

# **Black Liquor Gasification and Bio-Fuel Production in Canada**

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# Black Liquor Gasification and Bio-Fuel Production in Canada

- ▲ Current Status of Black Liquor and Canadian P&P Industry
- ▲ BLG Options Under Consideration
- ▲ BLG and the Bio-Refinery – Challenges
- ▲ Conclusions
- ▲ Current BLG Activities in Canada

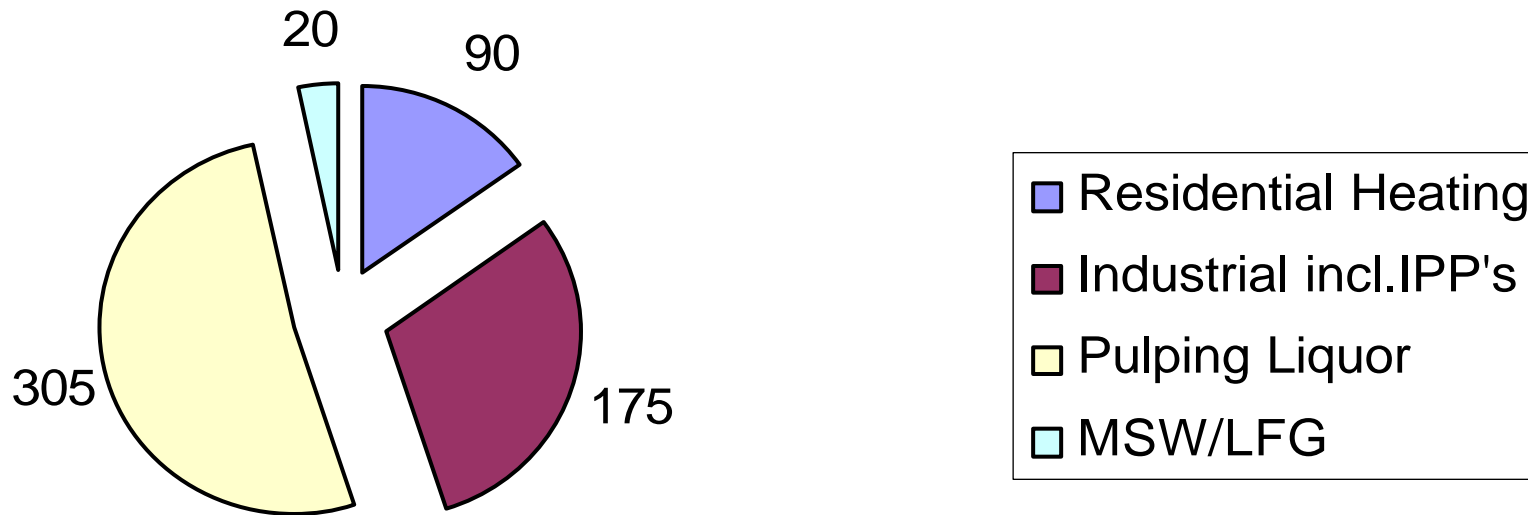
# Canadian Pulp & Paper Industry Current Situation

- ✦ Under ENORMOUS Pressure from Global Competition
- ✦ Generally Small Mills by World Standards
- ✦ Remote Locations Necessitate Self-Sufficiency
- ✦ Net Users of Energy: Supplemented from Fossil Fuels and Purchased Power
- ✦ Use 100% of all Wood and Wood Waste – Shortage of Excess Biomass
- ✦ Great Variation in Mills Across Country
  - Wood Species, Energy Use, Age of Equipment
- ✦ VERY Conservative and Risk Averse

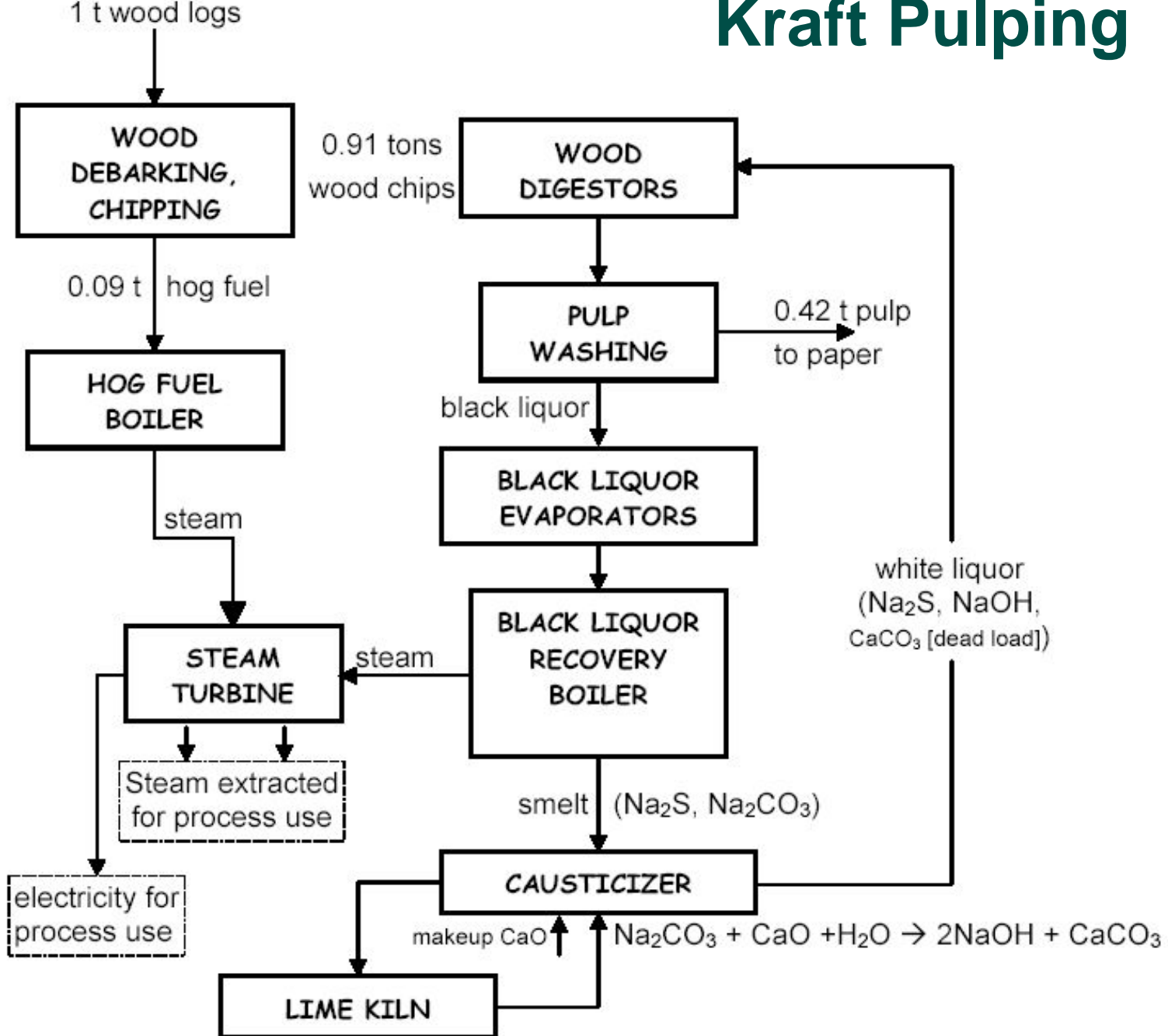


# Biomass Accounts for 5% of Canada's Energy Supply

Bioenergy in Canada 1996 ( PJ/a)



# Kraft Pulping



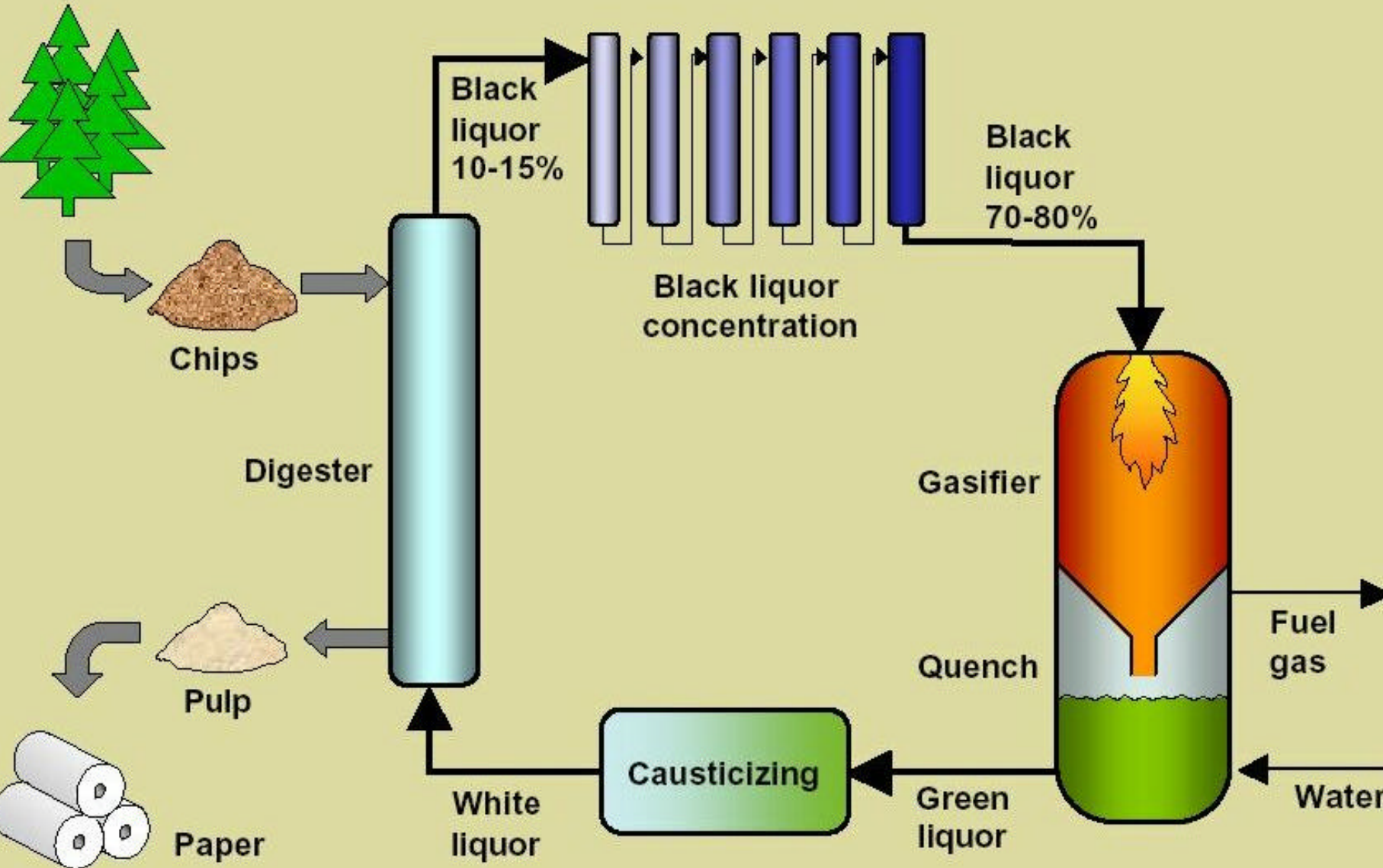
# Recovery Objectives

- To recover the chemicals from the spent cooking (black) liquor
- To produce fresh cooking liquor
- To incinerate the dissolved organic residuals to recover energy

## Steps

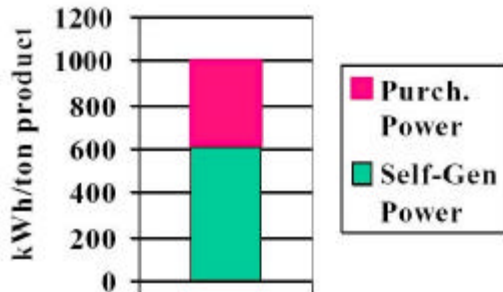
- concentration of weak black liquor in multiple-effect evaporators to form strong black liquor
- black liquor oxidation (if required)
- addition of saltcake to make up soda loss
- incineration of liquor in recovery furnace
- dissolving smelt from the furnace to form green liquor
- causticizing of green liquor with lime to form white liquor
- burning of lime mud to recover lime

# Pulping Cycle with Gasification



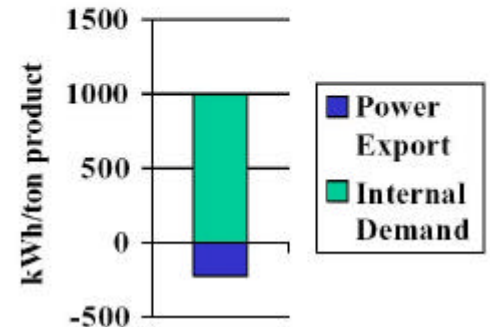
**Black Liquor Gasification offers energy self-sufficiency for the pulp and paper industry. It more than doubles the ability to generate electric power from renewable biomass – or alternatively it can produce significant amounts of liquid fuels and/or bio-based chemicals.**

**Bleached Kraft Paper Mill Power Generation and Consumption - Conventional**



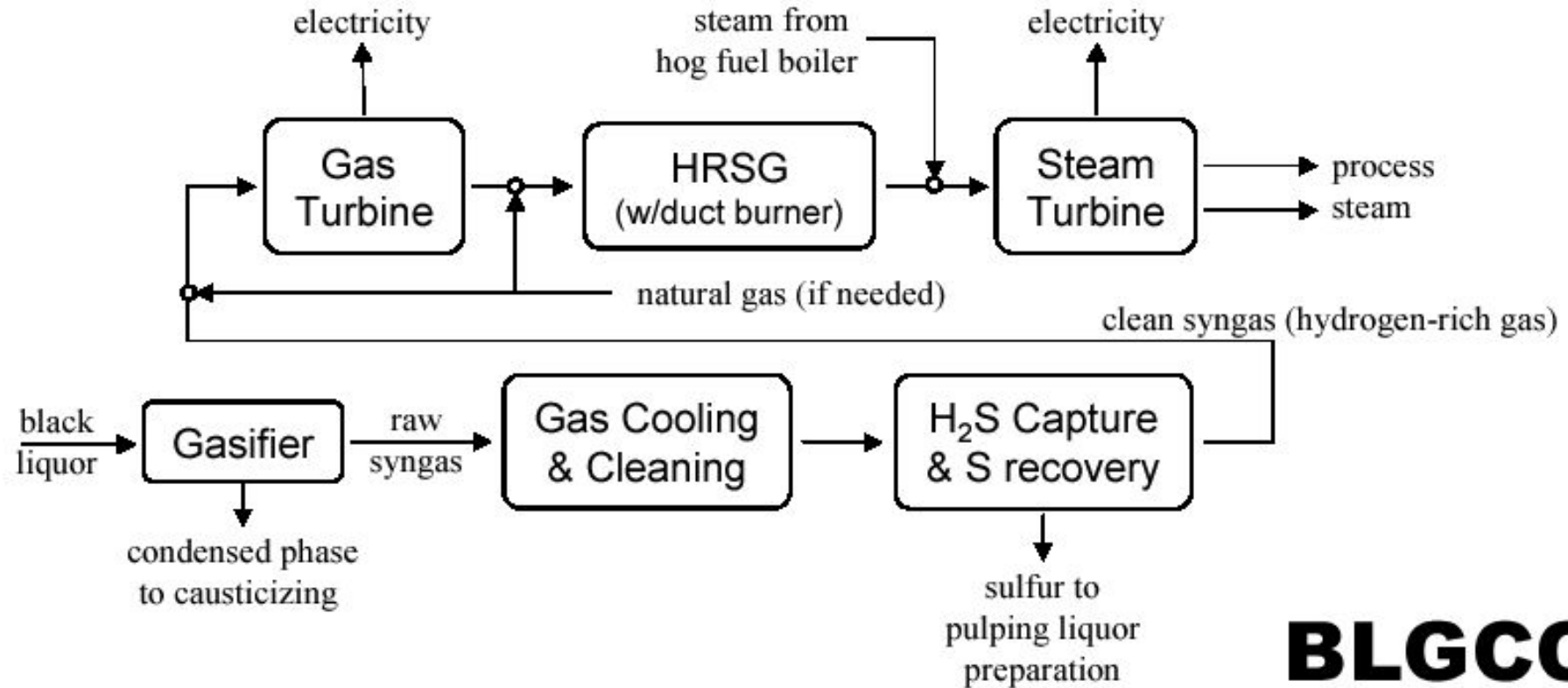
**BLG**  
→

**Bleached Kraft Paper Mill Power Generation and Consumption - Future**





# Black Liquor Gasification Combined Cycle



**Gasification**

```
graph LR; Gasification[Gasification] -- Syngas --> Synthesis[Synthesis]; Synthesis --> Methanol[Methanol]; Synthesis --> DME[Dimethyl Ether (DME)]; Synthesis --> FT[Fischer-Tropsch Fuels]; Synthesis --> Hydrogen[Hydrogen];
```

**Syngas**

**Synthesis**

**Methanol**

**Dimethyl  
Ether (DME)**

**Fischer-  
Tropsch  
Fuels**

**Hydrogen**

## Energy

- Double electrical output while maintaining steam output
- 5-10% higher thermal efficiency than modern recovery boilers

## Environment

- Lower CO<sub>2</sub> emissions by offsetting fossil fuel
- Lower emissions of NO<sub>x</sub>, SO<sub>2</sub>, CO, VOC's, particulates

## Economics

- Benefit from improved energy performance
- Can improve pulp yield by 2-4% through integration

## Other

- Eliminates risk of smelt-water explosions
- Benefits to mill processes (e.g. O<sub>2</sub>-delig, O<sub>3</sub> bleaching)

# Mill Integration Considerations

- Recovery and conversion of sulfur and sodium to pulping chemicals is ***as important*** as energy recovery
- 99+% recovery of S and Na is required, so excellent gas cleaning is a necessity
- Product gas must meet turbine inlet specifications (particulates, S, Cl)
- Non Process Elements or NPE's (K, Cl, etc.) must be dealt with

# BLG and the Bio-Refinery – Challenges

- ▲ Net Users of Energy – Source of Supplemental Power?
- ▲ Shortage of Excess Biomass
- ▲ Remoteness of Mills
- ▲ Scale of Mills
- ▲ Lack of Bio-Fuel Use, Infrastructure, Acceptance in Canada – What to do with Bio-Fuel Products?
- ▲ Conservative Nature of P&P Industry – Change is Painful
- ▲ \$\$\$\$\$\$\$

# BLG and the Bio-Refinery – Conclusions

- ▲ BLG will be a Hard Sell – Necessity for Survival?
- ▲ BLG & Bio-Refinery will be an even Harder Sell
- ▲ More than Just Economic Considerations
- ▲ BLGCC More Attractive Option
  - Meets Energy Demands
  - Ease and Flexibility of Selling Excess Power on Grid

# Canadian Initiative on Black Liquor Gasification

- ▶ Initiative to coordinate Canadian activities, and take advantage of existing and future funding programs

## ▶ MISSION

- To facilitate and accelerate the deployment of commercial-scale black liquor gasification in Canada. This will be achieved by reducing the technical barriers and fostering understanding of the potential benefits and risks of a successful installation

## ▶ 1<sup>st</sup> MEETING

- February 2003, Atlanta (IEA Annex XV Meeting)

# Canadian Initiative on Black Liquor Gasification

## ▲ PARTICIPANTS

- Natural Resources Canada
- Noram Engineering
- Norampac
- PAPRICAN
- UBC/PSL
- UofT/Simulent





# Canadian Initiative on Black Liquor Gasification

## ▲ Future Direction

- Focus activity and develop National Strategic Direction
- Share Information
- Secure additional sources of funds
- Broaden participation
- Continued International Cooperation – IEA Annex XV
- Transition to Industry-led Initiative