



Canadian Bioenergy Association

Bio-trade Equity Fund Pyrolysis Oil Worldwide

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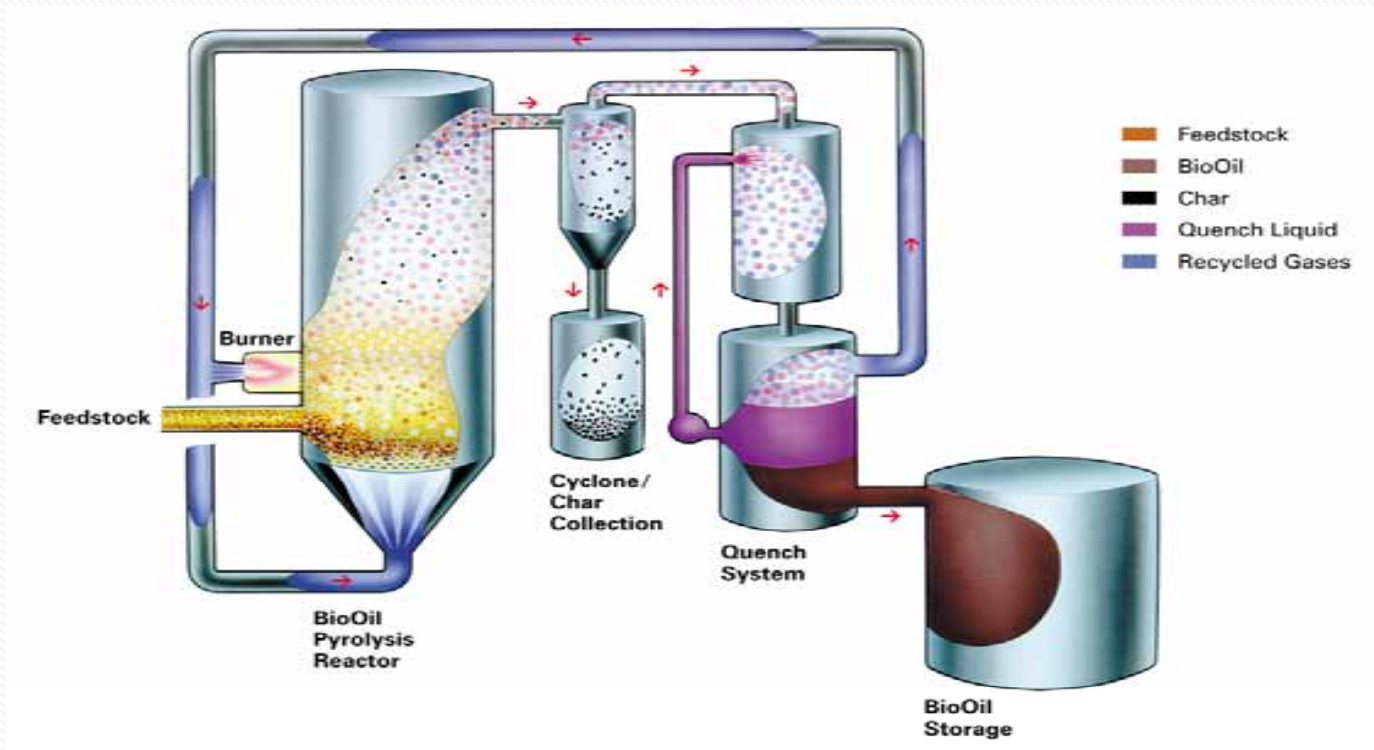


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Fast Pyrolysis: Rapid heating of biomass in the absence of oxygen. Two commercial products produced:

BioOil (yield 55 – 73%)

Char (yield 15 – 25%)





BioOil from Fast Pyrolysis- Characteristics

BioOil

- ~70% yield
- Brown, liquid biofuel
- Can be stored, pumped, transported
- 18 GJ/t
- Acidic- pH2-3
- Now not



Char

- 20% yield
- Black powder
- Non- combusted biomass
- 29-30 GJ/t





Many Different Feedstocks



Sugar Cane Bagasse



Wood Chips



Corn Stover



Eucalyptus



Waste Paper



Poplar

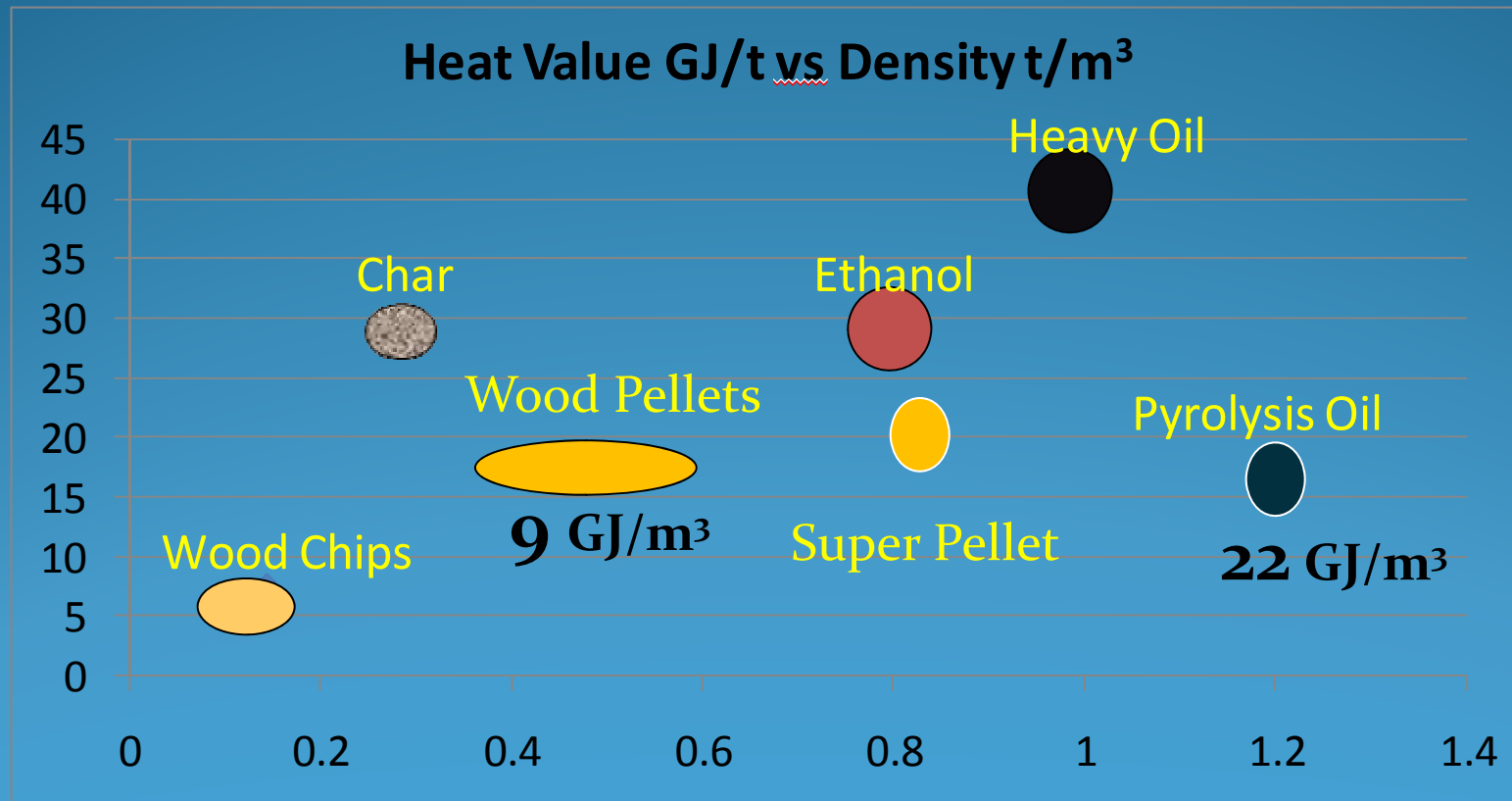


Peat



Miscanthus

Why trade it





World's Largest Pyrolysis Oil Plants





Initial Markets

- Replace fossil fuel in boilers
- Replace fossil fuel in any stationary engine
- Pulp & paper mill lime kilns
- Co-firing
 - BioOil in natural gas/oil power plants
- District heating
- Sawmill dry kilns
- Greenhouses
-



BioOil Applications

FUEL CONSUMPTION OF LIME SLUDGE REBURNING KILNS					
EUROPE (EU 25 + Norway) 2005					
COUNTRY	Pulp Production	% EU	Fuel Consump	BioOil Potential	200 tpd plants
	<u>000 t</u>		<u>PJ</u>	<u>000 t</u>	
Sweden	7,795	32%	13.6	766	17
Finland	7,783	32%	13.6	765	17
Portugal	1,841	8%	3.2	181	4
Spain	1,780	7%	3.1	175	4
France	1,380	6%	2.4	136	3
Austria	827	3%	1.4	81	2
All Other	<u>2,868</u>	<u>12%</u>	<u>5</u>	<u>281</u>	<u>6</u>
	24,274		42.5	2,386.0	53.0



Pulp and Paper Mill Firing BioOil in a Lime Kiln

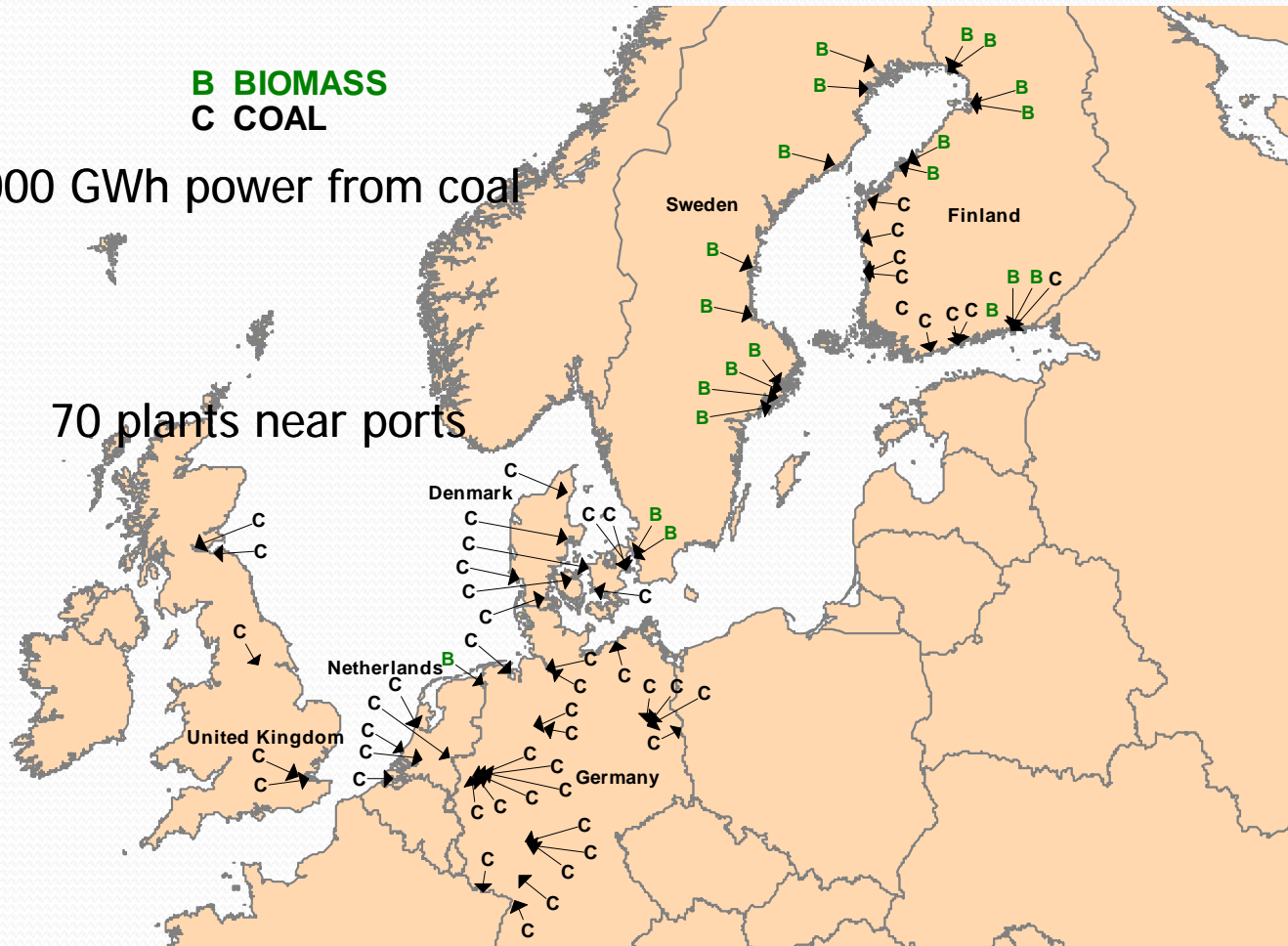


Co-firing- Power Plants on Coasts or Coastal Waterways

B BIOMASS
C COAL

EU 860,000 GWh power from coal

70 plants near ports





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Co-firing in Coal Power Plants

Amer Plant- RWE-Essent NL



- Co-fire now with pellets
- Co-fire % to rise
- Can co-fire with
 - Pyrolysis oil
 - char



Co-firing- BioOil with Natural gas or Oil



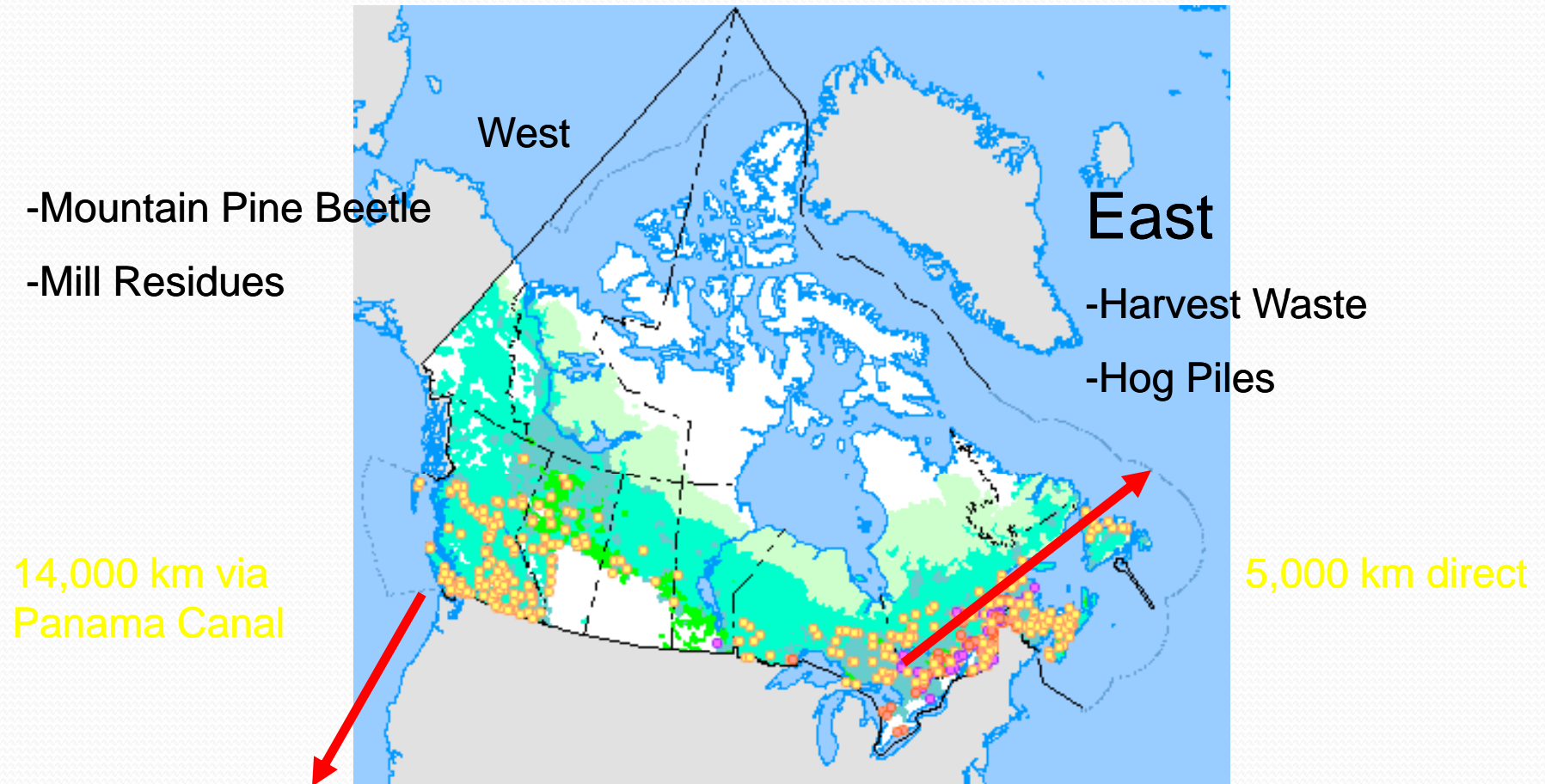
Natural Gas for Power- 2003		
	<u>TWh</u>	<u>%EU</u>
UK	151	26%
Italy	123	21%
Germany	66	11%
Netherlands	60	10%
Spain	41	7%
Belgium	24	4%
Others	<u>117</u>	
EU25	582	

Equiv to 320 MT BioOil

Many power plants are configured to use many different fuels



Canada- BioOil Sources





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Near Term BioOil Supply Sources





Brazil BioOil Potential



Sugar Cane In the Center – South Region



- Sugar Cane
 - Bagasse (stalks)
 - Trash (leaves & tops)
- Bagasse
 - 2006- 14 MT; 2012- 55 MT
 - 10% energy savings
 - 20-30% energy investments
 - Rest from new cane
- BioOil Potential
 - 18 million tonnes from bagasse
 - 50 million tonnes from trash



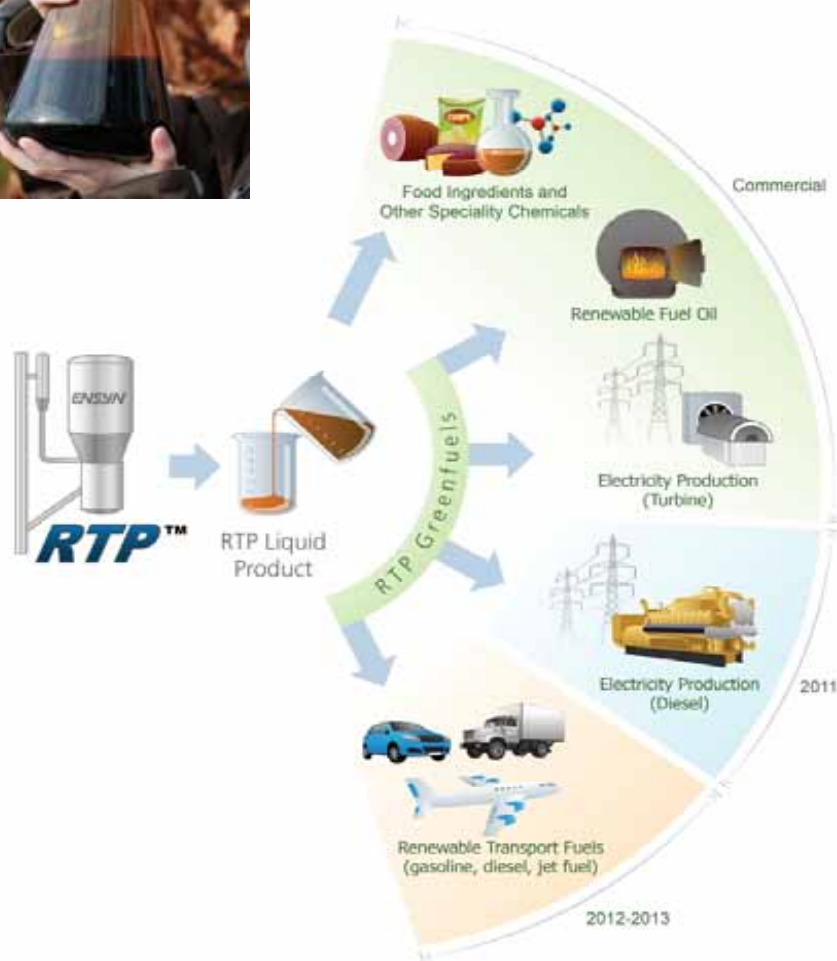
South Africa- Biomass Potential



- Namibia
 - Acacia clearing for Cheetah habitat
 - Conversion to pyro-oil
 - Export from Walvis Bay
- Mozambique
 - Palm plantations with “yellowing disease”
 - Conversion to pyro-oil
- South Africa-
 - 80% of biomass in 2 states
 - Bagasse 6.1 MT
 - Sawmill residue 1.0 MT
 - Pulp mill bark .3 MT
 - Export from Durban



Pyrolysis oil



- Denser than pellets
- Cheaper to transport
- Uses
 - In food and chemicals
 - Replace fuel in motors
 - Electricity (turbine)
 - Electricity (diesel)
 - To make renewable transportation fuels (gasoline, jet fuel....)
 - Char source of **carbon nanotubes**



Summary

- Pyrolysis oil IS commercial
- It has **many proven applications**
 - Replacing oil in boilers, engines, co-firing, power
- It has **intriguing future applications** (1-2 years)
 - Green transportation fuels, **carbon nanotubes**
- Potential for **imports** is large
- **Cheaper to transport** than pellets
- **Markets are huge**



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Thank You

-Bio-trade Equity Fund Study- on IEA Task 40 web site

<http://www.bioenergytrade.org/downloads/biotradeequityfundfinalreport.pdf>

-Bio-trade Equity Fund – Search for a Fund Manager

-BioOil Markets