



# **BC Bioenergy Network**

*PARTNERING FOR  
A GREENER FUTURE*



**Networking to build a world-class  
bioenergy industry in British Columbia**

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**WASHINGTON  
BIOENERGY  
RESEARCH  
SYMPOSIUM**

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# Mandate

- Maximize the value of BC's biomass resources;
- Develop mission-driven research, development and demonstration projects;
- Reduce GHG emissions;
- Network and partner in BC, Canada, and internationally, to advance BC's bioenergy sector; and
- Leverage funding to support BC-focused bioenergy technology and applications.



Develop and grow a  
world-class bioenergy  
industry in BC

# Establishment and Bioenergy Progress in BC



- April 2008
  - Established with \$25 Mil grant from the BC government
- 2009
  - Strategic Relationships via MOU
    - Sustainable Development Technology Canada
    - Innovative Clean Energy (ICE) Fund
    - Terasen Gas Inc.
    - BC Hydro
    - Green Heat Initiative



# Bioenergy Capacity Building in BC



- New Ventures BC Competition \$90,000
  - 3 Year support and Bioenergy Prize:
  - Bluekey Energy and Quadrogen Power Systems
- BC Bioenergy Network Conference, Vancouver BC, 2009
- Northern Bioenergy Partnership, Prince George, BC, 2010
- ARDCorp for the Renewable Agri-Energy Initiative – Capacity Building \$100,000
- 4th International BioEnergy Conference & Exhibition, June 8-10, 2010 Prince George
- MITACS Accelerate Program



# Co-Investments: Grants & Loans in 2009

- Nexterra Energy Corp: \$3.0 Mil investment
  - Thermochemical - Clean syngas research and commercial project demonstration
- Lignol Innovations: \$3.0 Mil investment
  - Biochemical - High purity lignin and ethanol pilot plant
- Cedar Road LFG: \$400,000 investment
  - Landfill gas to electricity generation - Collaborative Development and Demonstration Centre
- Clean Energy Research Centre, UBC, Gasifier Restart: \$100,000 investment



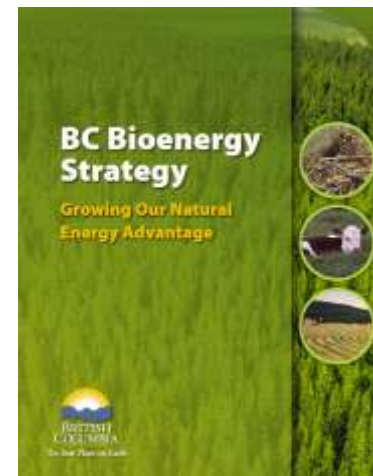
# Co-Investments: Grants & Loans in 2010

- ICC Group: \$1.5 Mil
  - Conversion of municipal source separated organic waste into synthetic diesel and aviation biofuels using Fischer-Tropes process
  - \$7.7 Mil project
- Bakerview EcoDairy: \$240,000
  - BC's first small scale on-farm anaerobic digestion pilot plant converting dairy cow waste to heat and electricity
  - \$600,000 project
- Wood Pellet Association of Canada: \$85 -135,000
  - Evaluation of torrefaction technology
- Terasen Gas Community Energy System Quesnel: \$200,000
  - \$17 Mil project



# BC Policy and Regulation Since 2007

- BC Climate Action Plan (2007)
  - Legally binding commitment to reduce GHG emissions (at 2007 levels) by at least 33 per cent by 2020 and 80 per cent by 2050
  - 90% of BC municipalities committed to carbon neutrality by 2012
- The Carbon Tax - first in North America
- Signatory to Provincial-International Climate Change Agreements
  - Western Climate Initiative
- BC Energy Plan (2007)
- Clean Energy Act (2010)
- Other Regulations and Policies
  - BC Bioenergy Strategy (2008)
  - Renewable Fuel standards (2009)
  - Low Carbon Fuel Requirements (2009)



# Transportation Biofuels and Co-Products

## Alcohols, Heat and Power

- Northwind Ethanol
  - Location: Prince George, BC
  - Feedstock: Starch residues and wood waste
  - Technology: Low temp acid hydrolysis
  - Outputs: Ethanol (starch and lignocellulosic), heat & power
  
- Syntec Biofuel
  - Location: Washington State Corporation with operational headquarters in Vancouver
  - Feedstock: Organic material including wood chips, garbage
  - Technology: Biomass-to-Alcohols thermo-chemical process that converts organic material to gas and catalytic conversion into alcohol
  - Outputs: Ethanol, methanol, butanol, propanol

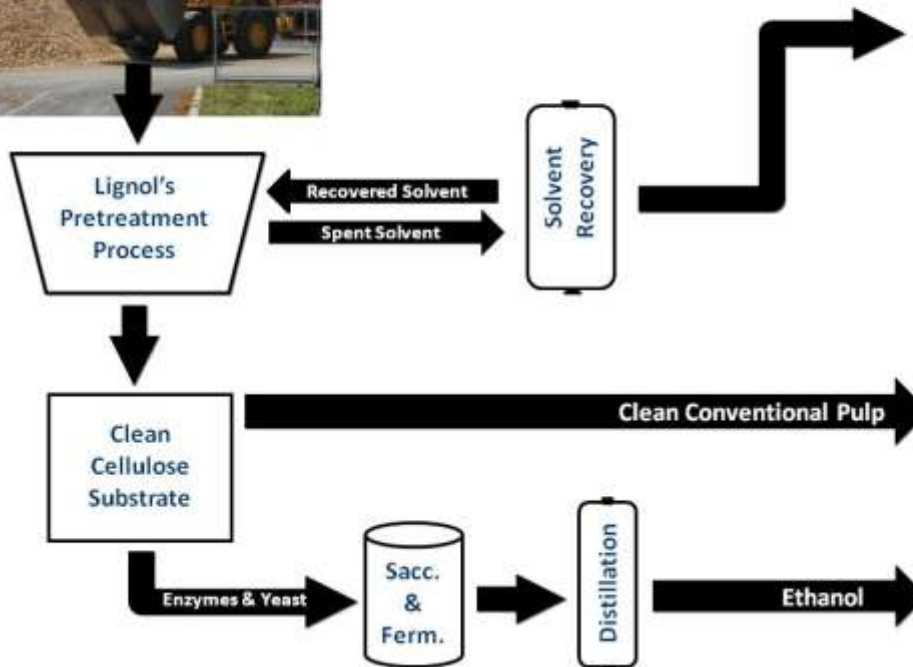




# Lignol Innovations Corporation

## Cellulosic Ethanol, HPL, and Chemicals

- Location: Pilot Plant in Burnaby, BC
- Technology: Patented Organosolv technique
- Feedstock: Woody biomass
- Collaborations with Novozymes and ORNL



- HP-L™ Lignin
- Furfural
- Specialty Chemicals
- Industrial Sugars





## Integrated Biorefinery Demonstration Plant producing Cellulosic Ethanol and Biochemicals from woody biomass

Lignol Innovations Inc. (Lignol) is developing a demonstration plant for the continuous production of cellulosic ethanol, high purity lignin and furfural from hardwoods. The plant will use Lignol's proprietary integrated biorefinery process which has been extensively pilot-proven on a wide variety of biomass feedstocks.

Lignol's technology is an integrated biorefinery process which consists of

- A well-proven modified organosolv pretreatment process for preparing cellulose for bioconversion.
- A proprietary bioconversion process, which itself is based on well-proven enzymatic hydrolysis and fermentation techniques, for producing ethanol.
- A number of established recovery processes to recycle solvent and to produce valuable co-products.

The most notable co-product is HP-L™ Lignin, a unique form of lignin having many potential applications where it will displace conventional petrochemicals in the chemical, forest products and materials



industries. The use of HP-L Lignin contributes to the exceptionally low carbon footprint of the Lignol Biorefinery - the plant will produce Ultra-low carbon cellulosic ethanol.

### Project Description

The plant, to be located in Ferndale, WA, will process 100 tpd of woody biomass, initially local hardwood which is plentiful within a 50 mile radius of the plant, and in future test campaigns, softwood and agricultural residues. The feedstock, which will come from local residues, will be chipped onsite and transported to the site by truck - the site is exceptionally well placed near highways, railways and a deepwater port. The resulting ethanol will be blended into the local gasoline supply. Lignin will be delivered to selected customers across the US, in biochemical applications.



### Potential Impact

A vital step on the path to realizing the goal of extensive commercial production of cellulosic ethanol in USA is the demonstration of the process at reduced scale. By funding this 10% scale demonstration plant, DOE is assisting in proving and de-risking Lignol's process technology, opening the way to commercial deployment across the country - future expansion of capacity at the Ferndale site is also possible. The facility could become the cornerstone of a wood-based cellulosic ethanol industry supplying the Pacific states.

### Other Partnerships

Lignol is assembling a consortium of strategic and financial partners to build, own and operate the facility

Prime	Lignol Innovations Inc.
Location	Ferndale, WA
Feedstock (s)	Alder, Aspen, Poplar and Cottonwood
Target Size	100 BD tonnes per day
Primary Products	Cellulosic Ethanol, Lignin, Furfural
Target Capacity	1.8 MGY ethanol, 5500 tonnes/Y lignin, 550 tonnes/Y furfural
Award Date	TBD
GHG Reduction	3 kg CO <sub>2</sub> eq/L of ethanol produced, 20,400 tonnes/Y
Anticipated Job Creation	200 people during plant build-out 39 people for plant and business operations
Company Point of Contact	Michael Rushton, <a href="mailto:mrushton@lignol.ca">mrushton@lignol.ca</a> , 604.453.1242

# Solegear Bioplastics

- Products: Traverse (hybrid) and Polysole plastics
  - proprietary
  - energy efficient
  - non-toxic
  - biodegradable
- Uses:
  - film, sheet, blow moulding and injection moulding
- Feedstock
  - natural materials and organic additives,

**SOLEGEAR**



# International Composting Corporation Biodiesel and Aviation Fuel

- Feedstock: municipal organic waste
- Pilot Plant in Nanaimo, BC
- Products:
  - synthetic diesel
  - aviation biofuels
- Technology: First small scale innovative liquid synthetic biodiesel and aviation fuel using a bioreactor, gasifier, and the Fischer-Tropes process



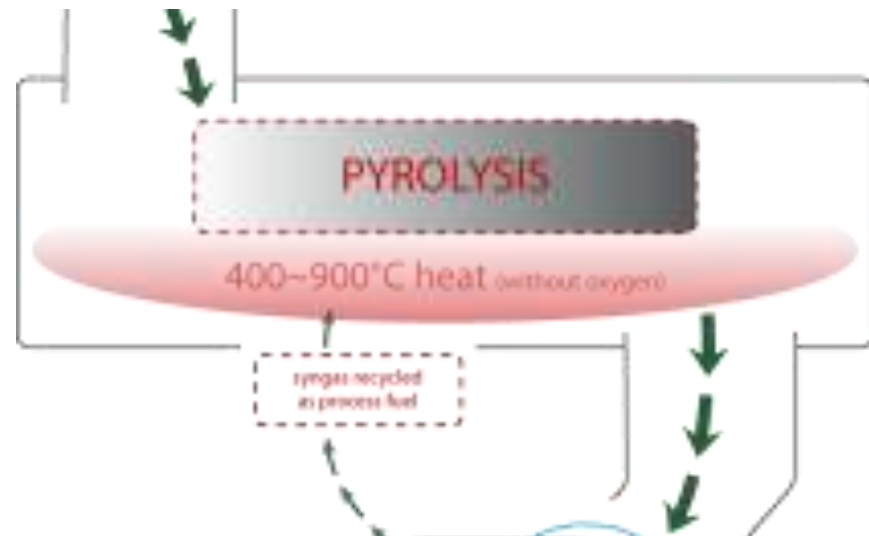
# Torrefied wood and Biocoal Companies

- **Canadian Bio-Coal Ltd.**
  - Location: Vancouver, BC
  - Feedstock: Woody biomass
  - Technology: Rotawave Targeted Energy System
  - Outputs: Biocoal for coal-fired power production
  
- **Alterna Biocarbon**
  - Location: Prince George, BC
  - Feedstock: Any organic material
  - Technology:
  - Outputs: Biochar, Terra-preta, Activated carbon,



# Diacarbon Energy

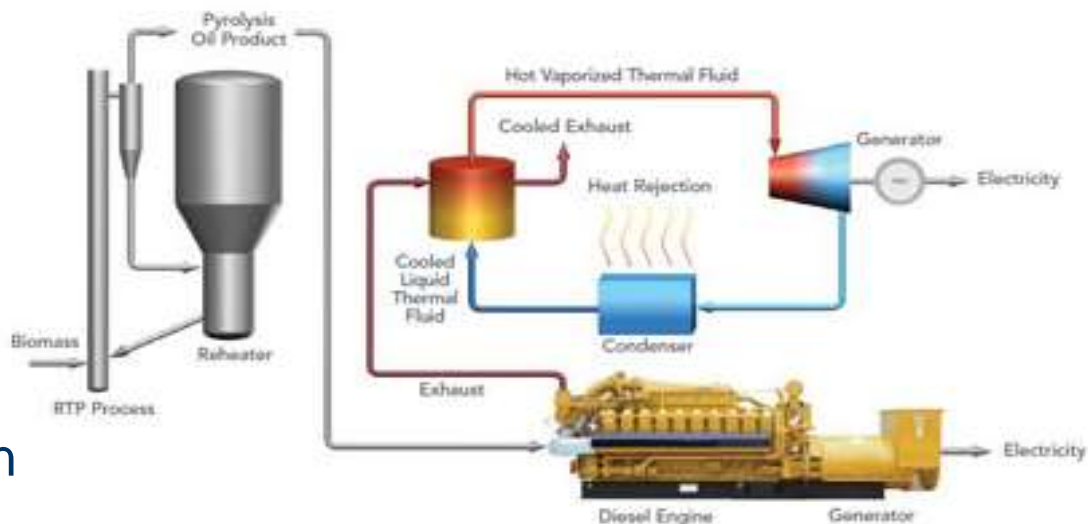
- Location: Burnaby, BC
- Feedstock: Woody biomass
- Technology: Portable pyrolysis technology
- Outputs: 2 TPH Biochar and bio-oil, and syngas
  
- BCBN + WPAC study



# Envergent

Pyrolysis oil: food additives, resins, gasoline

- Location: Ontario and Illinois
- Co-venture: Ensyn and Honeywell UOP
- Feedstock: wood residues
- Technology: proprietary pyrolysis process
- Outputs: pyrolysis oil, food additives, CHP, resin, drop-in gasoline,



# Paradigm Environmental

## Biogas production enhancement

- Location: Vancouver, BC
- Products: increased biogas production from WWTP and WAS in P&P plants
- Results
  - Decreased fertilizer
  - Decreased electricity
  - Decreased biosolids
  - Decreased transportation
  - Increased biogas

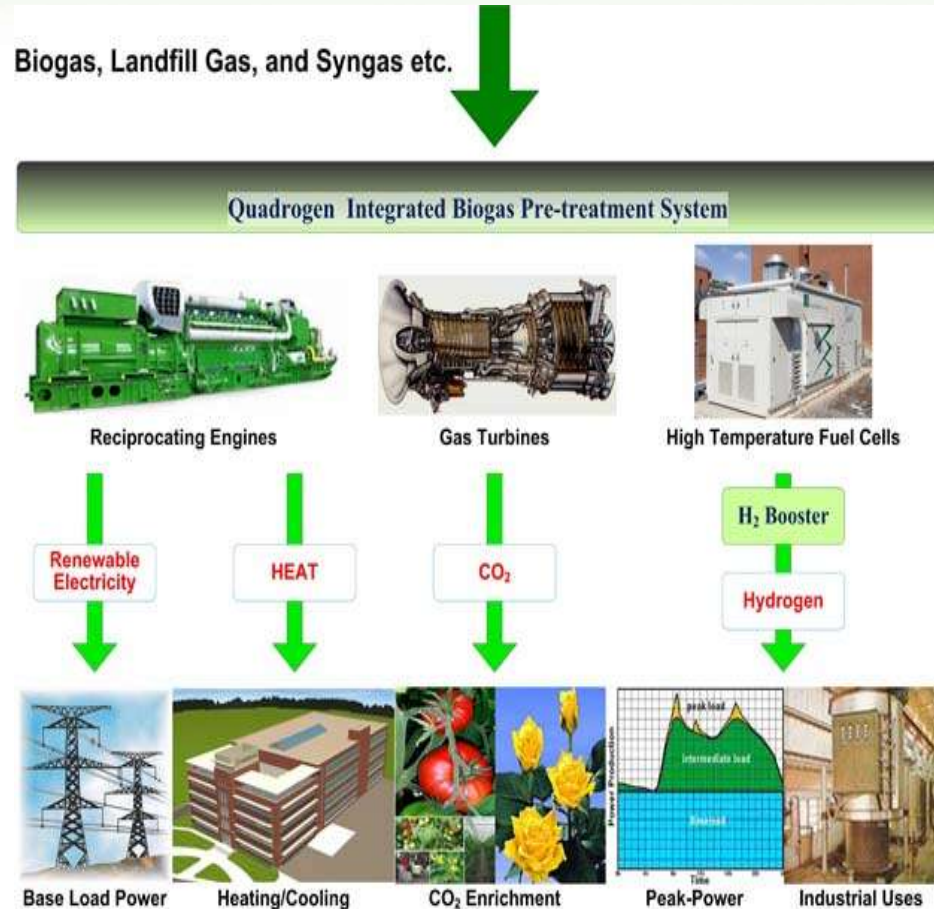




# Quadrogen Power Systems

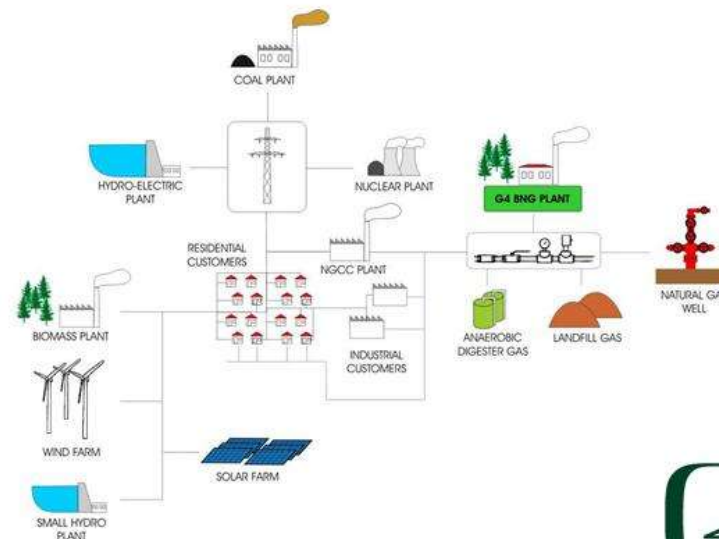
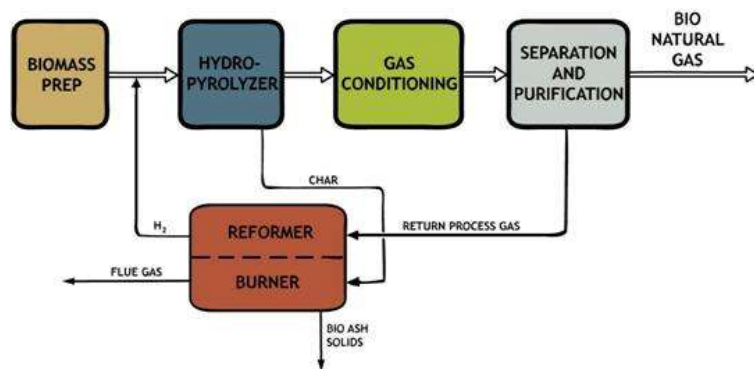
## Gaseous Fuel – High Purity Hydrogen

- Biogas clean-up and hydrogen co-production technologies
- Feedstock: bio-methane from landfills, WWTP, or anaerobic digesters
- Output: biogas and high-purity hydrogen for high-efficiency distributed power generation systems



## G4 Insights Inc.

- Thermochemical conversion of forestry biomass into bio-natural gas
- \$40 billion/year market for renewable natural gas from available biomass
- Renewable power in NGCC power plants – 20% cheaper than wind power
- Bio-CNG for transportation @ < \$2/gasoline gallon equivalent
- MOU's for \$120 million/year bio-natural gas sales
- \$2.5 million demo project supported by California Energy Commission
- Contact: Edson Ng [Tel: 604-451-9166 / edson@g4insights.com]



# Conclusion

- Build a Sustainable Bioenergy Industry linking BC to other jurisdictions
- Seeking partnerships and best-in-class technologies that can be applied in BC
- Collaborate with world leaders for bioproducts development
- Partnering for a Greener Future



# Thank you



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