



Biomass as an Alternative for Coal in Ontario.

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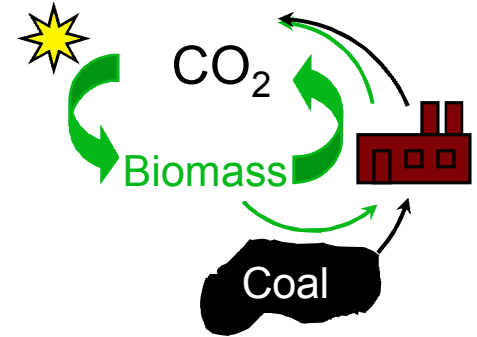
Capturing Canada's Green Advantage

www.biocap.ca



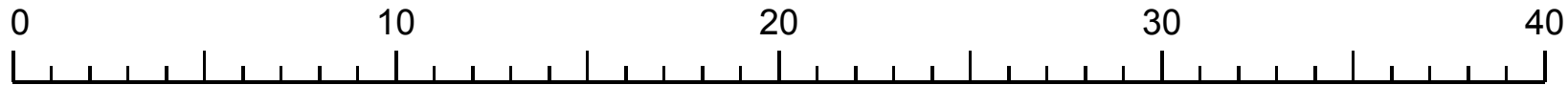
Why Biomass?

1. Reduced climate impact
 - *Closes the carbon cycle*
2. Improved air quality
 - *Lower sulfur emissions*
3. Rural economic development
 - *Produced in Ontario, not imported*
4. Integrates with existing infrastructure
5. Amenable to cleaner, more efficient processing technologies (eg. gasification)
 - *Possible links to biorefinery transportation fuels / chemicals.*



Comparison of Energy Content

Energy Content - Gigajoules / tonne (GJ/t)



BIOMASS

Straw



Wood



COAL

Lignite



Typical for Heat & power



Sub-bituminous



Bituminous



Anthracite



CRUDE OIL (~ 43 GJ/t)

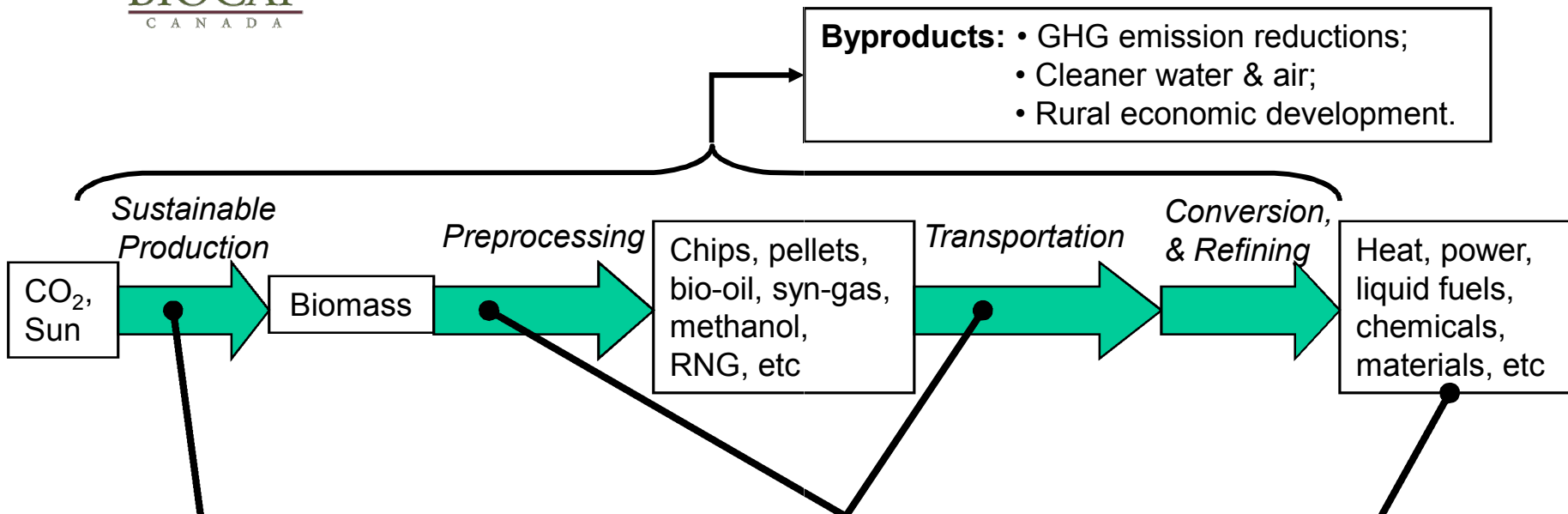
NATURAL GAS (~48 GJ/t)

From [http:// bioenergy.ornl.gov](http://bioenergy.ornl.gov) and Juliya Fisher 2003. ([http: hypertextbook.com/facts/](http://hypertextbook.com/facts/))

For thermal conversion of bioenergy, the biomass must be dried (and ideally densified). Even then, 1.5 t biomass would be needed to replace each t coal.

Therefore, about 25 to 30 Mt dry biomass would be needed to provide the energy currently derived from coal in Ontario.

Critical Questions in the Feedstock-to-Product Chain



What is Ont.'s (& Canada's) potential for sustainable biomass prod'n?

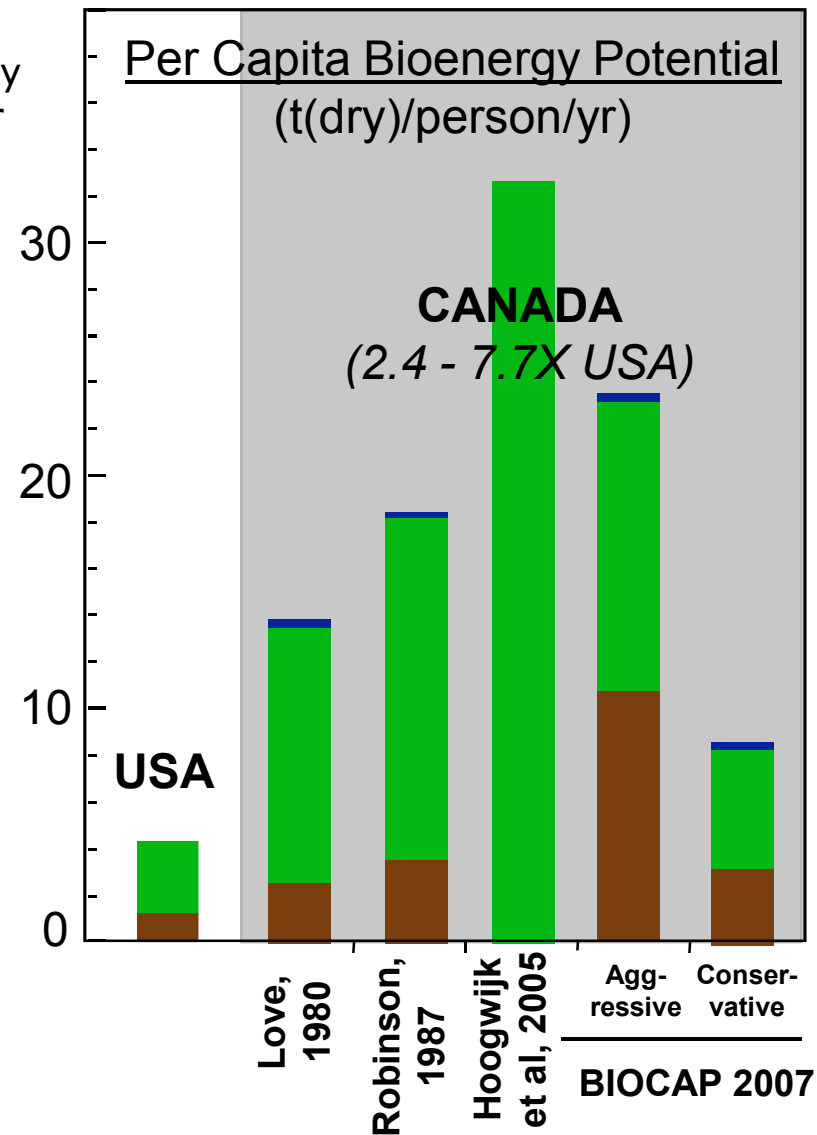
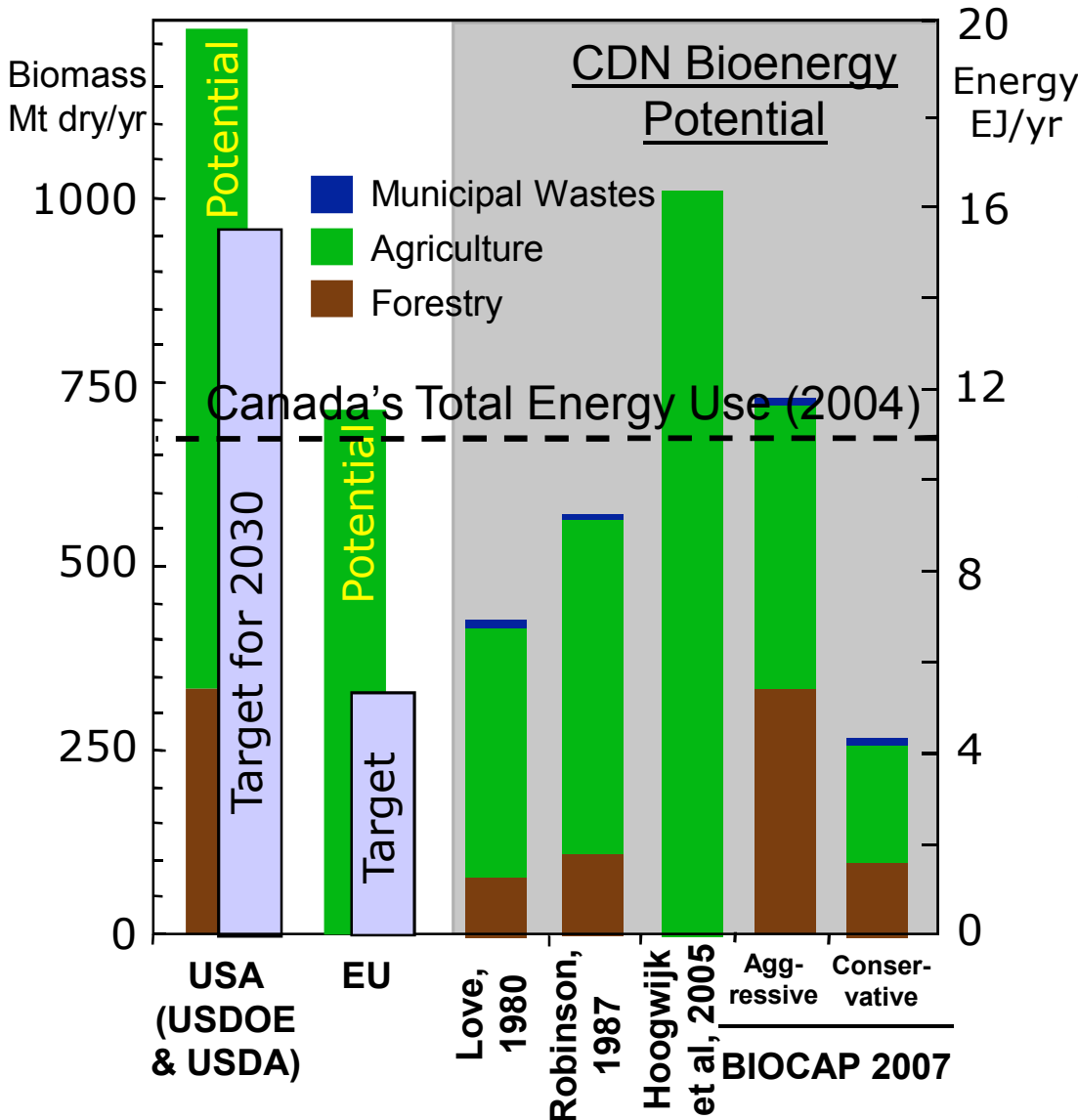
What is the optimal biomass form and transportation route for heat & power production?

Can biomass be economic for heat & power production?

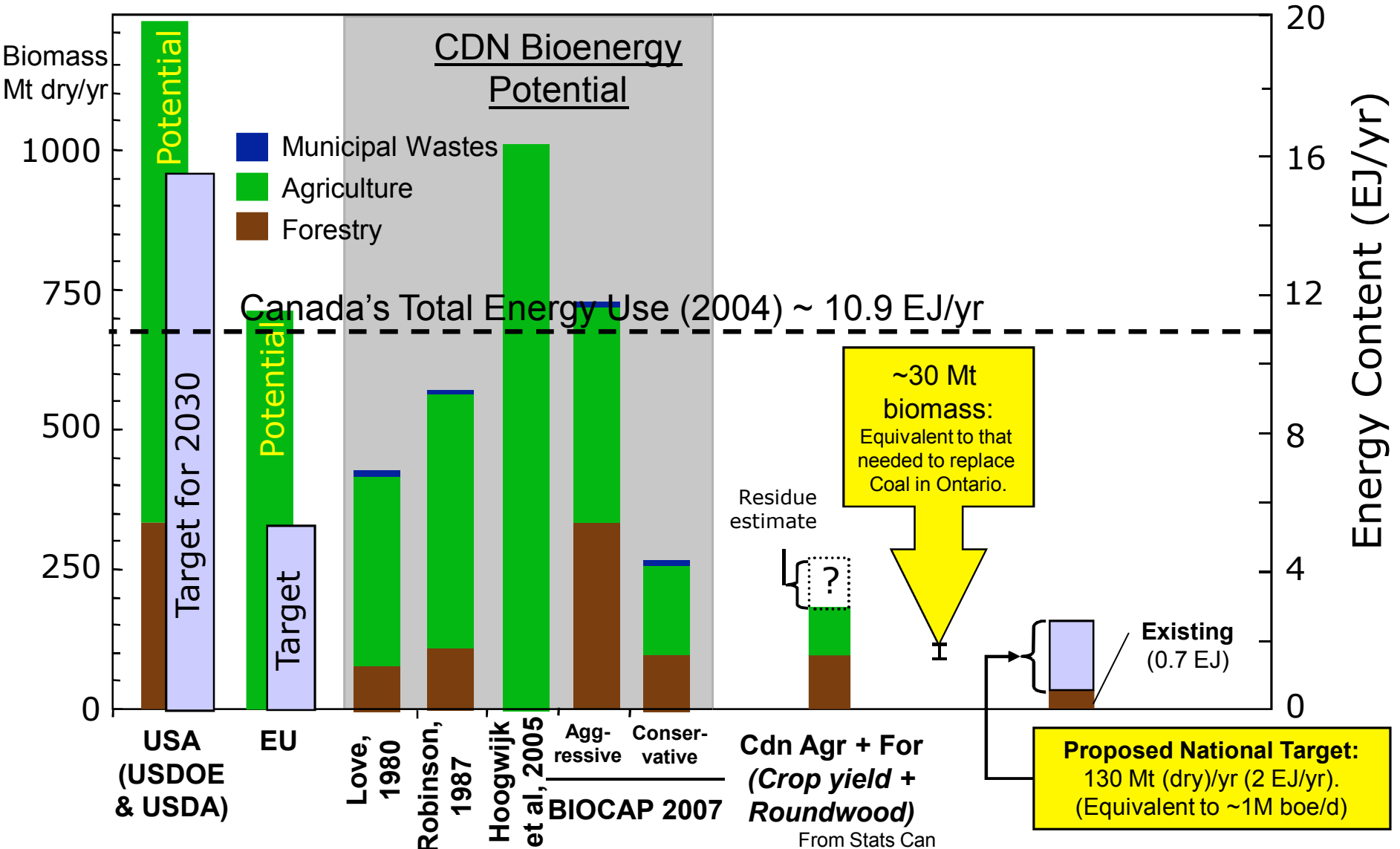


Sustainable Biomass Energy Production: *an international comparison*

Canada's Bioenergy Advantage



USA, EU & CDN Bioenergy Potential

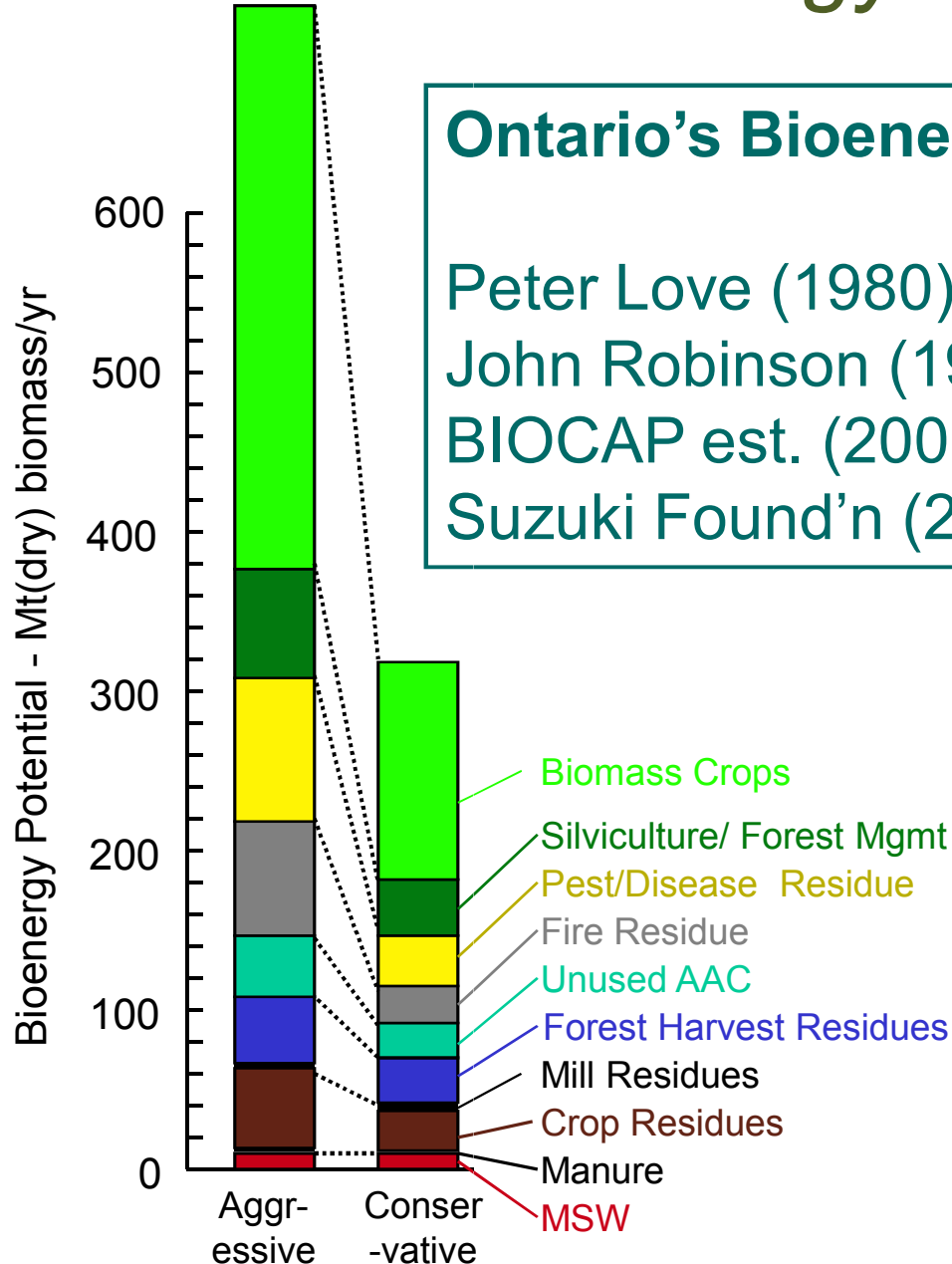


Canada's Bioenergy Potential

130 Mt/yr:
Biomass
required to
provide 20%
of Canadian
energy by
2030:



~30 Mt/yr:
Biomass
required to
replace coal
in Ontario



Ontario's Bioenergy Potential:

Mt(dry)/yr

Peter Love (1980):	105
John Robinson (1987):	148
BIOCAP est. (2006):	63
Suzuki Found'n (2004):	15

*Ontario has
the potential
to produce
sustainably,
the biomass
needed to
replace coal.*

The Transportation Issue:

Compared to the EU & USA, Canada's vast distances between production and use could make bioenergy less competitive.

Examples of Possible Solutions:

1. Distributed biomass processing facilities, ideally producing multiple products for regional needs.

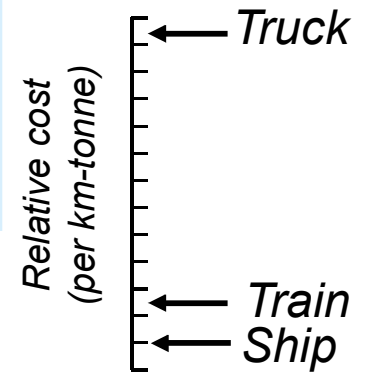
2. Build 'bioenergy corridors' around existing transportation systems:

- Shipping, train tracks, pipelines;
- Integrate biomass into fossil fuel infrastructure
- Crown lands valuable asset.

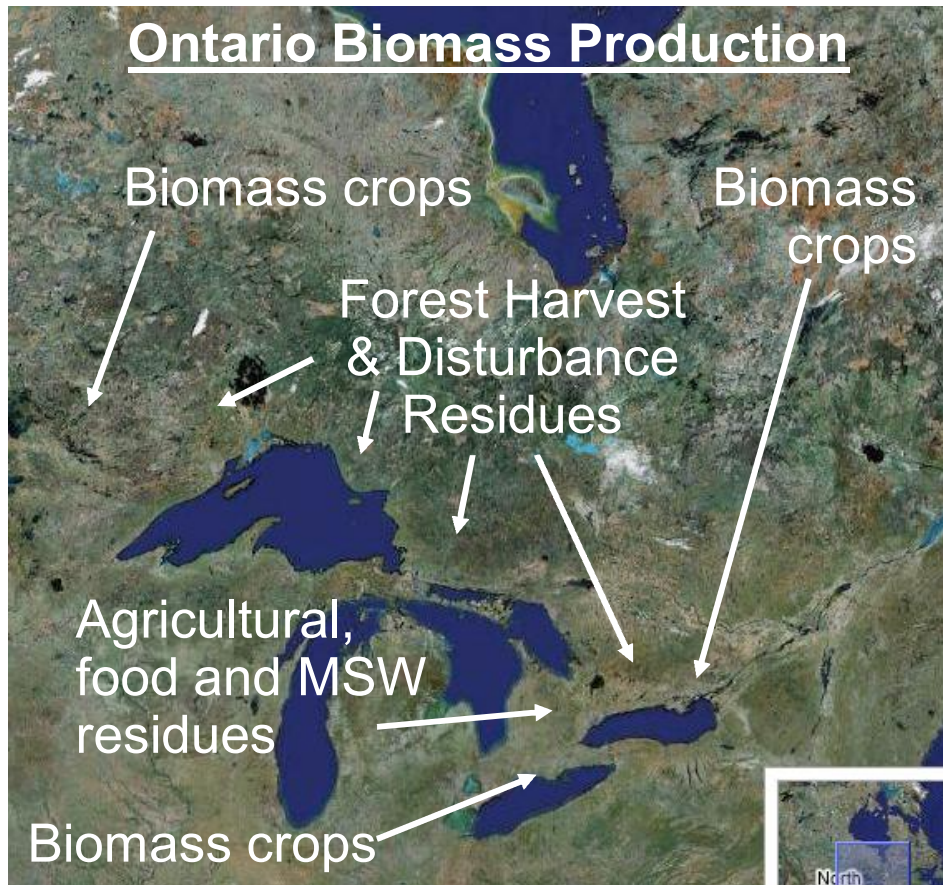
3. Establish dedicated bioenergy pipelines carrying densified biomass linked to larger 'biorefineries'

- e.g. Mountain Pine Beetle wood to oil sands

These strategies are needed to replace coal use in Ontario



The Great Lakes / St. Lawrence as a Bioenergy Corridor



Biomass Production:

- From a wide range of sources

Preprocessing & Transportation:

- Possible conversion to pellets;
- Regular pellets could be shipped by train;
- Water-resistant wood pellet technology could allow pipelining to deep water ports (coal slurry tech.);
- Ships bring biomass to large industrial users.

Biomass Users

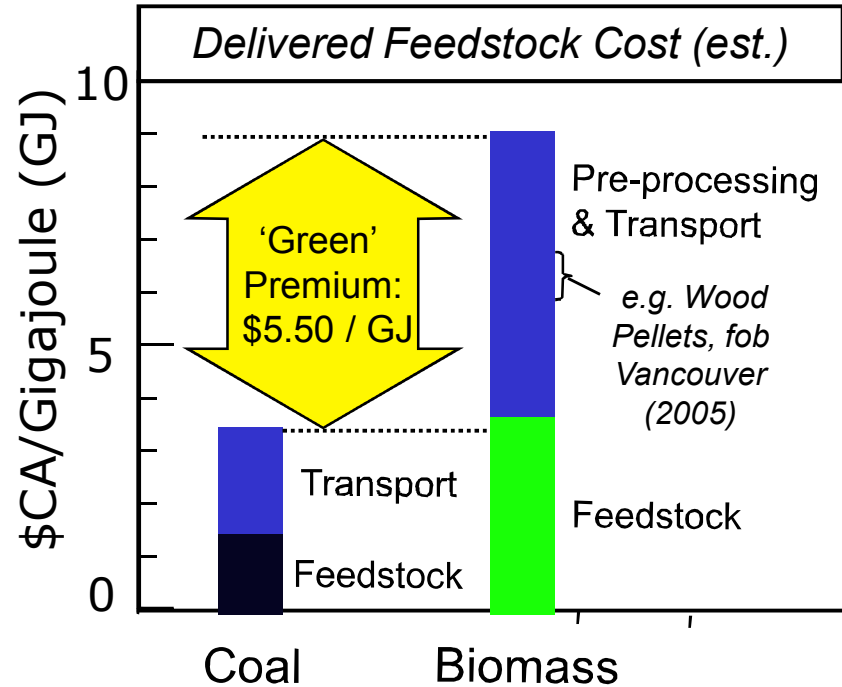
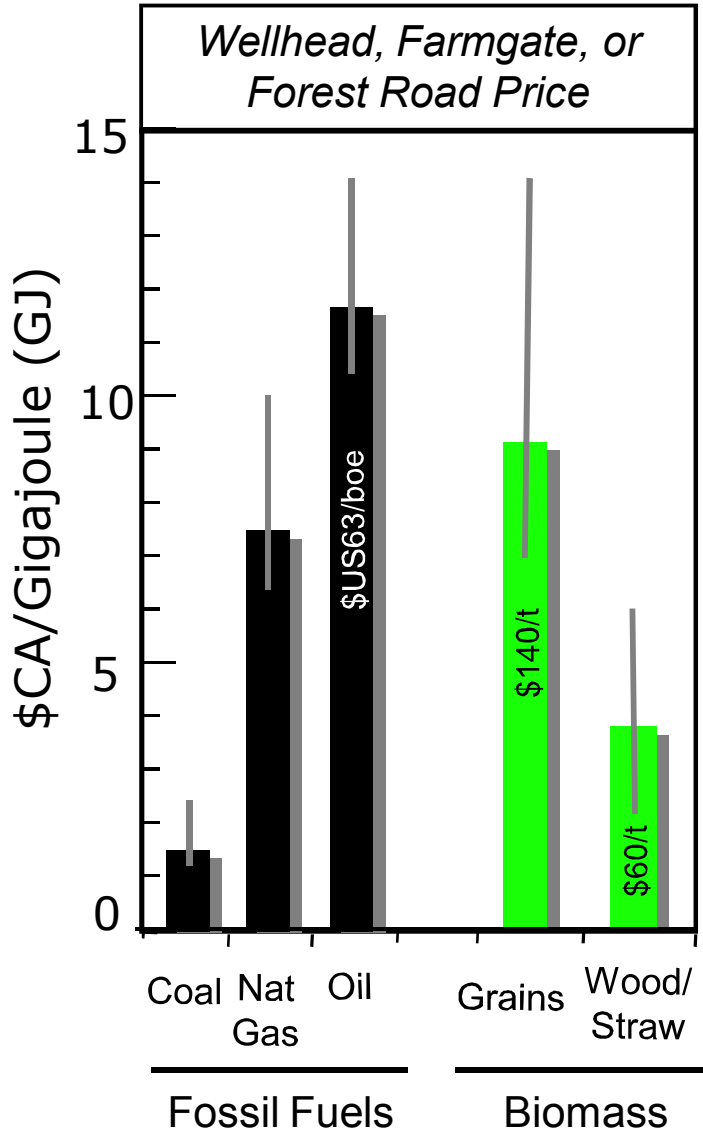
- Cement and steel making
- Power generation
- Biorefinery for fuels and chemicals (via pyrolysis and gasification)



What about the Economics?:

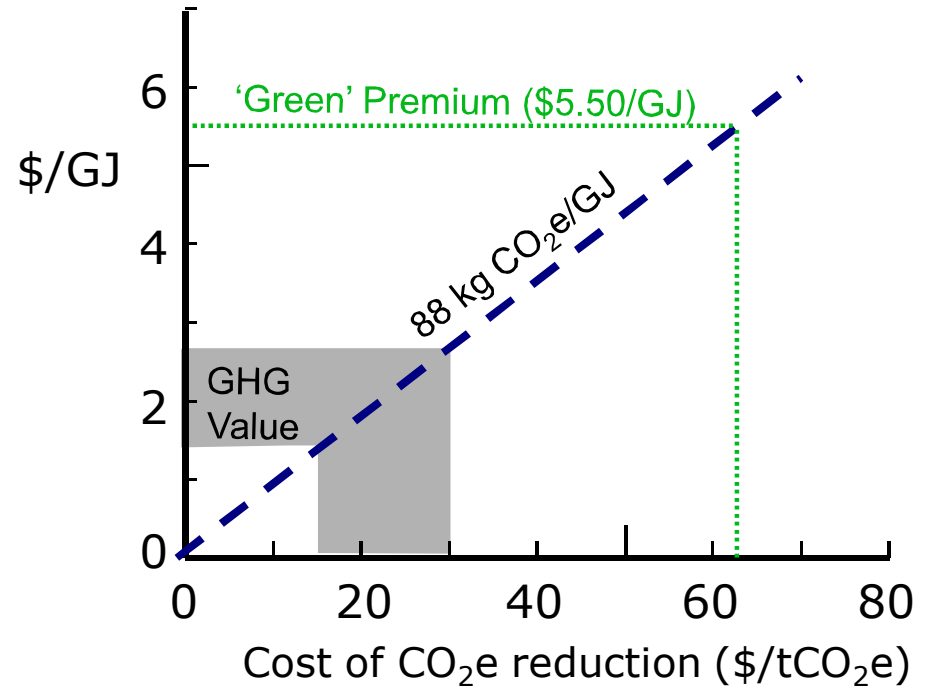
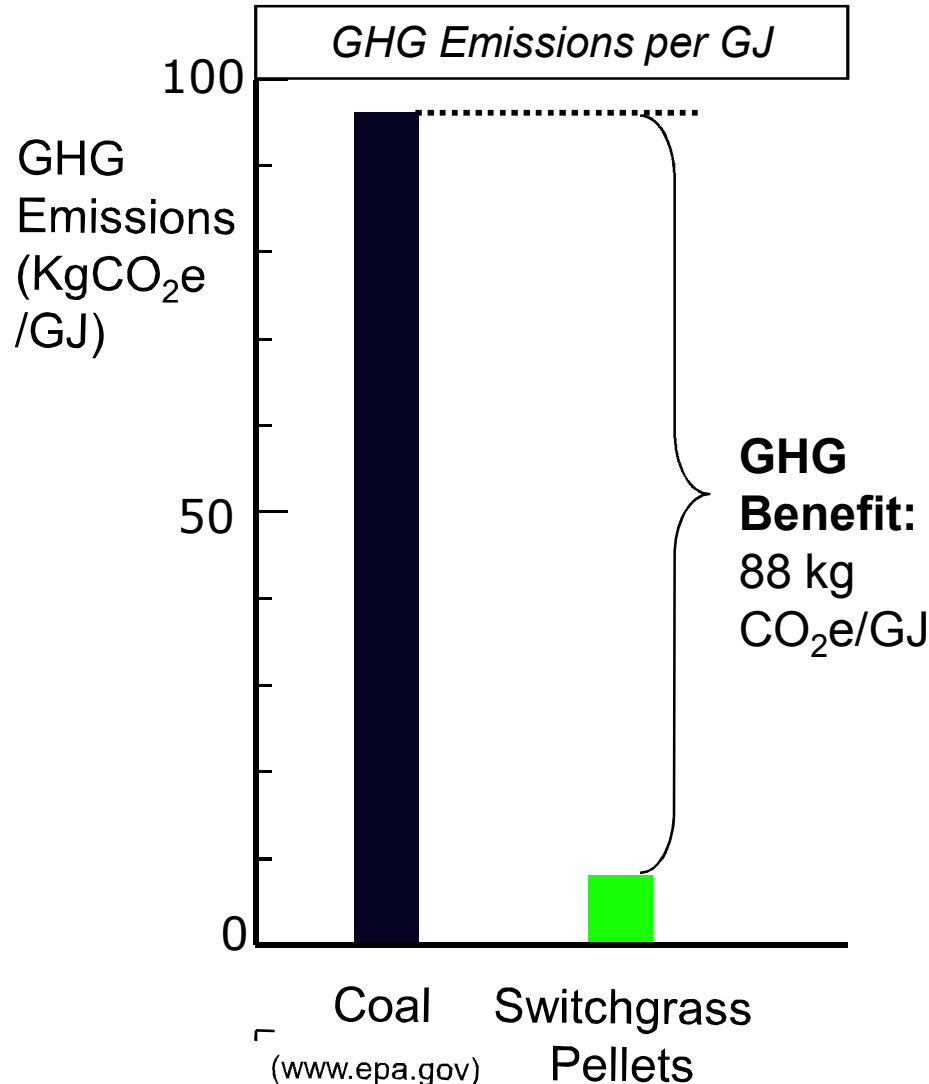
*...a complete analysis has yet to
be done, but...*

Cost Comparison: Coal vs. Biomass



How could a 'Green' Premium of \$5.50/GJ be justified?

GHG Emissions: Coal vs. Biomass



While part of the justification, the GHG benefit cannot carry the full burden for the added cost of bioenergy.

(Rural) Economic Development: Coal vs. Biomass

	\$B/yr	
	Coal	Biomass
\$ Leaving Ontario	\$1.2B	-
\$ Invested in Ont.	\$0.5B	\$4.5B
Total	\$1.7B	\$4.5B

New
Economic
Activity in
Province:
\$4.0B/yr

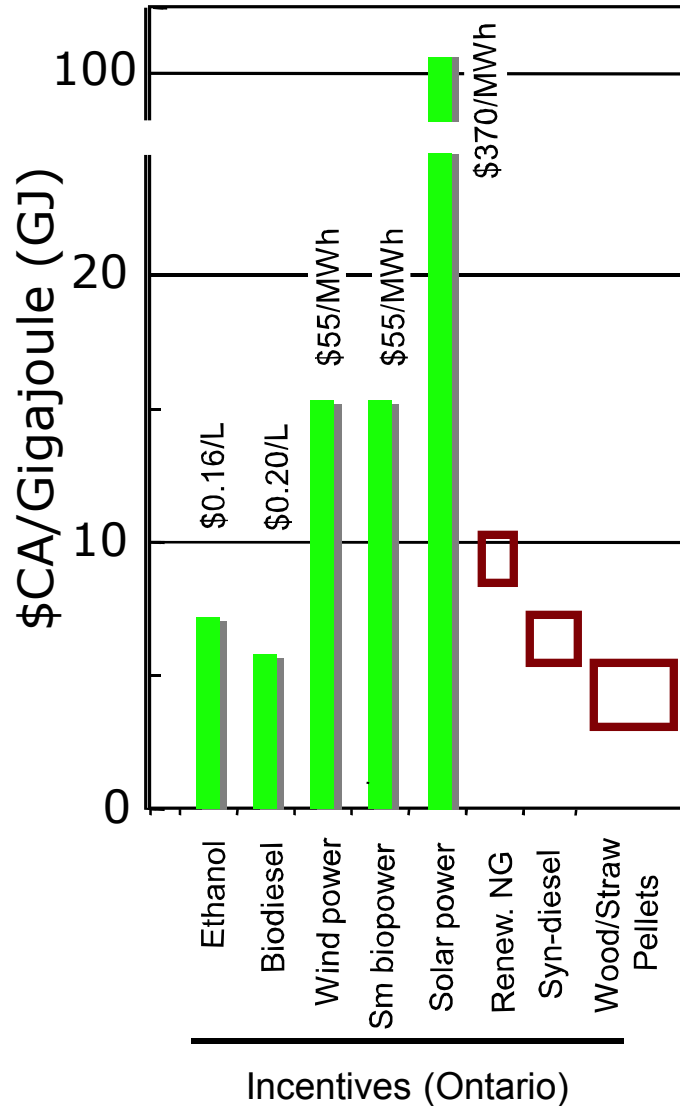
Outcome:

- New opportunities for agriculture, forestry, aboriginal groups, Northern Ontario, small communities;
- More tax revenue;
- More jobs;
- Fewer subsidies;
- Stimulation of other commercial activity

+ Energy Security + Cleaner Air

*Are these benefits worth another \$3 to \$4/GJ?
Precedence suggests that they are...*

Typical Renewable Energy Incentives are more than \$5.50/GJ



Incentives for solid biomass fuels in this range would help the province break its dependence on coal and provide 2 to 5 times the greenhouse gas benefit currently provided by incentives for ethanol & biodiesel.

Conclusions

1. Ontario-grown biomass is a credible alternative to coal use in the province;
2. The additional cost of biomass over coal could easily be covered by an incentive that is equal to or less than that provided to other renewable energy alternatives;
3. The GHG benefits of coal replacement by biomass would be up to 5 times that for grain-based ethanol;
4. There would be significant benefits for the rural economy;
5. To implement, we need a 'Made-in-Ontario' strategy that engages industry, producers, academe, environmental groups and policy makers.





For Further Information:



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