# Evolution of Canada's Biofuel Industry

***David Layzell, Ph.D., FRSC***
*CEO and Research Director, BIOCAP Canada Foundation*
*Professor and Queen's Research Chair, Queen's University, Kingston, Ont.*

**Canada's Cleaner Energy Technologies for Today and Tomorrow**
*COP11 Side Event - Montreal, Nov. 30, 2005, 6:00 to 8:00 pm*

Capturing Canada's Green Advantage

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Future

Bioenergy and

# Evolution of Canada's Biofuel Industry:

## *Towards a Sustainable Bio-economy*

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# BIOCAP Canada Foundation

*- a national non-profit research organization -*

**Mandate:** To develop biosphere solutions to the challenges of climate change and clean energy by establishing, encouraging and capitalizing on Canadian research partnerships.

… Provide the insights and technologies to inform policy and investment decisions in government and industry

*Since 2002, BIOCAP has invested ~$6.5M to leverage $38.5 M (cash) in research at 25 universities in 8 provinces*

# A Unique Multi-sector Partnership

**Federal Gov't:**
- *Environment*
- *Energy*
- *Forestry*
- *Agriculture*

**Provincial Gov'ts**
- *British Columbia*
- *Alberta*
- *Saskatchewan*
- *Ontario*

**Non-Gov'tl Org**
- *Pollution Probe*
- *Pembina*
- *AgWest Bio.*
- *BioProd. Can*

**Universities**
- *Queens' (host)*
- *24 other universities*


**Energy**
- *Suncor*
- *Shell*

**Power Generation**
- *TransAlta*
- *Ont. Power Generation*

**Steel**
- *Dofasco*

**Cement**
- *Lafarge*

**Fertilizer**
- *Canadian Fertilizer Institute*

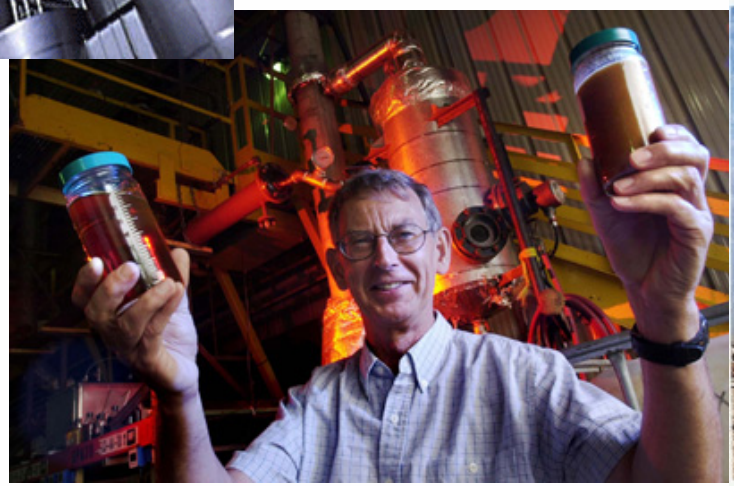
**Forestry**
- *AlPac*

*+ ~30 research partners associated with individual projects.*

# Biofuels will be the Foundation for the Transformation to a Sustainable Bioeconomy

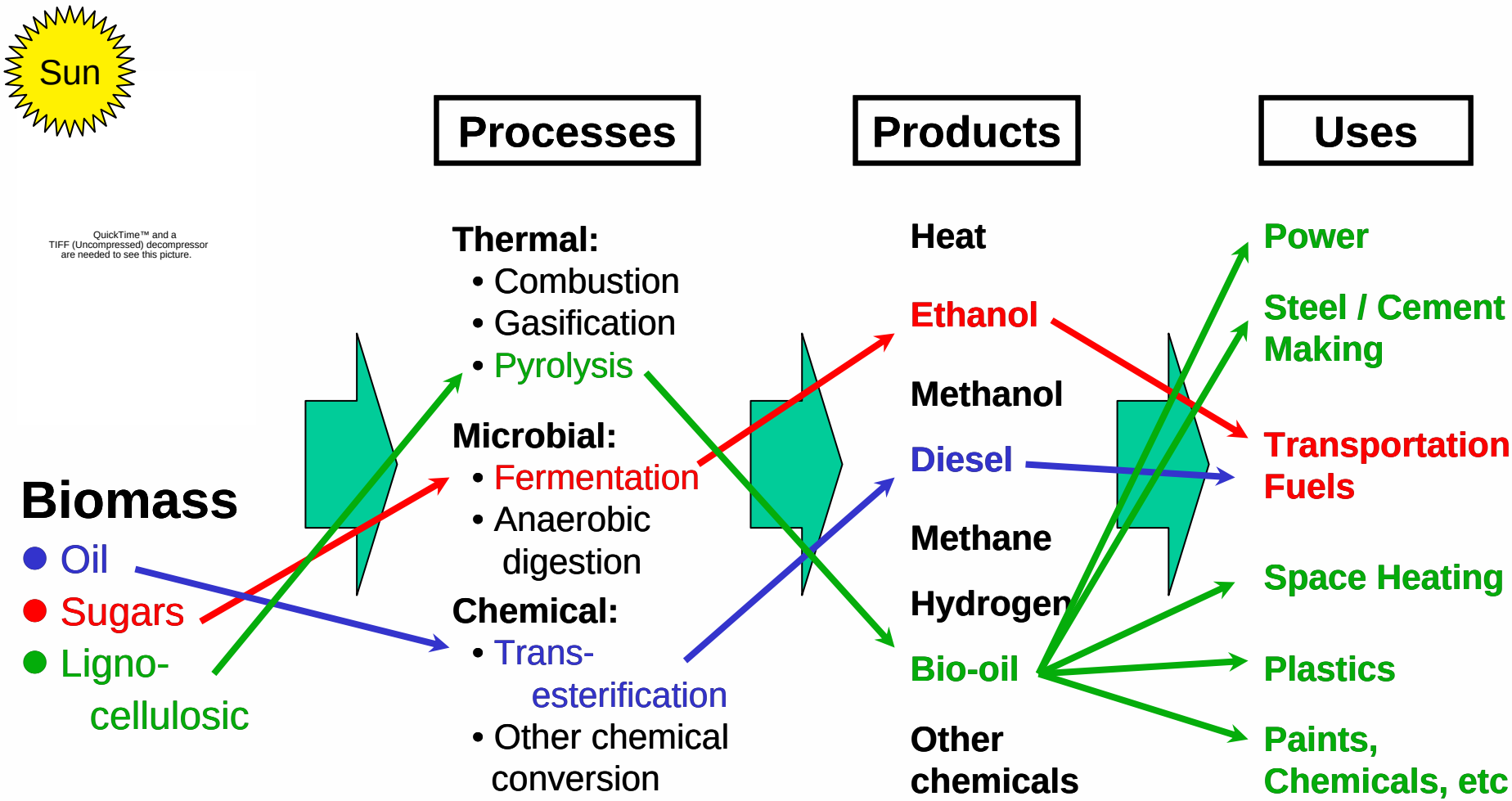
***Bioeconomy:***

*The use of the nation's vast forest and agricultural resources to provide renewable* ***energy, industrial feedstocks and environmental values,*** *in addition to food, feed & fibre.*



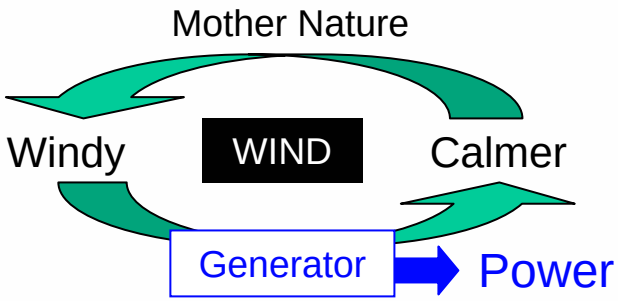
# Biomass:

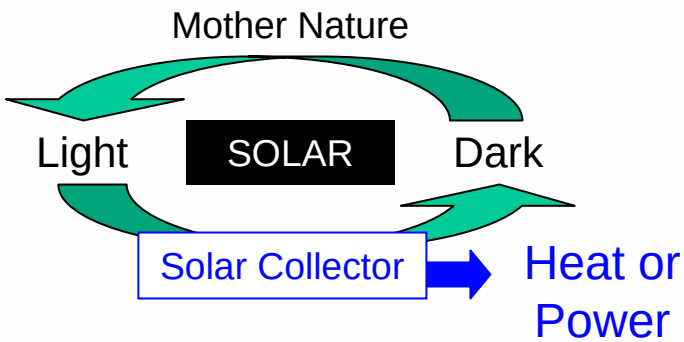
## … a highly flexible, renewable resource

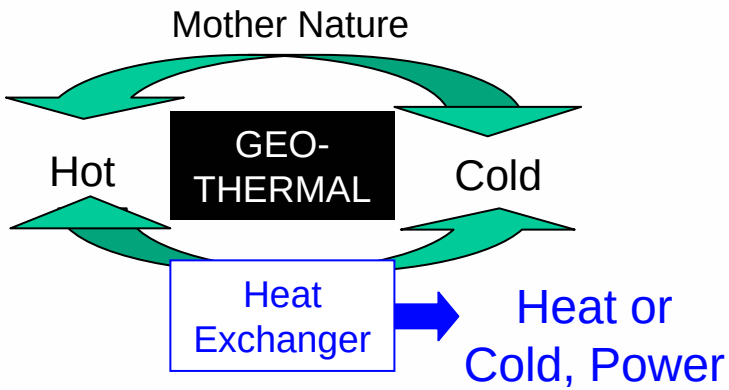


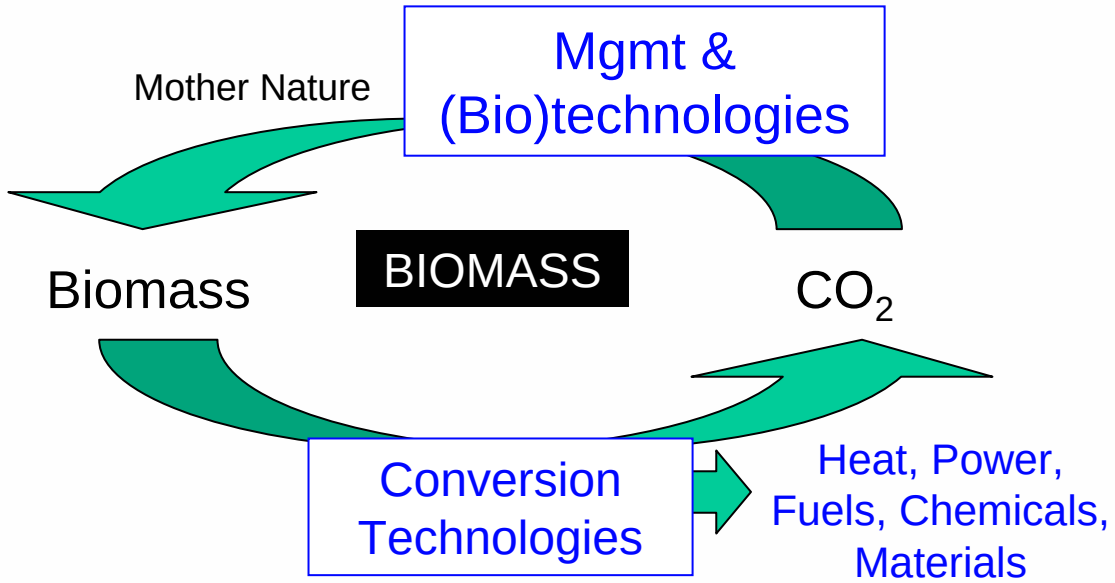

*Biomass energy differs from other renewable energy sources…*

# Biomass as a Renewable Energy



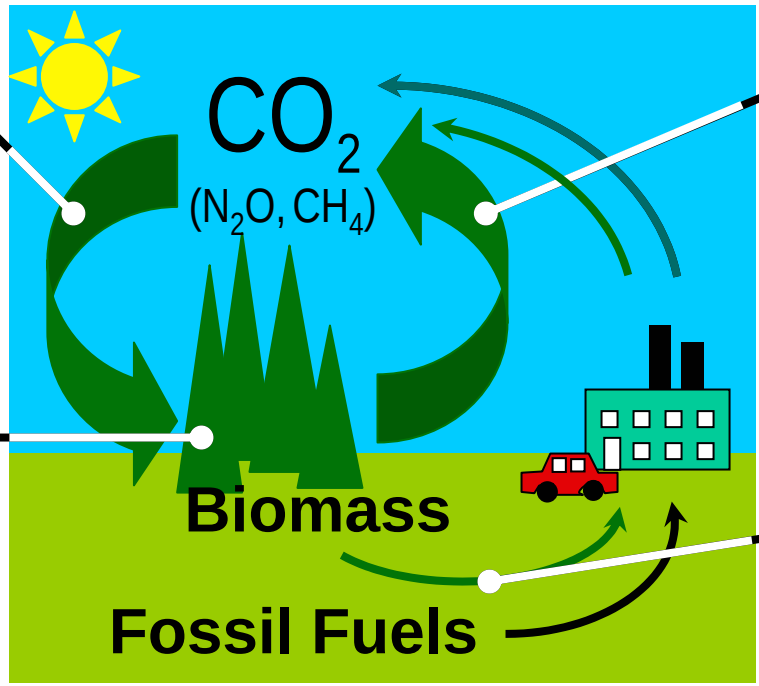

- Mother Nature doesn't instantly regenerate the biomass harvested for energy;
- Traditional bioenergy was not sustainable (potentially worse than fossil fuels);
- Biomass energy of the 21st century must focus on the entire C (and N) cycle.

# A Sustainable Bioeconomy

*The use of agricultural and forest resources to provide energy, industrial feedstocks and environmental values in addition to food, feed & fibre.*

**SEQUESTER** Atmospheric C & solar energy into biomass

**ADAPT** biosphere to changing climate & atmosphere




**REDUCE** $CH_4$ & $N_2O$ associated with biosphere management

**COMPLEMENT** fossil energy with biomass

*Does Canada have the biological resources to make a significant contribution?*

# A European Perspective…

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## Potential of biomass energy out to 2100, for four IPCC SRES land-use scenarios

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European estimate of Canada's bioenergy potential for 2050?:

**15 to 20 EJ/yr**

Canada's Total Energy Demand (FF, Hydro, Nuclear) in 2000 = **13 EJ/yr**

# BIOCAP Estimate for 2030: ~280 Mt dry biomass/yr = **5 EJ/yr**

Canada's Total Energy Demand (FF, Hydro, Nuclear) in 2000 = **13 EJ/yr**

*Sufficient energy to support:*

- ***Bioethanol*** *equivalent to 100% to 225% of current gasoline use (40B L/yr) assuming 325 L/t dry biomass,* ***OR***
- ***Bio(syn)diesel*** *equivalent to 62% to 139% of current diesel fuel use (30B L/yr) assuming 150 L/t dry biomass,* ***OR***
- *Electrical* ***power*** *equivalent to 27% to 61% of total power consumption (576 TWhr) assuming 35% conv. efficiency,*

# Challenges for Bioenergy & Biofuels

1. Transportation distances
   - New technologies for densification; distributed energy
2. Economics
   - Link to other values: rural economy, climate change, energy security, etc?
3. Regulatory barriers
   - New policies, incentives, etc.
4. Improved efficiencies, reduced impacts;
   - R&D for improved growth, collection, processing
5. Public perception / acceptance;
   - Education, dialogue

*There future is bright for biofuels to lead in the transformation towards a sustainable bioeconomy.*

# For Further Information


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