



Towards a Sustainable Bioeconomy: Opportunities and Challenges

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Capturing Canada's Green Advantage

www.biocap.ca





BIOCAP Canada Foundation

- a national not-for-profit research organization -

Mandate:

To provide the scientific insights, technologies and policy options to support the transition to a sustainable bioeconomy.

Approach:

1. Build partnerships & networks:

- Among academe, industry, government and NGOs;
- Knowledge transfer, focus R&D;

2. Leverage R&D investments

- \$38.5M (2002-2006) into 32 Univ.

3. Synthesize & Integrate across disciplines and sectors

- Through in house efforts & contracts

Capturing Canada's Green Advantage

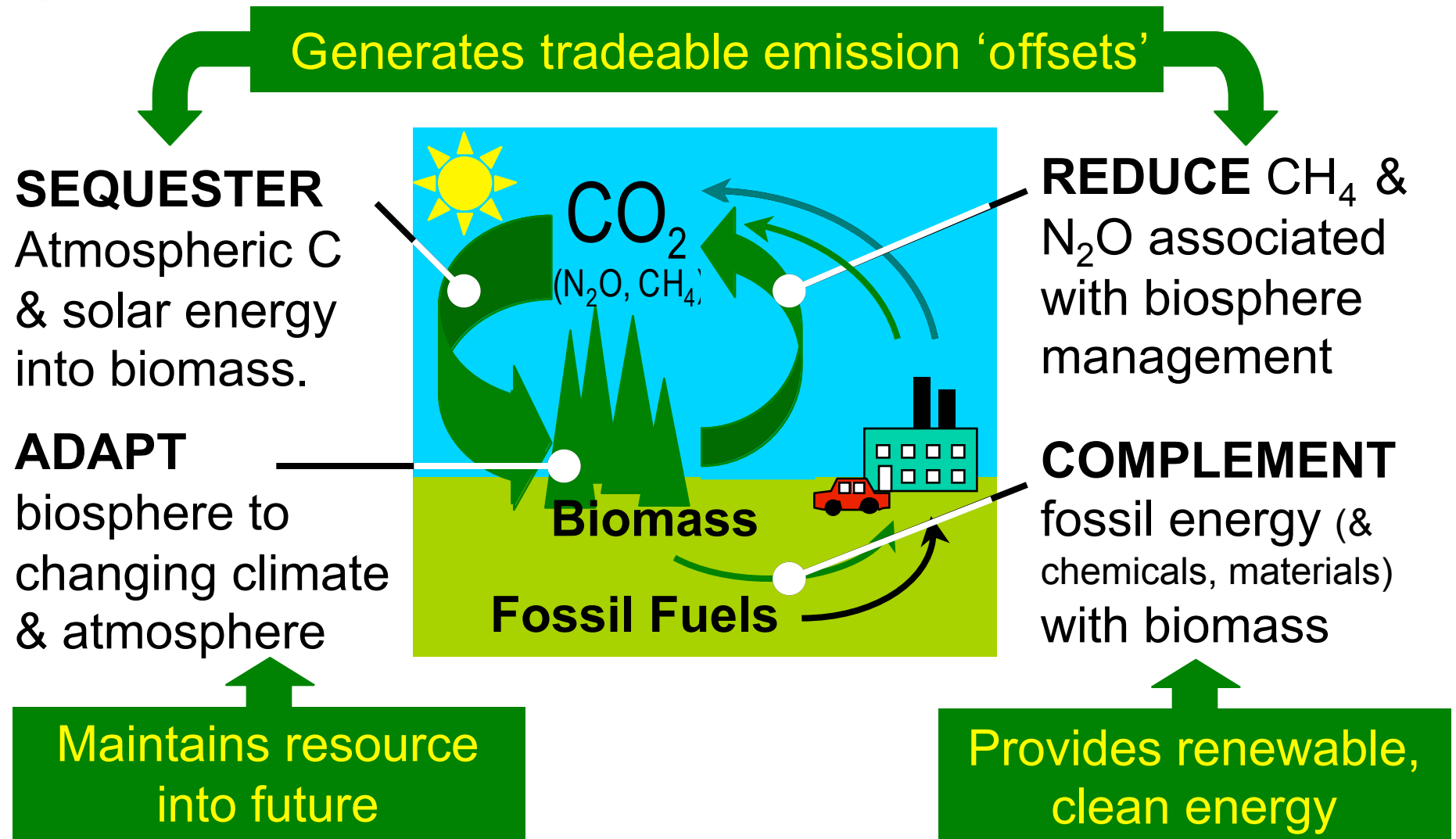
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A Sustainable Bioeconomy

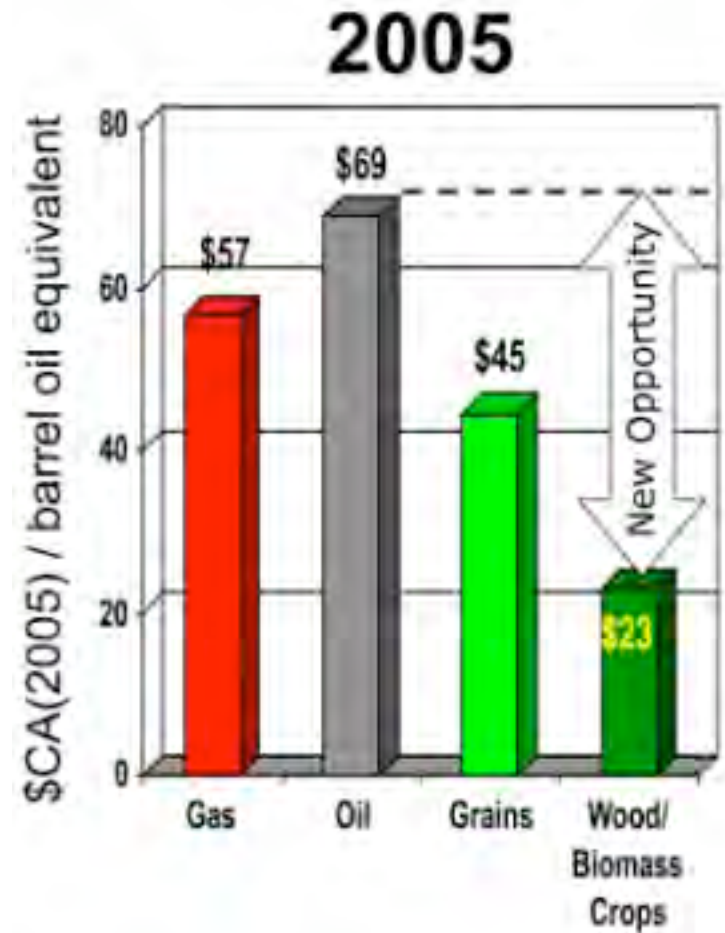
Improved management and use of our biological cycles



Sustainability & Renewability

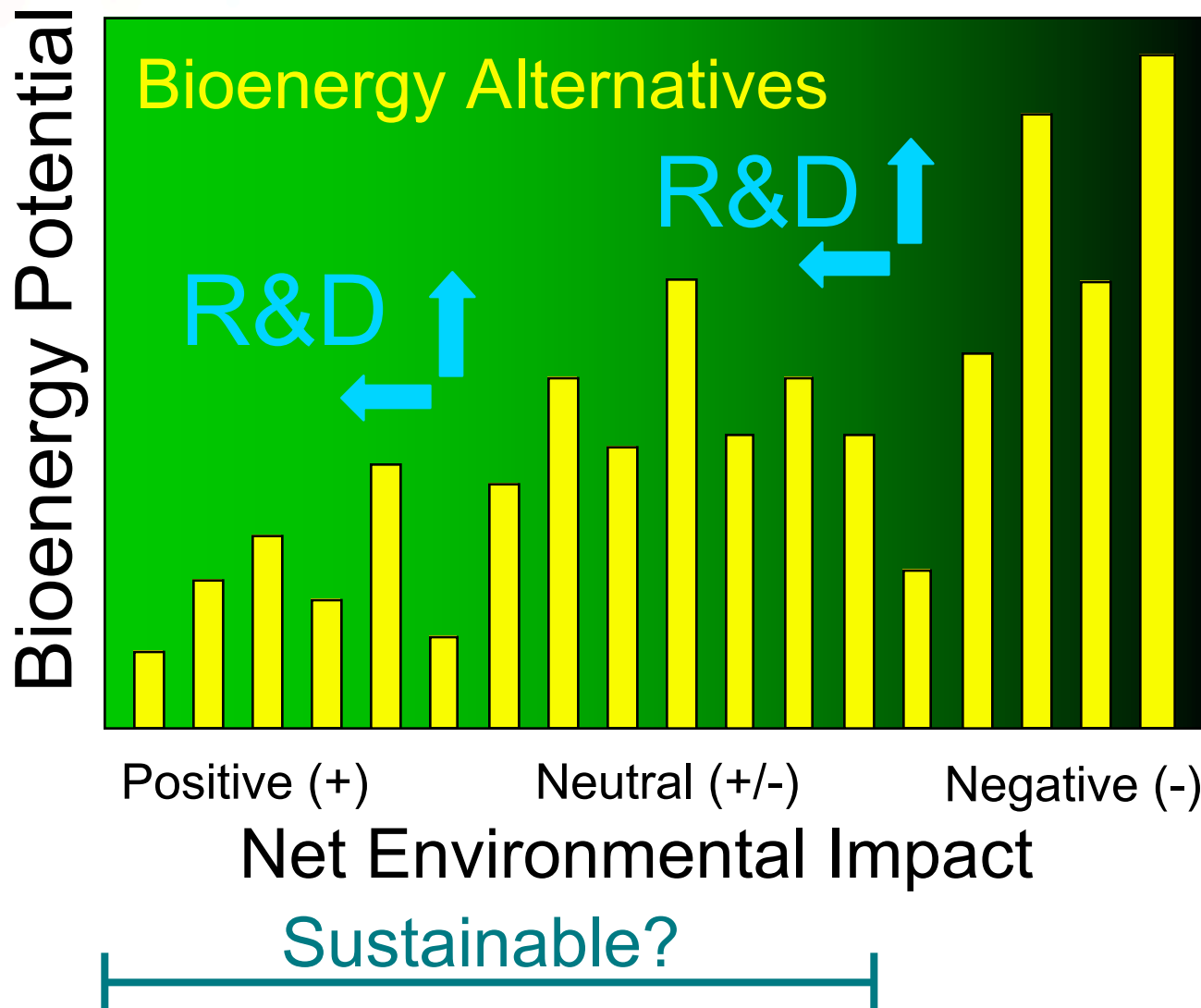
Triple 'E':

- Economic →
- Environmental
- Ethical/Social



All energy alternatives have an environmental footprint.

Bioenergy Solutions Vary in “Greenness”



Research & Development (R&D) will increase potential and sustainability of bioenergy alternatives.



*What is the
magnitude of the
sustainable
bioenergy potential
in Canada?*

*How does it
compare with other
nations?*





The USA has set a bioenergy target based on their potential



January 31, 2006

State of the Union Address

- *"America is addicted to oil"*
- *"Goal: to replace more than 75% of our oil imports from the middle east by 2025";*
- *"fund additional research... [to produce] ethanol, not just from corn but from wood chips and stalks, or switchgrass";*
- *"...dramatically improve our environment, move beyond a petroleum-based economy and make our dependence on middle eastern oil a thing of the past"*



Vision

for Bioenergy & Biobased Products
in the United States

The US Bioenergy Target

By 2030, a bioenergy goal “that is equivalent to 30% of current [US] petroleum consumption and will require more than 1B dry tons of biomass feedstock annually - a five fold increase over current consumption.”

Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply

April 2008



Biomass R&I

Feasibility Study (2005)

	Mt/yr	EJ/yr
US Forestry	334	5.3
US Agric.	906	14.5
Total	1,240	19.8

Canada has yet to define a longer-term bioenergy target.



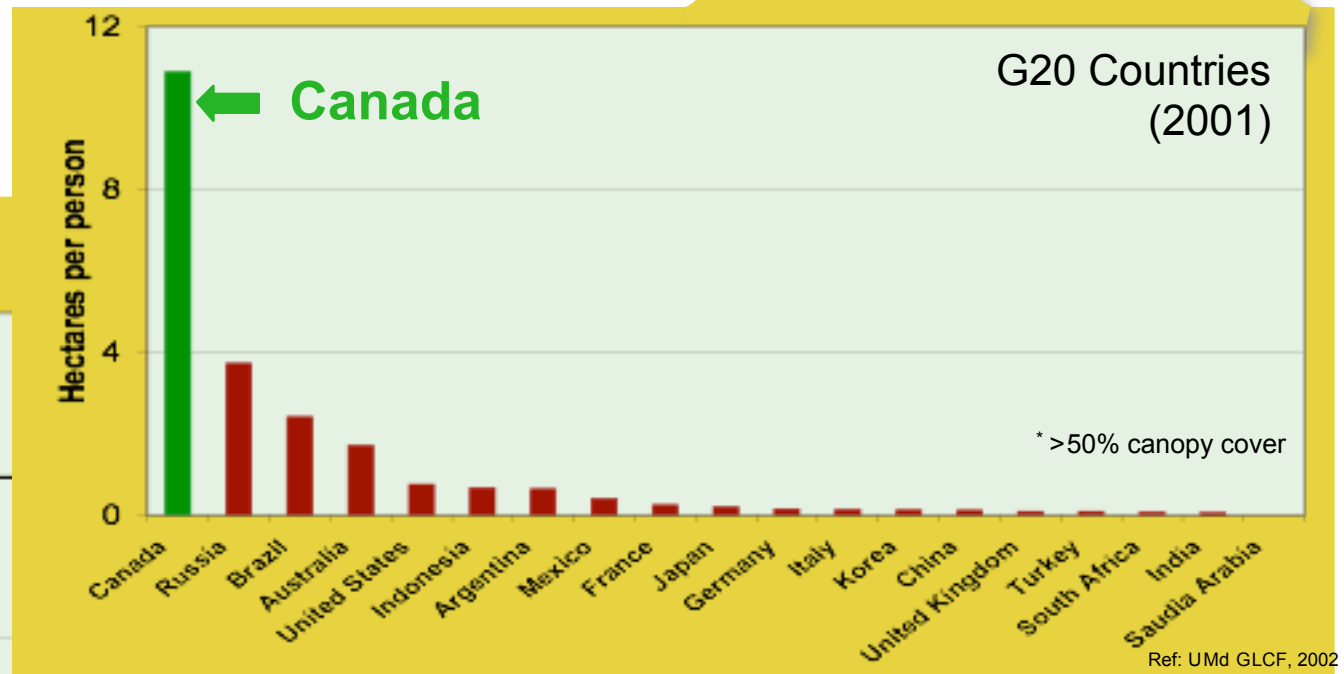
Why Set Targets?



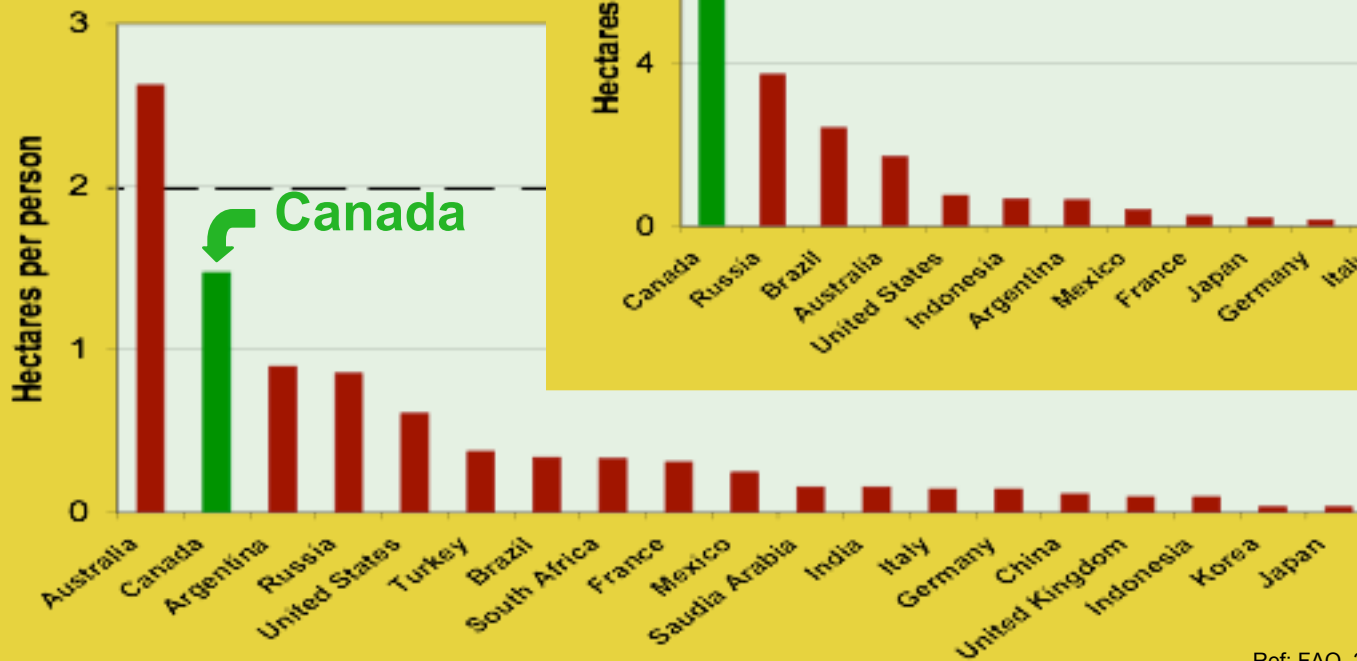
*"If you don't know
where you are going,
you will wind up
somewhere else."
Yogi Berra*

Canada's Green Advantage

Forest area per person*



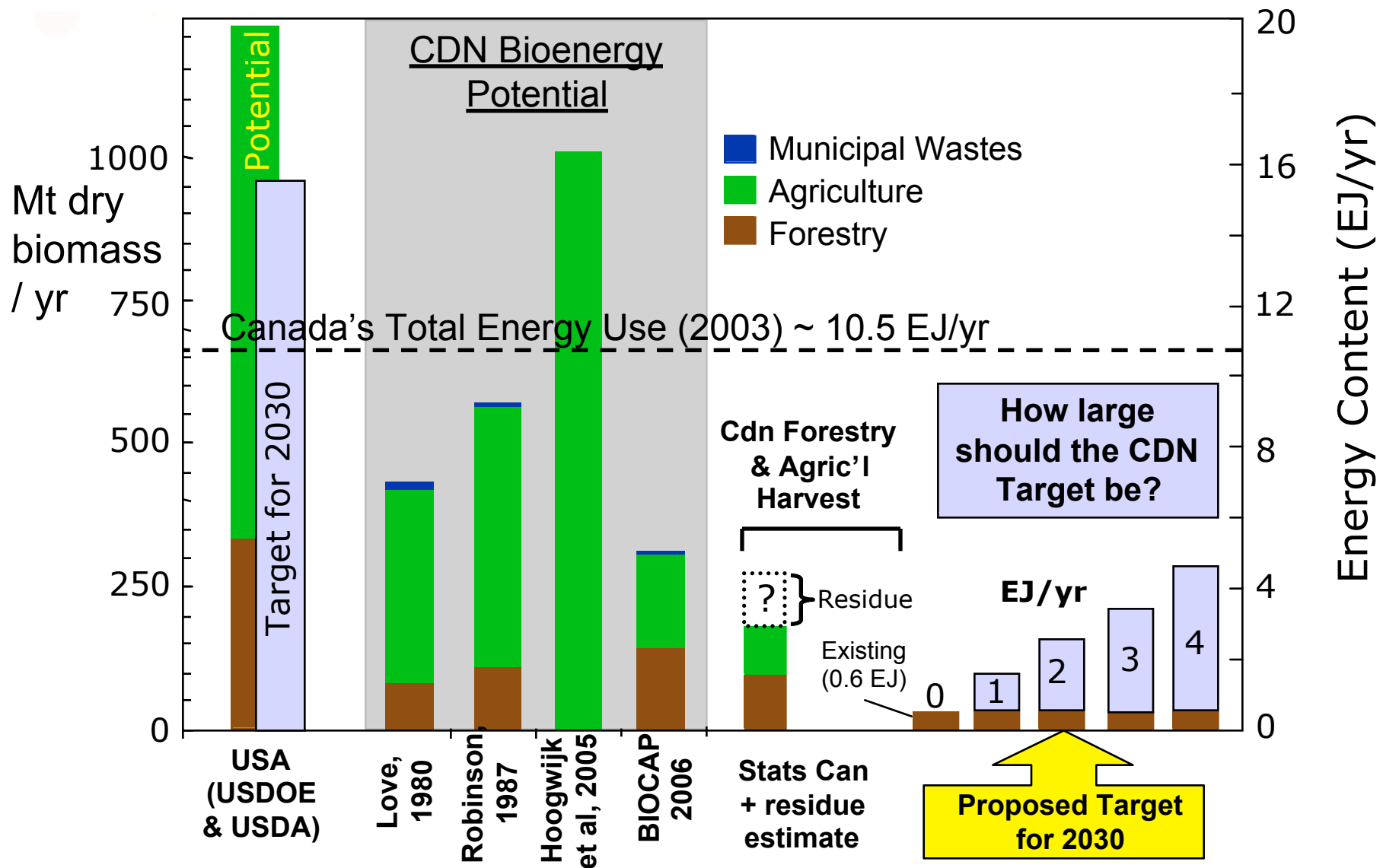
Arable land per person



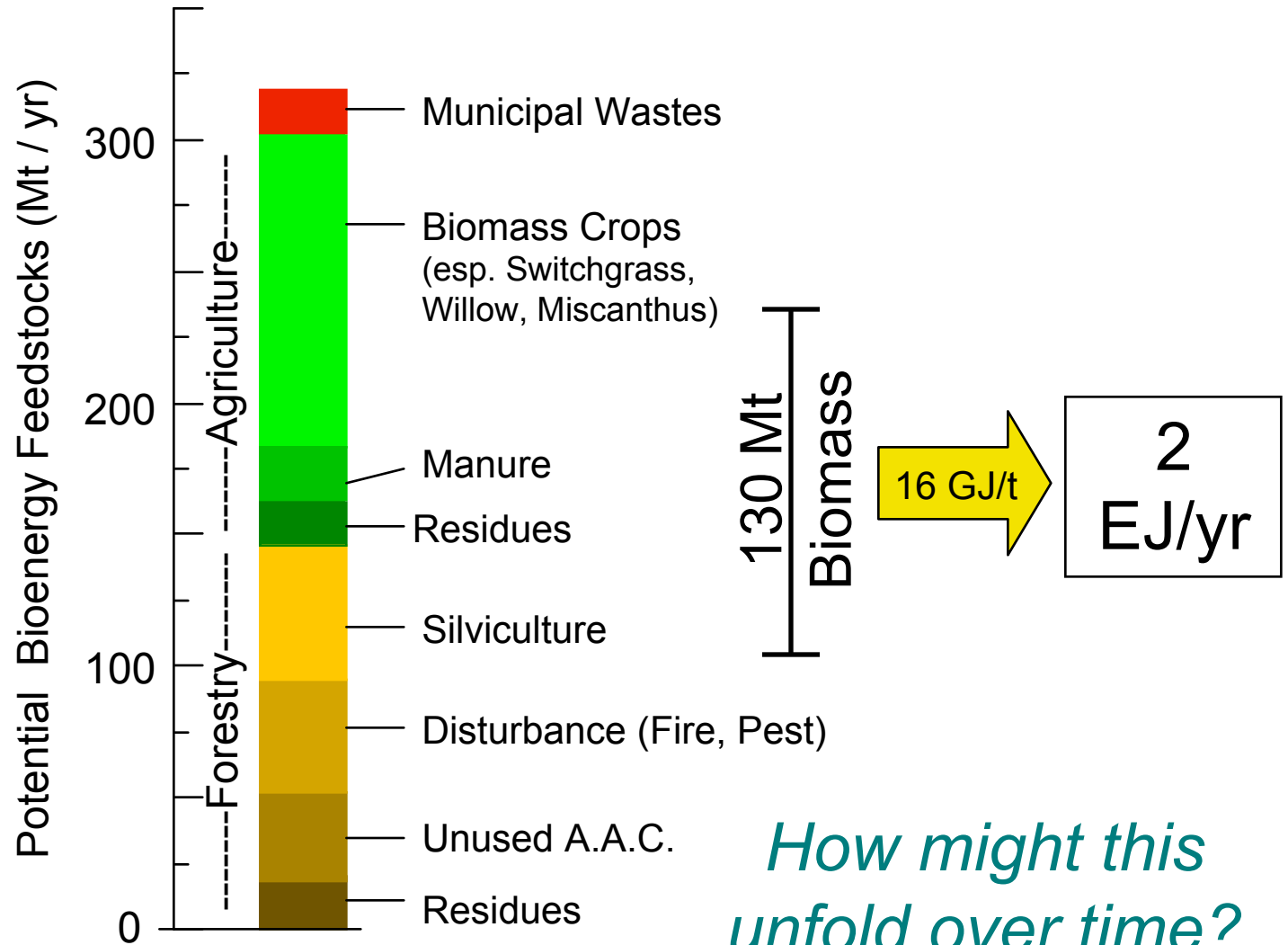
National Opportunity and Global Responsibility

A USA - Canada Comparison

- Bioenergy Potential vs. Targets -



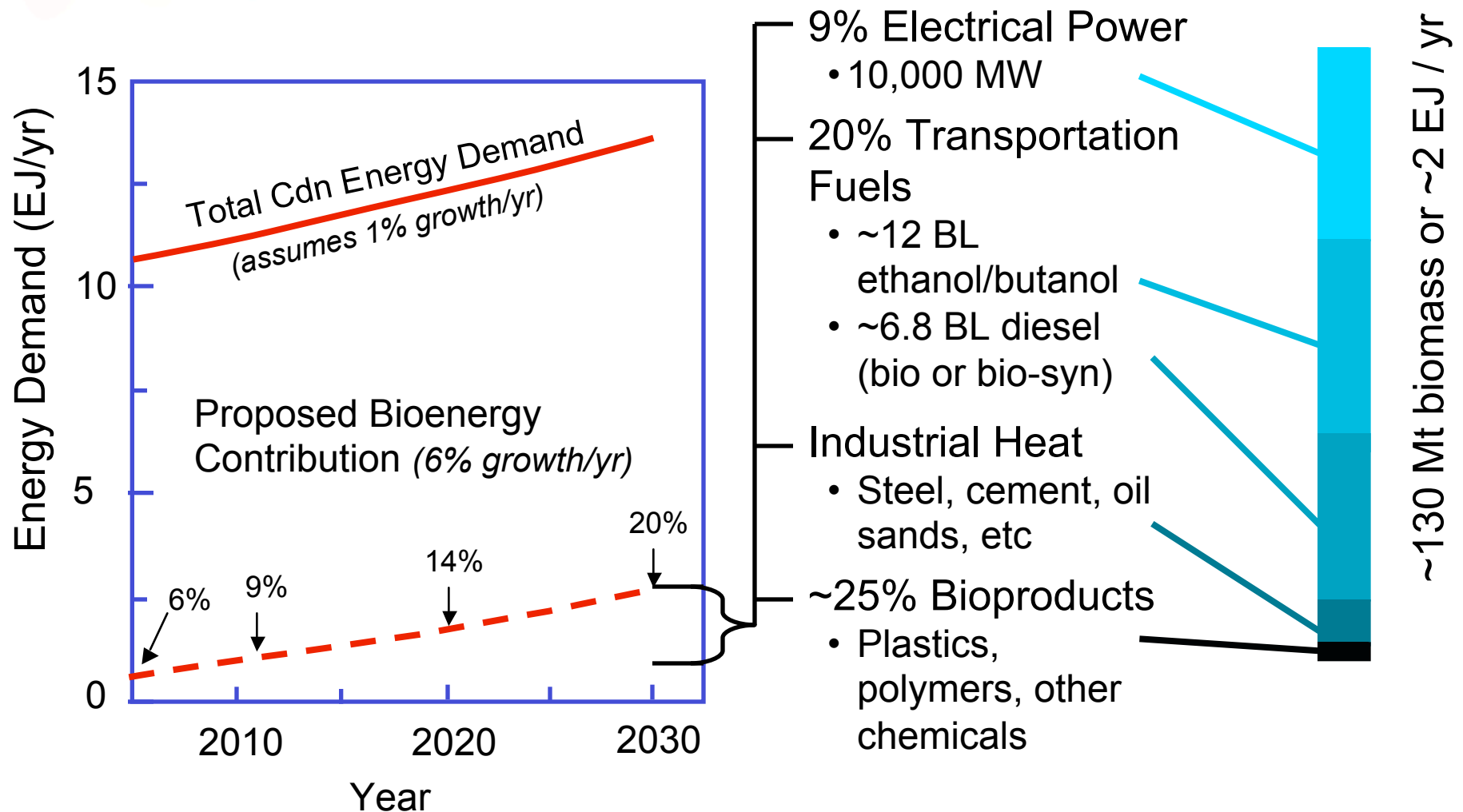
How Could a 2 EJ/yr Target be Met?



From BIOCAP, 2006

How might this unfold over time?

Vision for a Bioenergy Future





What would it mean for Canada?

- \$7.8B/yr (2005\$) invested directly in farms and forestry operations;
- \$30B+/yr (2005\$) stimulus to the national economy;
- 100,000 jobs across Canada;
- Greenhouse gas emission reductions of 70 Mt CO₂e/yr (*corrected for LCAs*);
- Cleaner air and water;
- Solutions for municipal & animal waste;
- Improved energy security;
- More fossil resources available to export.



A Sustainable Bioeconomy: *Addressing 21st Century Challenges*

Environment
(Climate Change, Clean Air & Water)

To get there from here, we need
transformative (not incremental) change.

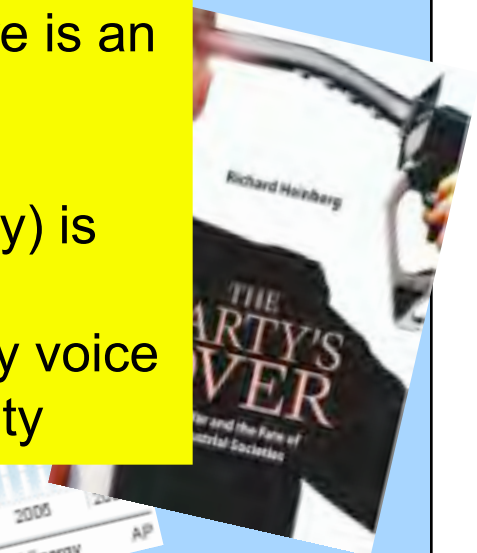
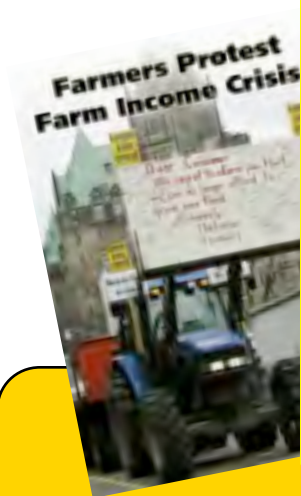
Challenges:

- Canadian public not yet convinced that there is an energy security issue;
- Environment may not be sufficient driver;
- Canadian economy (if not the rural economy) is booming;
- Canada lacks a strong, coordinated industry voice representing the larger bioenergy opportunity

Energy Security

Farmers Protest
Farm Income Crisis

Rural Economic Development





One more thing...

The Transportation Challenge



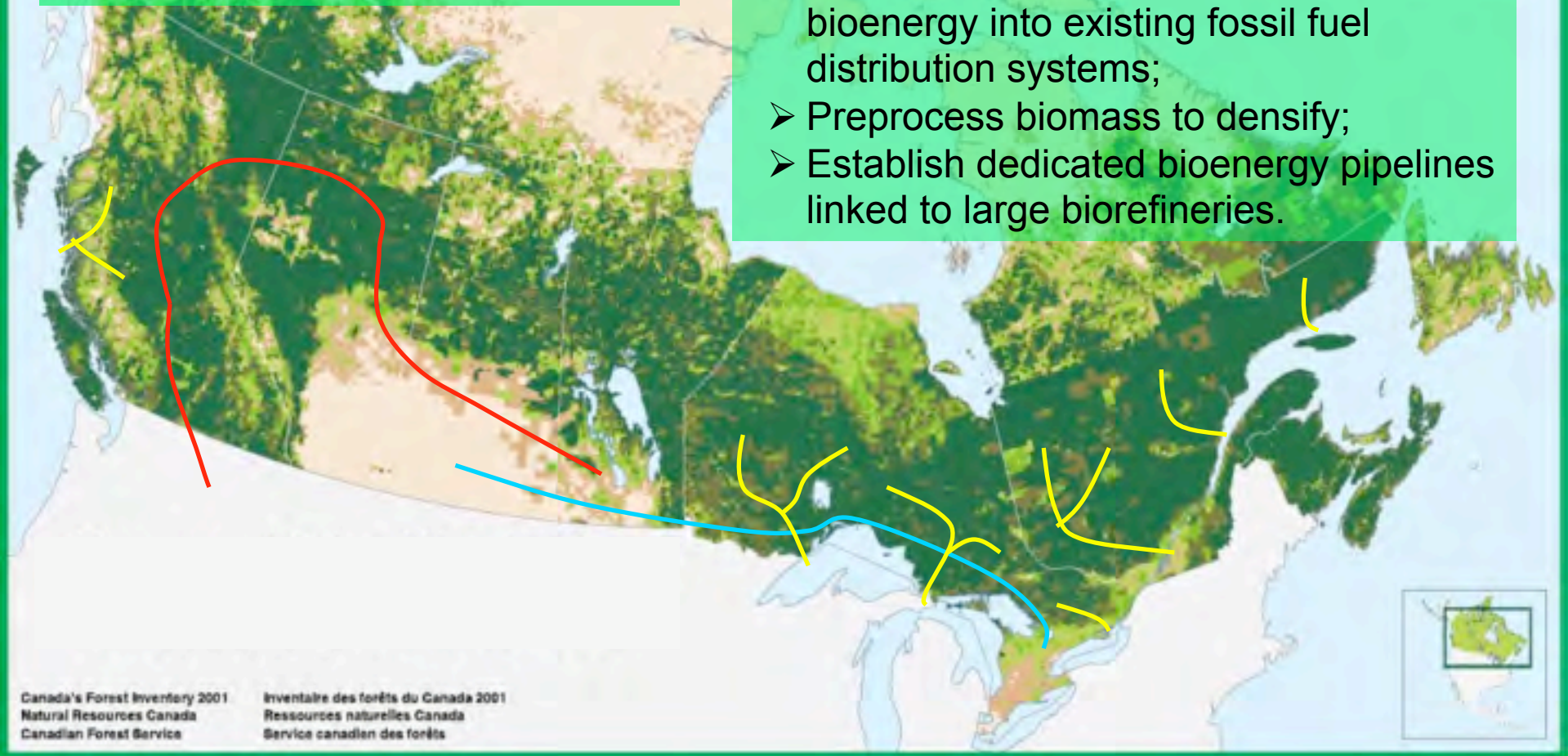
Transportation Distances

Challenge:

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

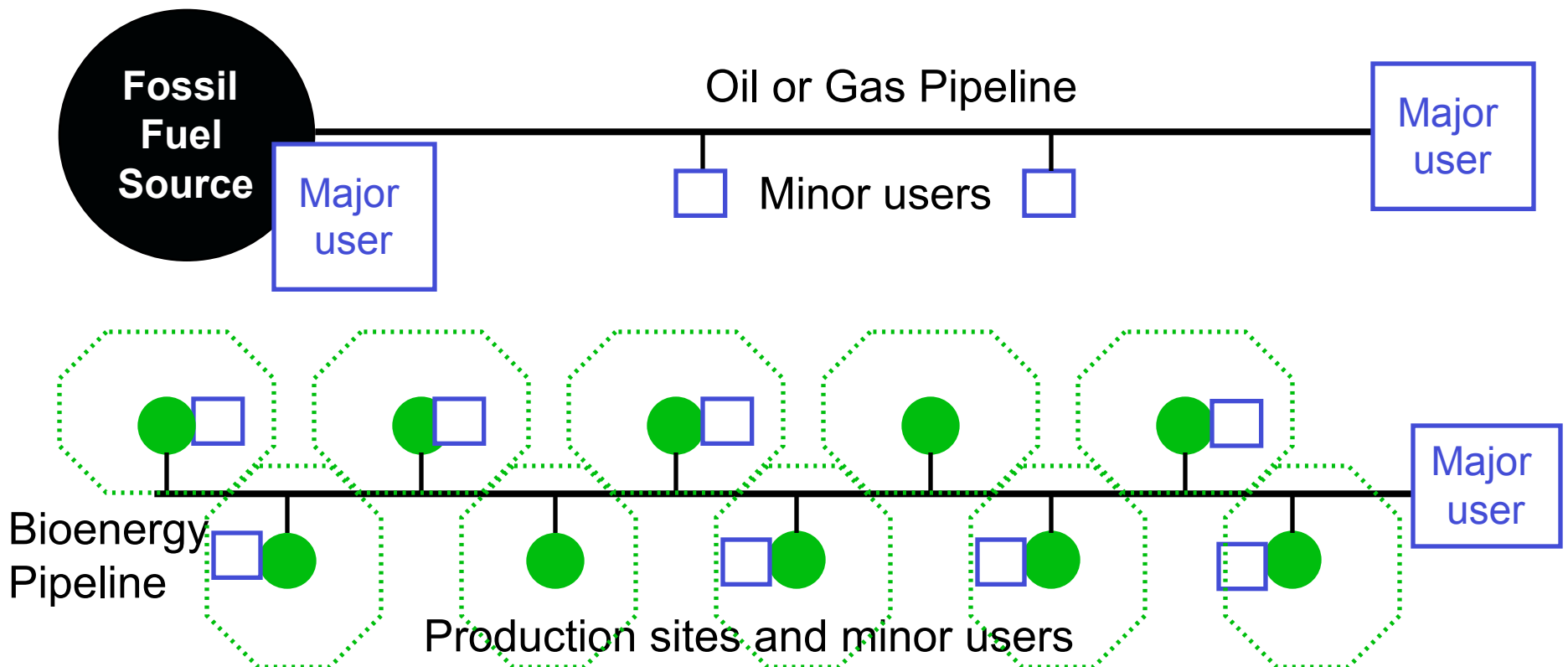
Opportunity:

- Build 'bioenergy corridors' around existing transportation corridors:
 - Shipping, train tracks, pipelines;
 - Crown lands valuable asset.
- Develop technologies to integrate bioenergy into existing fossil fuel distribution systems;
- Preprocess biomass to densify;
- Establish dedicated bioenergy pipelines linked to large biorefineries.



Scale and Pipeline Comparison

Petrochemical Refineries:	Barrels/day	Bioenergy Equiv. (Mt/yr)
World's Largest (Venezuela)	940,000	131
Canada's 17 refineries	112,000 (avg)	15.6





Moving Bioenergy in Pipelines

Minimal Processing

- Wood chips, straw
 - Wood pellets
- Carry in water stream (2nd product);
 - Can begin cellulose digestion in pipeline;
 - Pelleting technology can be water resistant

Processing to liquid or gas

- Pyrolysis oil
 - Biogas
 - Syngas
 - Hydrogen (H_2)
 - Methane (CH_4)
 - Methanol, ethanol, butanol
 - ??
- Mobile pyrolysis possible
 - Possibly integrate with clean coal technology
 - Poss. compatible with existing ff pipelines

Feedstock logistics and infrastructure will play a key role in determining the winners in large scale bioenergy/biorefinery.



If Bioenergy Corridors, Why Not Biodiversity Corridors?

- Natural ecosystem corridors to allow species to move in response to climate change;
 - Reduce ecosystem fragmentation
- Also replant after harvest with genotypes or species better adapted to future climate and atmosphere



Conclusions

1. Canada has huge bioenergy potential;

- *Need Targets and Transformative Change*

2. *Solutions needed for Canadian issues of scale and distance;*

- *Bioenergy corridors (shipping, trains, pipelines)*

3. *Sustainable Production;*

- *In both forestry and agriculture*
- *Adaptation to future climate*

“Canada is Really Big”

By The Arrogant Worms

“...you can put 14 Frances Into this land of ours...”

“...we’re bigger than Australia and it’s a continent...”

“... It is not what you do with it, It’s the size that counts...”

