

Bath Plant


performance
P L A N T S

 **LAFARGE**

bringing materials to *life*

What will it take to beat coal?

November 17,
2009

Lafarge-PPI: Work Underway

- Can we purpose grow biomass fuel crops for use as fuel?
 - Economics
 - Fuel Quality
 - Policy Questions

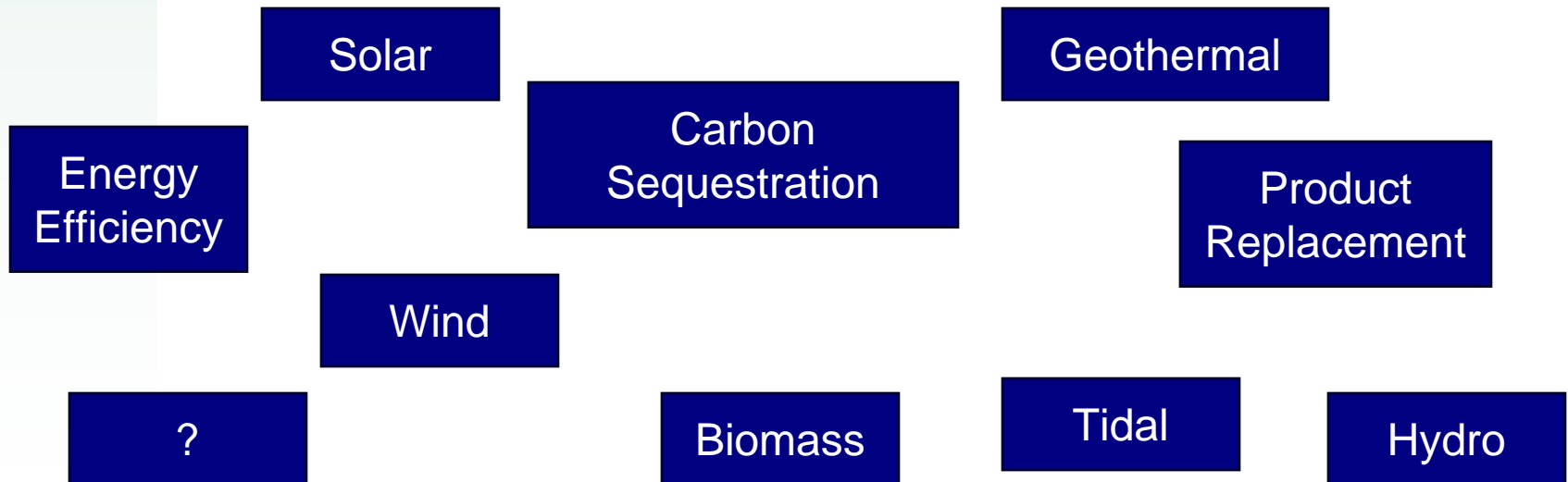
- Biomass Co-Fire test
 - 30% co-fire
 - Emission Testing
 - Public Demonstration

- Life Cycle Assessment Study
 - Crops planted
 - 3-year Program
 - Ministry of Environment Co-Funder



Thought for the day

- If our society chooses to address greenhouse gas emissions, it will provide an opportunity for economy-changing technologies to emerge.
- Which solutions will win and which will lose?



Cost of Fuels

Fuel Type	Cost per GigaJoule	Cost per Tonne
Gasoline	\$24	
Natural Gas	\$10-\$12	
Grown Biomass	\$6-\$10	\$100 - \$170
Coal	\$3-\$4	\$70 - \$90
Coke	\$2-\$3	\$50 - \$70

Note: Coal releases about 90 kg CO₂/GJ, EU “Cap & Trade” credits have been estimated to be about \$50/tn CO₂ or about \$4.5/GJ

Why does Energy Density matter?

■ Transportation

- Energy per truck load / boat load
- Coal & Coke are shipped by boat



■ Storage

- Footprint = \$
- Covered storage?
- Matching supply to need



■ Combustion

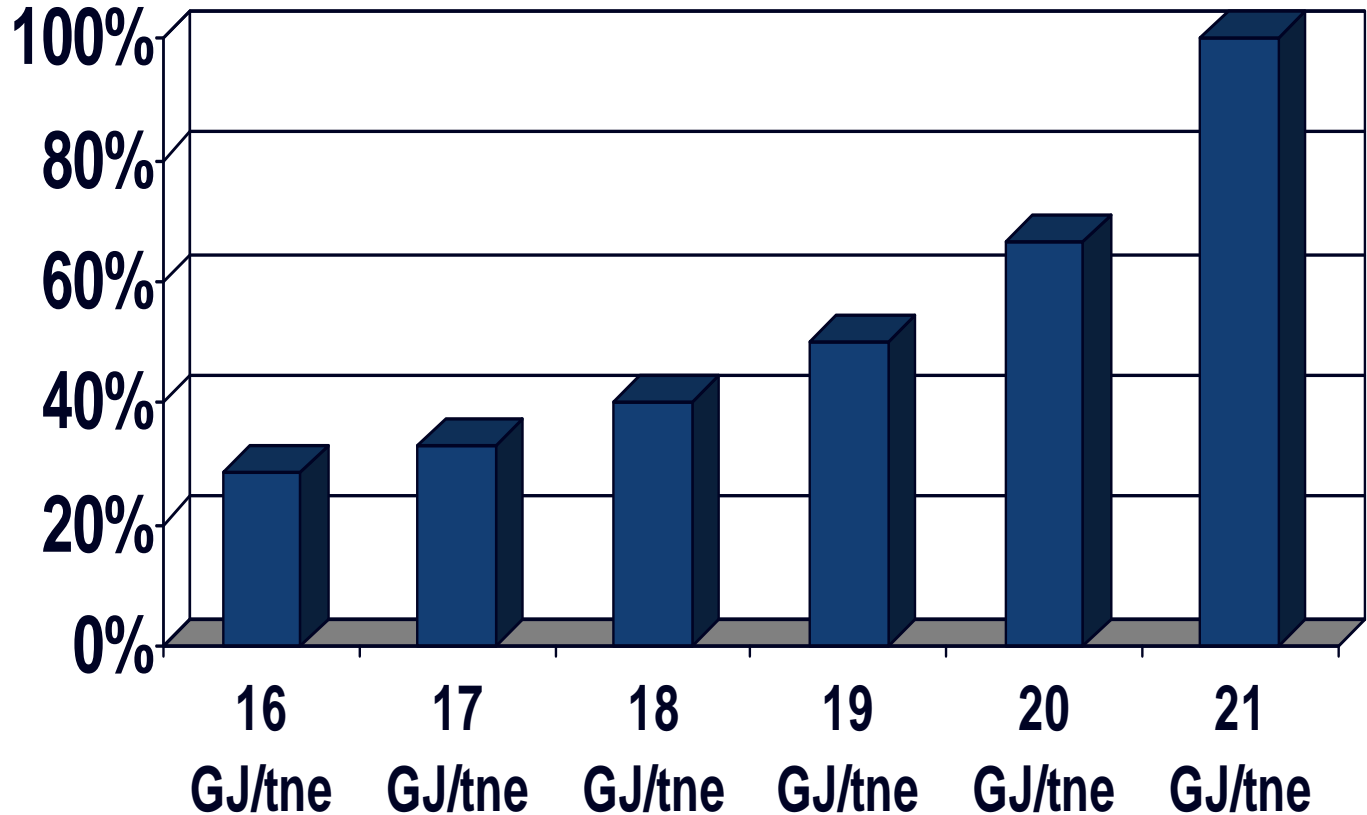
- Lower Heating Value vs. Higher Heating Value
- Average of 21 GJ/Tne needed (Rule of Thumb)





How much coal and coke can biomass replace?

Percent Replacement of Coal / Coke



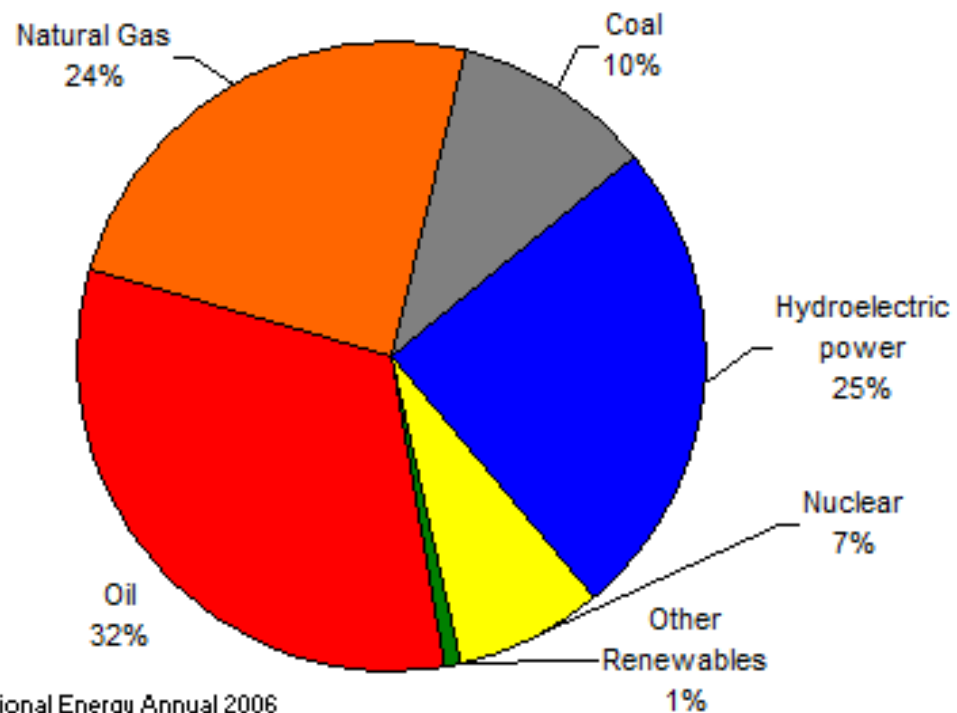
Biomass Lower Heating Value

Comparing Coal & Biomass

Characteristic	Coal	Biomass
\$/GJ	\$3-\$4	\$6-\$10
Energy Density	32 GJ/m ³	13 GJ/m ³
Shipping	Boat	Truck
% Ash	20%	3-10%
Ash Chemistry	Useful	Neutral
Availability	High	Low-Moderate
CO ₂ Emissions	100%	<10%
Other Emissions	Present	TBD (expected to be low)
Storage	Outdoor	Covered?

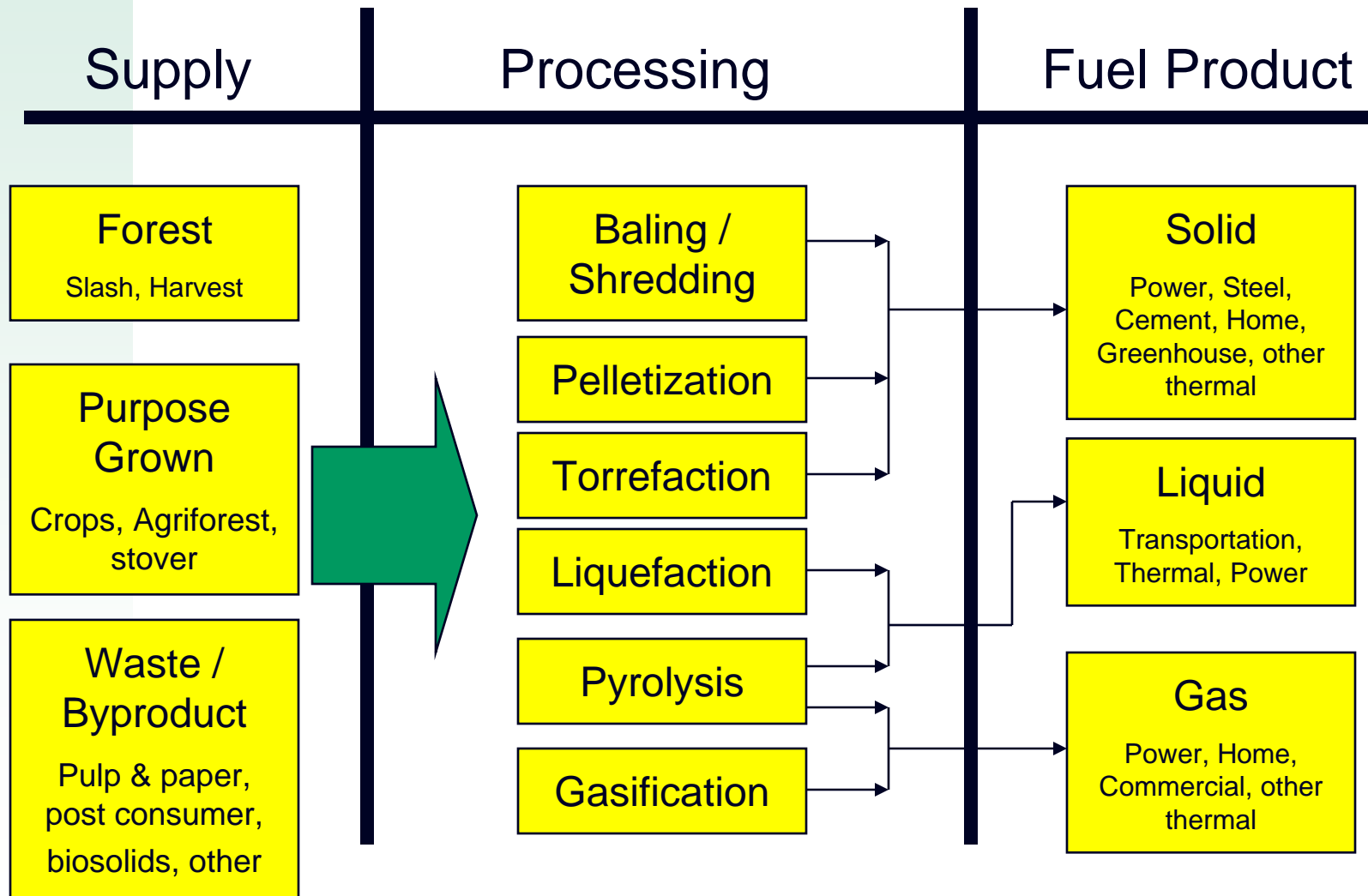
Canada's Energy – where does it come from?

Total Energy Consumption in Canada, by Type (2006)



Source: EIA International Energy Annual 2006

Seed to Flame



Conclusions

- Beating fossil fuels is hard to do
 - Probably why we aren't using biomass today

- When Carbon Costs emerge...
 - Biomass fuels will become competitive
 - Biomass is storable, renewable, and we know how to do it
 - Subsidies will push towards an Ontario Bio-Energy Economy, carbon costs will pull towards a variety of solutions that may not produce an Ontario Bio-Energy Economy.

- R&D is needed
 - Have we considered all of the issues?
 - Which technology will win?