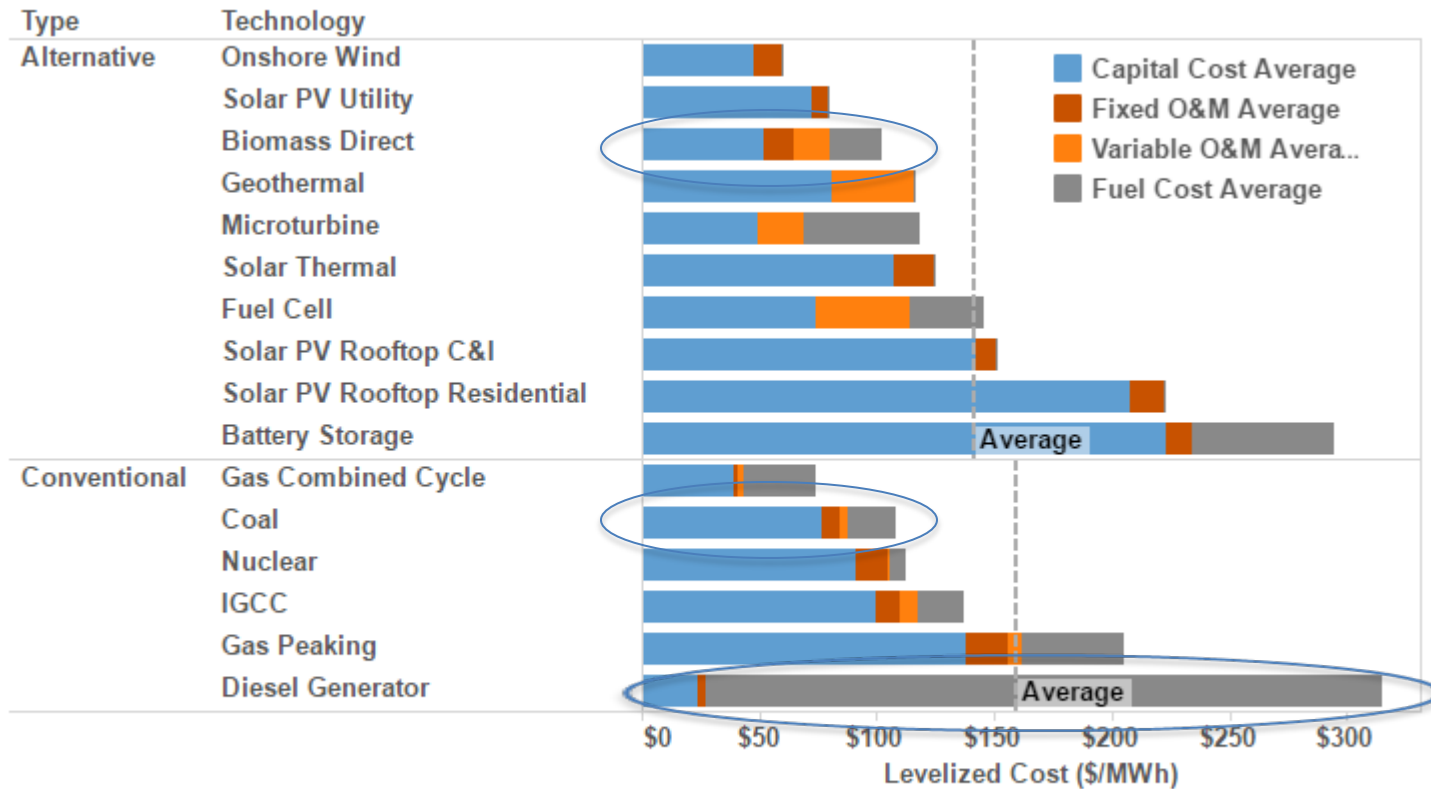
Is Bioenergy Effective?

Depends on the Criteria!

1. Cheap and Efficient heat and power
2. Job Creation
3. Environmental Benefits
4. Waste Management
5. Other

Effectiveness of Bioenergy?

Components of levelized cost of energy

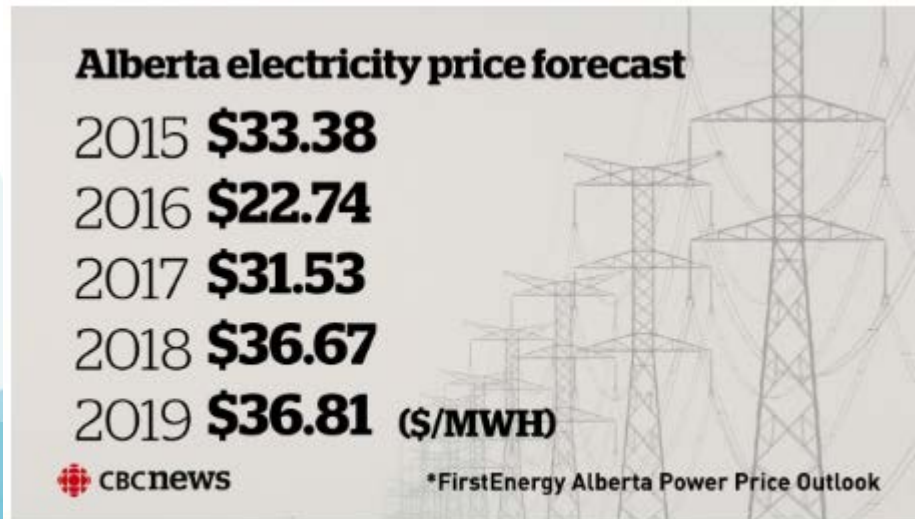


Source: Lazard's Levelized Cost of Energy Analysis--Version 8.0, September 2014
<http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf>



Is Bioenergy Effective?

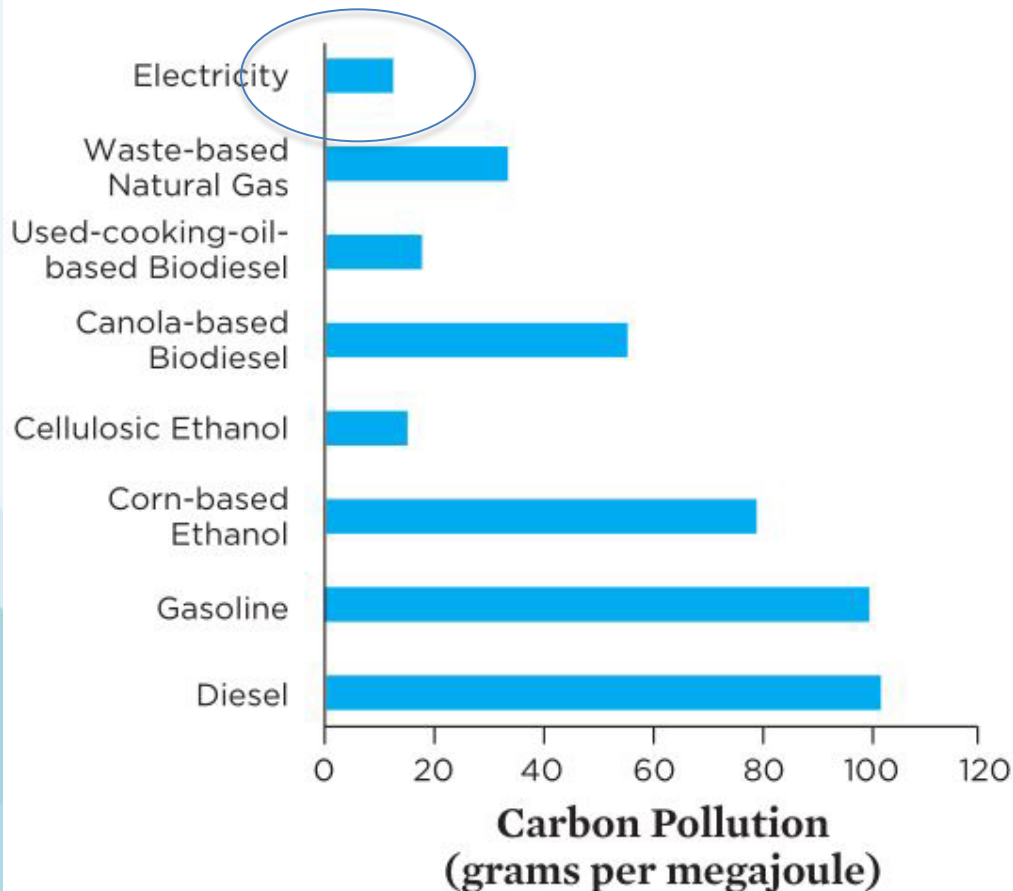
- According to Virasco Solutions, biogas power produced in Alberta is an average of 89% less greenhouse gas intensive than the current Alberta grid.
- International Renewable Energy Agency (IRENA) estimates that biomass creates 5.5 jobs per MW versus 0.2 to 0.7 per MW for Solar and On-Shore Wind



Electricity prices haven't been this low since the 1990s.

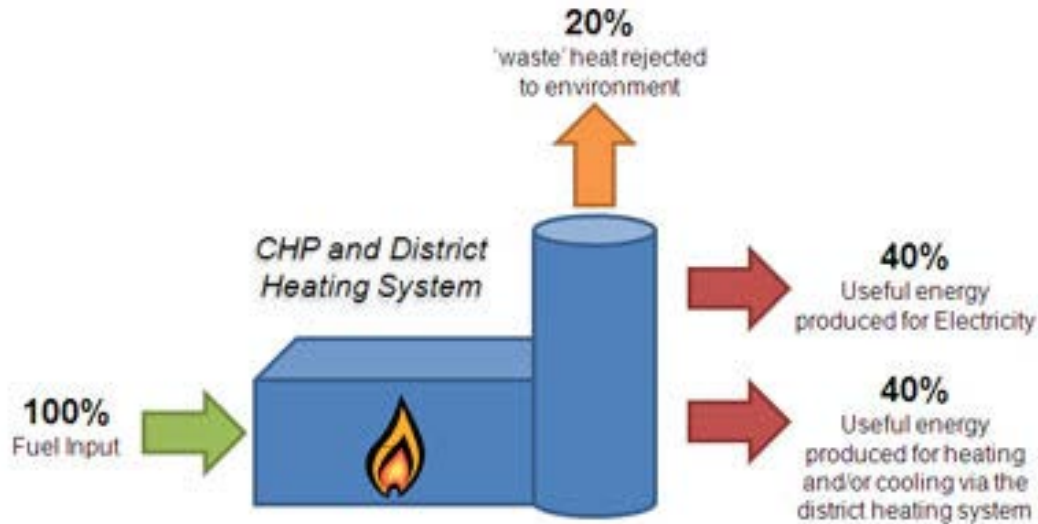
Is Bioenergy Effective?

The Carbon Intensity of Transportation Fuels in Washington State



Waste Management

Is there is business opportunity?



Combined Heat and Power (CHP)
Co-Firing



Potential Business Opportunities!

Resources and Programs

- Biomass Resource Information Management System (BRIMS)
- Community and Regional Economic Supports (CARES)
- Capital Investment Tax Credit (CITC)
- Alberta Investment Tax Credit (AITC)
- Emissions Reduction Alberta (ERA)
- Alberta Offset Protocol System
- Waste to Value-Added Product Demonstration Projects for Alberta Small Municipalities

<http://www.ai-ees.ca/opportunities/>

More Business Opportunities!



Thank You

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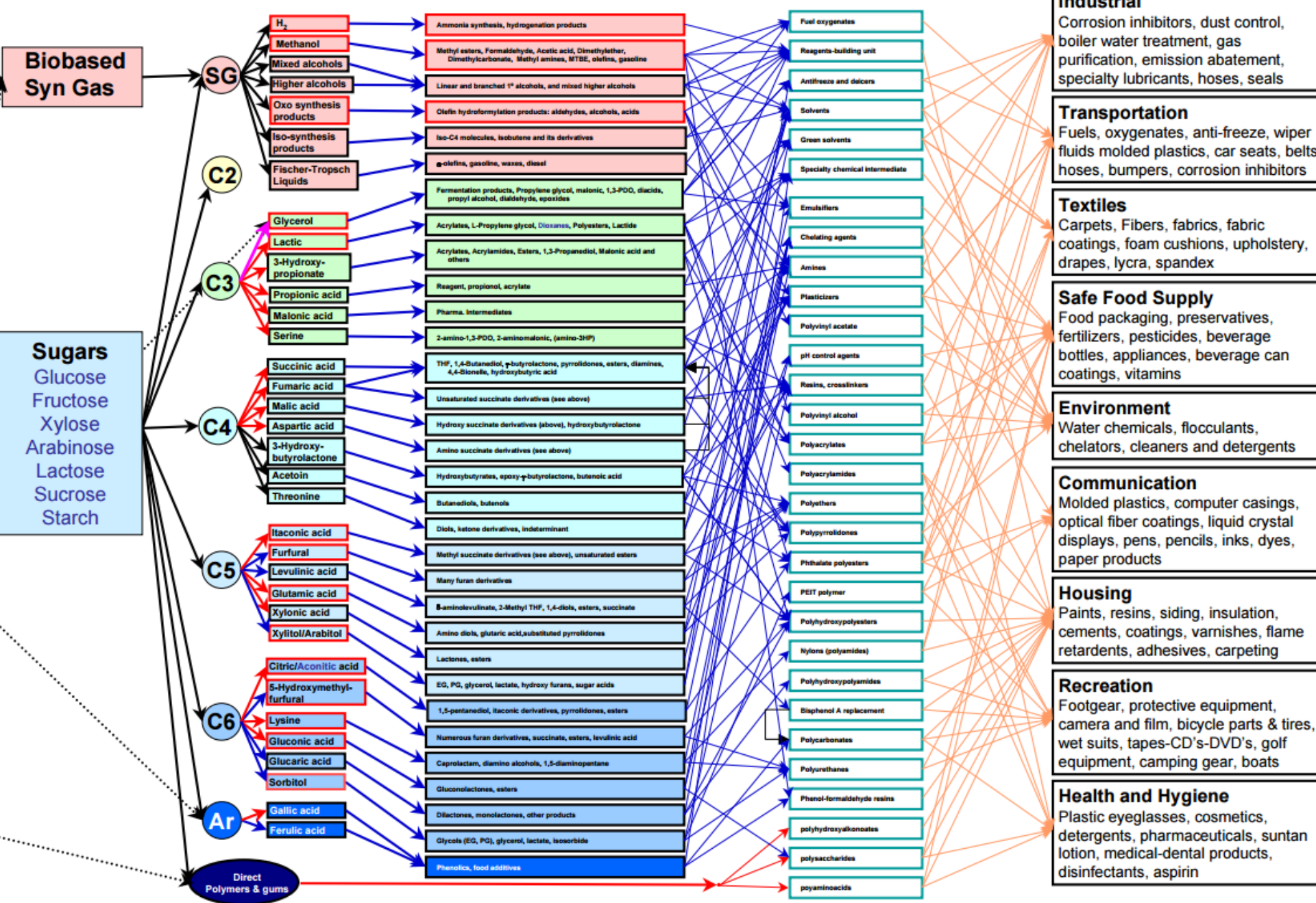


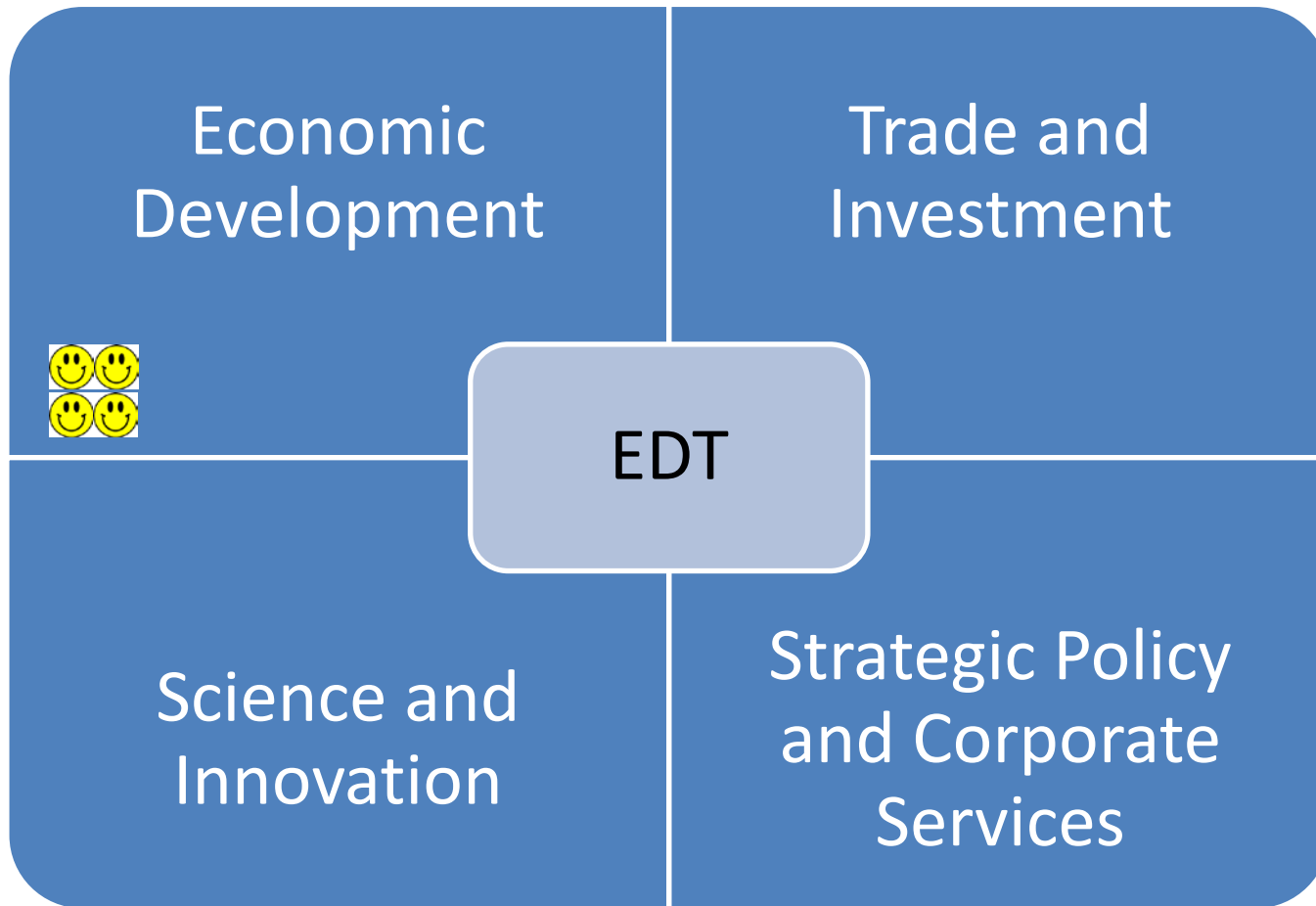
Figure 3 – Analogous Model of a Biobased Product Flow-chart for Biomass Feedstocks

Energizing the North

Athabasca March 28th
Peace River March 30th



Who We Are



Who We Are



Environmental and Renewable Industries Unit is led by Vicki Martin.

1. *Environmental Products & Services and Water Industries* – Led by **Alberta Telfer** Alberta.telfer@gov.ab.ca
2. *Bio Industrial and Waste Management*– Led by **Morley Kjargaard** morley.kjargaard@gov.ab.ca
3. *Renewable Energy Industries* – Led by **Holly Driscoll and Larry Ottewell** holly.driscoll@gov.ab.ca , larry.ottewell@gov.ab.ca

What We Do



What is Ethanol?

Fuel	Pathway Description	Carbon Intensity Values (gCO ₂ e/MJ)		
		Direct Emissions	Land Use or Other Indirect Effect	Total
Gasoline	CARBOB – based on the average crude oil delivered to California refineries and average California refinery efficiencies	95.86	0	95.86
Ethanol from Corn	Midwest average; 80% Dry Mill; 20% Wet Mill; Dry DGS	69.40	30	99.40
	California average; 80% Midwest Average; 20% California; Dry Mill; Wet DGS; NG	65.66	30	95.66
	California; Dry Mill; Wet DGS; NG	50.70	30	80.70
	Midwest; Dry Mill; Dry DGS, NG	68.40	30	98.40
	Midwest; Wet Mill, 60% NG, 40% coal	75.10	30	105.10
	Midwest; Wet Mill, 100% NG	64.52	30	94.52
	Midwest; Wet Mill, 100% coal	90.99	30	120.99
	Midwest; Dry Mill; Wet, DGS	60.10	30	90.10
	California; Dry Mill; Dry DGS, NG	58.90	30	88.90
	Midwest; Dry Mill; Dry DGS; 80% NG; 20% Biomass	63.60	30	93.60
	Midwest; Dry Mill; Wet DGS; 80% NG; 20% Biomass	56.80	30	86.80
	California; Dry Mill; Dry DGS; 80% NG; 20% Biomass	54.20	30	84.20
	California; Dry Mill; Wet DGS; 80% NG; 20% Biomass	47.44	30	77.44

Diesel Replacements?

Fuel	Pathway Description	Carbon Intensity Values (gCO ₂ e/MJ)		
		Direct Emissions	Land Use or Other Indirect Effect	Total
Diesel	ULSD – based on the average crude oil delivered to California refineries and average California refinery efficiencies	94.71	0	94.71
Biodiesel	Conversion of waste oils (Used Cooking Oil) to biodiesel (fatty acid methyl esters -FAME) where “cooking” is required	15.84	0	15.84
	Conversion of waste oils (Used Cooking Oil) to biodiesel (fatty acid methyl esters -FAME) where “cooking” is not required	11.76	0	11.76
	<u>Conversion of Midwest soybeans to biodiesel (fatty acid methyl esters –FAME)</u>	<u>21.25</u>	<u>62</u>	<u>83.25</u>
Renewable Diesel	Conversion of tallow to renewable diesel using higher energy use for rendering	39.33	0	39.33
	Conversion of tallow to renewable diesel using lower energy use for rendering	19.65	0	19.65
	<u>Conversion of Midwest soybeans to renewable diesel</u>	<u>20.16</u>	<u>62</u>	<u>82.16</u>