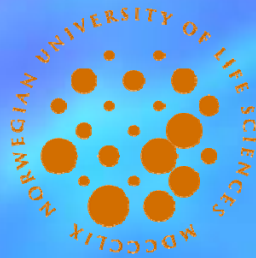




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World Biofuel Maritime Shipping Study

D. Bradley/F. Diesenreiter/E. Trømborg

IEA Task 40

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Doug Bradley

President, Climate Change Solutions

402 Third Avenue • Ottawa, Ontario • Canada K1S 2K7

phone • 613.321.2303 email • douglas.bradley@rogers.com

web site • www.climatechangesolutions.net



World Maritime Biomass Shipping Study

- **Types** of ships
- Current biomass shipping **lanes**
- **Ports**
- Biomass **properties** - shipping requirements
- Biomass **volumes** traded
- **Obstacles** and barriers
- **Future shipping** capacity, lanes, types of ships



Brief Shipping Facts

- More than 80 % of world merchandise trade by volume is carried by sea
- Ocean shipping is divided into two main sectors;
 - dry goods
 - liquids
- Main shipping countries
 - Greece, Japan, Germany, China, and Norway
 - These 5 have market share of 54.2%.



Types of ships- This Study

- Dry bulk carriers:

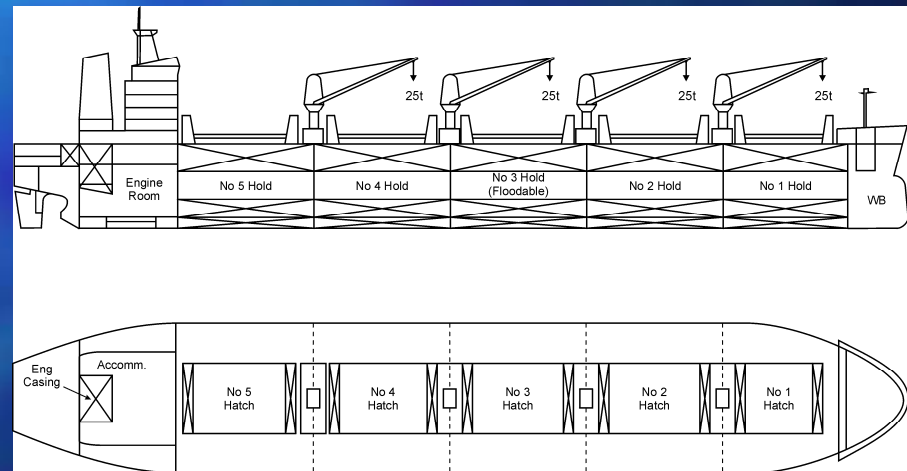
For dry bulk cargoes: coal, iron ore, grain, dry bulk biomass (wood chips, wood pellets, oil seeds...)

- Tankers:

For liquid bulk cargoes: crude oil, gasoline, liquid biofuels (ethanol, biodiesel, bio-oil, vegetable oil)

Dry bulk carriers

<u>Classes:</u> Handysize	20,000-35,000 dwt	} Wood chips, pellets
Handymax	35,000-50,000 dwt	
Panamax	50,000-80,000 dwt	} Oil seeds
Capesize	100,000-300,000 dwt	
		} Coal, iron ore



Picture and plan of typical modern Handymax bulker with 5 holds, 5 hatches and 4 cranes

Source: Wikipedia



Tankers

Types:

chemical tankers

5,000-40,000 dwt

LNG carriers

crude oil tankers

50,000-550,000 dwt

For the transport of liquid biofuels

-Vegetable oils

-Biodiesel

-Ethanol

-Pyrolysis oil

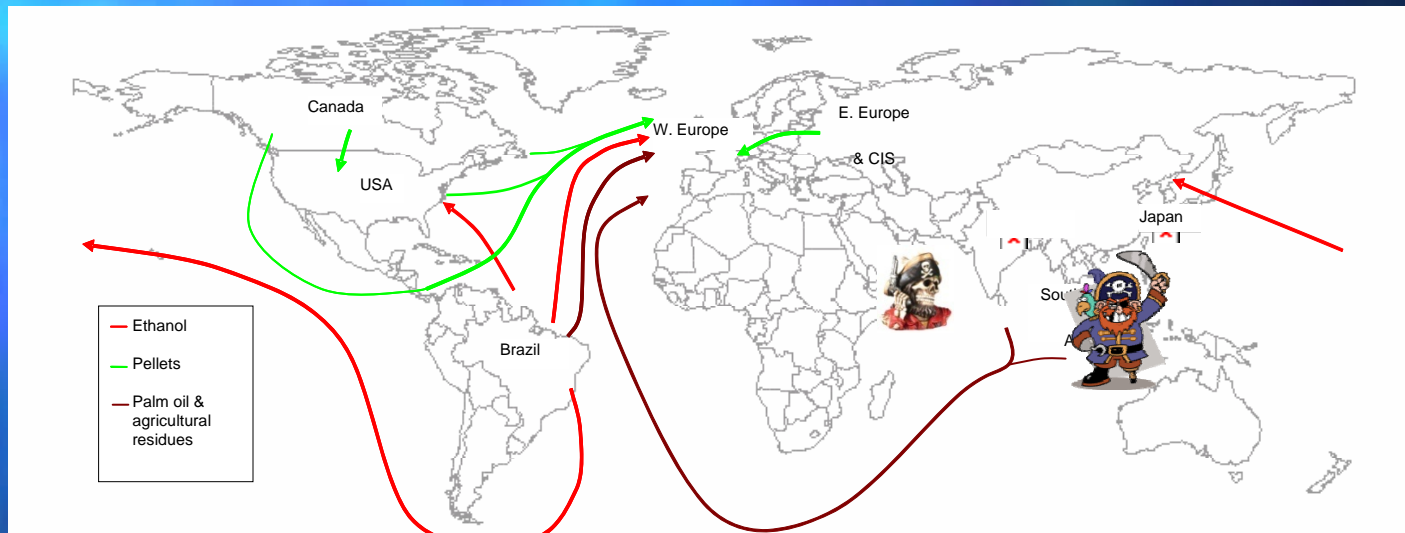
Chemical tankers



Chemical tanker; 18,000dwt

Source: www.cssc.net.cn

Current Shipping Lanes



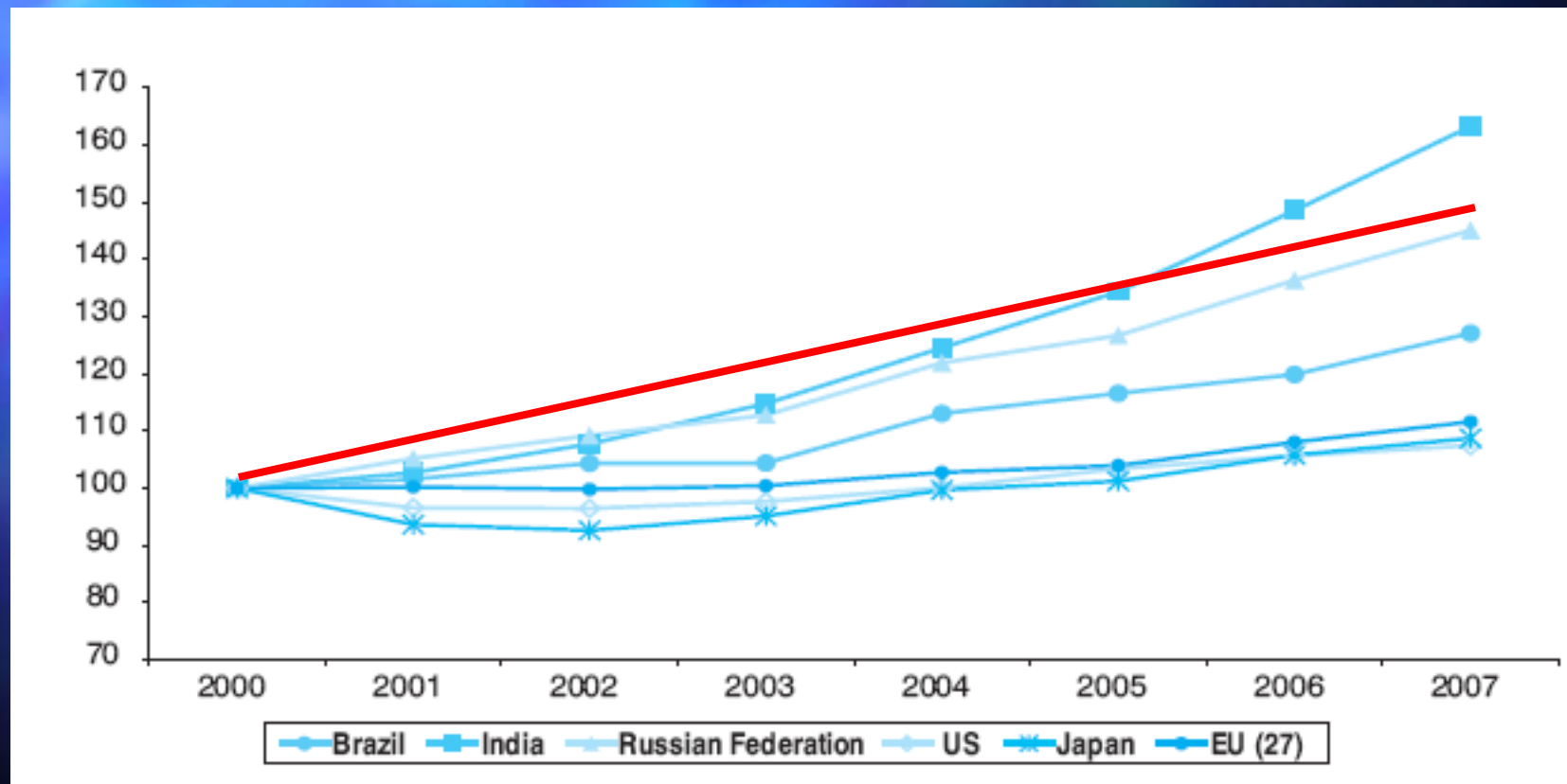
Wood Pellets

Ethanol

Palm Oil & Ag Residues



Growth- Seaborn trade vs Economies



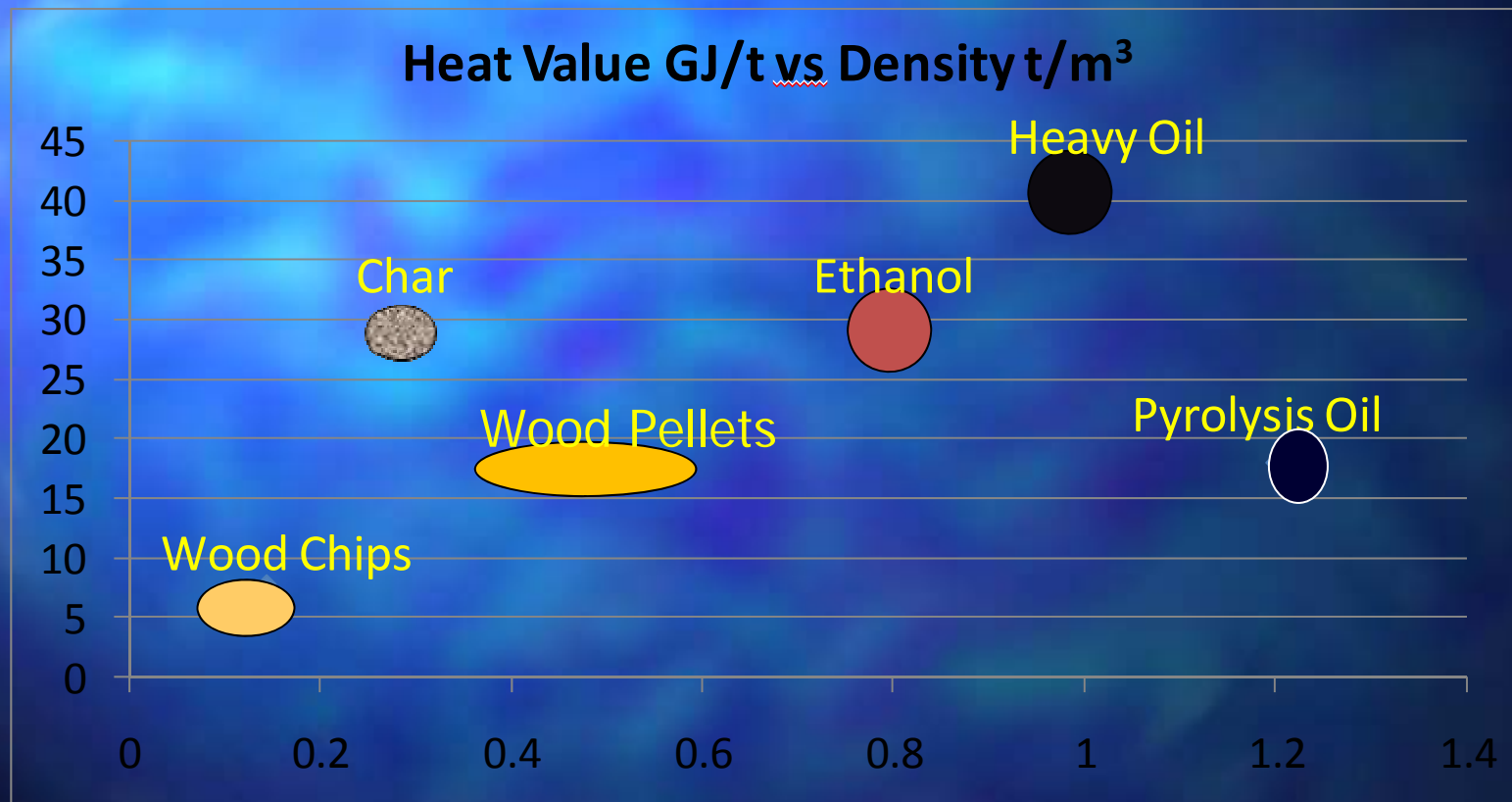


Seaports

- Gateways for movement of cargo
- Ideally offer:
 - Good **land connections** (river, rail, road)
 - **Equipment for loading /dispatching of cargo**
 - **Storage** facilities goods
 - **Large ship** capability
- Ports efficiency: crucial to bioenergy trade growth
 - Most efficient ports: Hong Kong, Singapore, Rotterdam, Hamburg
 - Least efficient ports: in undeveloped nations (often where biomass is)



Bio-product Characteristics





Biomass Shipping Characteristics

Fuel	GJ/m ³	Positives	Negatives
Ethanol	23	<ul style="list-style-type: none">-Liquid-pour- Hi volume trade already (=lo price)	<ul style="list-style-type: none">-Absorbs water from atmosphere, needs nitrogen blanket (loaded into tanks on ship)-Need tank coatings such as phenolic epoxy-May be limited to < Panamax
Bio-Oil	21.6	<ul style="list-style-type: none">-Liquid- fast load-Hi energy, density-No spill danger	<ul style="list-style-type: none">-pH 2.2-3- needs stainless 304, Teflon..-Heat, agitation recommended- Is not currently ocean shipped
Wood Pellets	9	<ul style="list-style-type: none">-Simple product-Hi volumes now-Supply chains in place	<ul style="list-style-type: none">-Low Energy Density, ie costly/GJ-Must keep dry-Off-gassing CO/CH₄, new handling proced.- Hi temp= bacteria=explosions
Char	9	<ul style="list-style-type: none">Easy to handle if pelletized	<ul style="list-style-type: none">-Too light, dusty, hard to handle-Can ignite if exposed to air. Soln? Wet, or wait for char to deactivate



Biomass Shipping Characteristics

Fuel	GJ/M ³	Positives	Negatives
Biodiesel		<ul style="list-style-type: none">-Liquid- easy to handle-Storage in any oil tank	<ul style="list-style-type: none">-Temp must not go below cloud point- Must not contaminate
Vegetable Oils		<ul style="list-style-type: none">- If mishandled as food, can be OK for energy	<ul style="list-style-type: none">-Avoid frequent pumping, else oxidation-Protect from light- Store at <15-20° above melt point



Ethanol Trade (million litres)

Net Exporters	<u>2006</u>	<u>2007</u>	<u>2008</u>
Brazil	3,427	3,276	3,809
China	<u>1,010</u>	<u>811</u>	<u>446</u>
	4,436	4,087	4,254
Net Importers			
United States	-2,595	-1,497	-1,565
Japan	-623	-718	-800
South Korea	-248	-304	-339
European Union-25	375	-125	-251
Canada	-43	-255	-323
India	0	0	258
ROW	<u>-1,301</u>	<u>-1,187</u>	<u>-1,234</u>
	-4,436	-4,087	-4,254



Wood Pellets Shipped

000 tonnes

2006

Canada	600
US	0
Latvia	315
Estonia	212
Finland	195
Lithuania	90
Norway	29



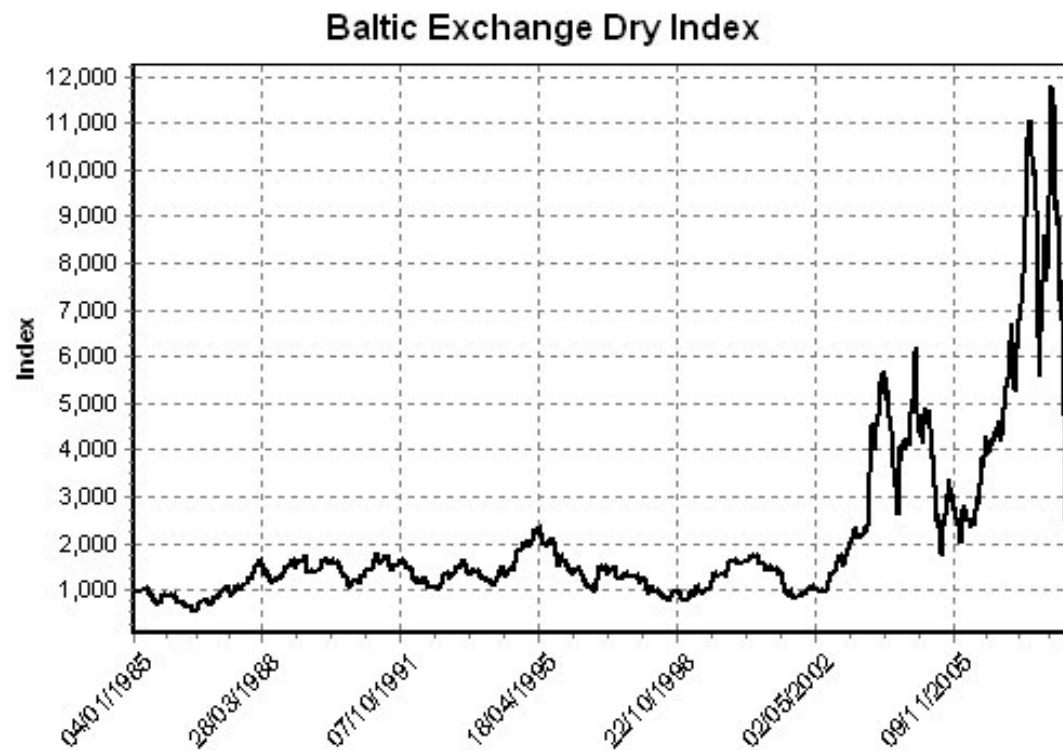
Wood Pellets Shipments

000 tonnes

	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009e</u>	<u>2010e</u>
Canada	600	740	770	850	1,250
US	0	150	500	850	1,000
Latvia	315				
Estonia	212				
Finland	195				
Lithuania	90				
Norway	29				



Cost of Shipping



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Obstacles to Growth in Shipping Biomass

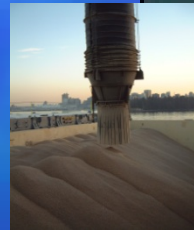
- World demand for shipping capacity- China
- Reliability of biomass supply- Russia
- Port inadequacies
 - Chile- Low pellet profits- no \$ for port facilities
 - Vancouver- Modern, but needs efficiencies
- Risk of investing in facilities where biomass is
- Product characteristics
 - Bio-oil- pH 2-3
 - Pellets not waterproof, give off gases
- Change in feedstock costs- Residue now \$50/BDt



Vancouver Bulk Terminals

Vancouver Wharves

- Kinder Morgan- New
 - 1million tonnes- to 2 mill.
 - + dust removal
 - + covered conveyors
 - - immovable loader
- Fibreco
 - + covered conveyors
 - - need storage, dust prob
 - - union
- Trains
- Grain cars 80% full





Growing (New) Shipping Lanes

- Pellets- Vancouver to EU (UK)
- Pellets/Bio-oil
 - Quebec corridor to EU
 - Australia to Far East
- Pellets – Chile to Far East
- Bio-oil- S. America to EU
- Ethanol- Brazil to EU



Impact of 2nd Gen Biofuels*

	2015	2015	2030	2030
	<u>Mil tonnes</u>	<u>HandyMax Ships</u>	<u>Mil tonnes</u>	<u>HandyMax Ships</u>
US	33	80	32	115
Europe	30	55	80	145
Asia	<u>18</u>	<u>58</u>	<u>50</u>	<u>140</u>
Total	81	193	162	400

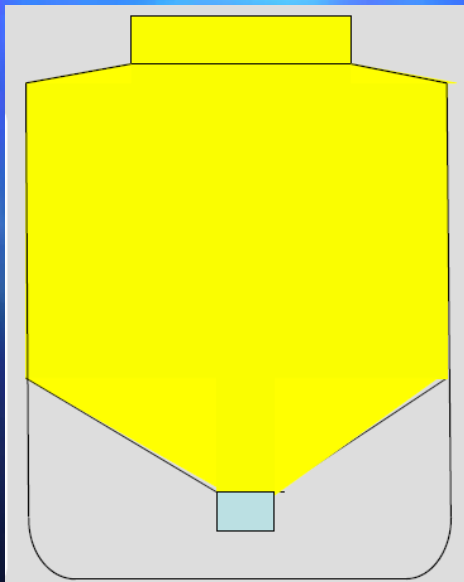


* R. Sadler- 2008- Biofuels and their effect on the shipping industry

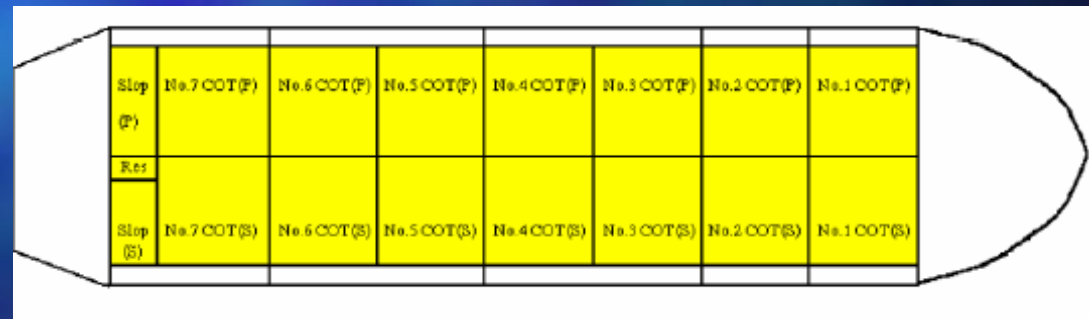


New Ship designs

- Solids- V-shape hulls with bottom conveyors



- Bulk liquids- basic Panamax design convertible to Chemical Tanker capability
- Double bottom 2.15m, side protection. 7 tanks per side divided into 14- 3000m³ limit





Factors for Success

- Establish new routes while ship costs low
- Long term price contracts
- Better port facilities where biomass is
- Enable use of larger ships
- Investment in new biomass sources;
Chile, Argentina, Quebec



CanBio Conferences

- **Vancouver Aug 27**
- Sheraton Wall Centre
- Business oriented w/s
- **Tour Aug 28**
- "Dockside Green"
- Award winning biomass heat community
- **Edmonton Oct 20-21**
- Annual conference
- 28 co. trade show
- B2B meetings
- **Tour Oct 22**
- Enerkem MSW to ethanol + others





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Thank You!

- Doug Bradley
- Friedrich Riesenreiter
- Erik Trømborg

