**BioClustering**

**Bio-economy:** the economic activities related to the development and commercialization of products and processes – in whole or in part – using renewable biological sources from agriculture, forestry and marine.

**Biomass:** is agriculture and forestry fibre, by products and other feedstocks such as livestock manure.

**Bio-Industrial Products:** are products that use biomass to make chemicals materials and fuels.

**BioClusters:** are bio-industrial companies that co-locate to share resources such as a side or waste stream to realize economic opportunities.
Alberta is unique:

- Agriculture, Energy and Forestry in one jurisdiction
- Abundant Biomass
- Forested lands: 38 M ha or 60% of the province
- Agriculture: 21M ha in agriculture, 9.3M ha in crops and 0.7M ha under irrigation (2009 Statistics)
- Alberta food manufacturing sales reached a record $11.8 B in 2012. (Alberta Agri-Food Industries Data and Trends, Dec 2013)
Cross-sector utilization of Bio-mass

- Food processing waste streams
- Agricultural waste streams
- Forestry waste
- Industrial crops
- Specialty botanicals

- Functional Foods
- Neutraceuticals
- Cosmetic ingredients
- Active pharmaceutical ingredients (API)
- Energy applications
- Biomaterials
- Animal and Aquaculture feeds
Bio-Industrial Opportunities Branch

- Food and Bio Processing Division, Alberta Agriculture and Rural Development
- Highly dedicated team of business, scientific and engineering professionals
- Primary objective is to enable industry
  - through the application of science, engineering and business development.
Bio-Industrial Opportunities Branch

- Provide industry with business development expertise and specialized knowledge to identify and create new opportunities
- Provide facility and knowledge for process/product development and scale-up
- Support Industry and rural economic development
Our Focus: Maximizing Value and Sustainability

1. **New Opportunities for Ag Processing and Production Wastes / By-Products**
   - Reduce / reuse / repurpose agricultural production and processing wastes
   - Reuse into bioenergy (biogas, bioethanol)
   - Zero waste (goal is to an integrated, collaborative and sustainable waste to resource)

2. **Maximizing Value through Fractionation for Ingredients and Intermediaries**
   - Increase utilization and product identification from grains, oilseeds, pulses and biomass
   - Understand feedstock
   - Facilitate value chain development

3. **Facilitate Commercialization and market access**
   - Create an environment for companies to demonstrate, test market, and prepare for commercialization
   - Help for business connections, market information
Alberta Bioenergy Opportunities

- **Renewable Gasoline**
  - Ethanol
  - Methanol
  - Butanol
  - Green gasoline

- **Renewable Diesel**
  - FAME
  - HDRD

- **Biocrude**

- **Bio-coal**

- **Biogas**

- **Renewable Natural Gas**

- **Syngas**

- **Energy Pellets**
  - Straw
  - Waste
  - etc.

- **Renewable Chemicals for the Oil Patch**
  - Drilling fluids
  - Surfactants
  - Solvents
Alberta Biomaterials Opportunities

- Fibre processing
- Biocomposites
- Building products
- Textiles
- Automotive parts
- Reclamation / erosion control
- www.albertabiomaterials.com
Specialty Chemical Ingredient Initiative Initiative

• Unique government-industry collaboration advancing an emerging bio-based chemistry cluster in Alberta.
• Focused on development and commercialization of innovative, high-value ingredients/products from renewable biomass and biorefining sidestreams.

• www.agriculture.alberta.ca/biobasedchemicals
Alberta Biochemicals Opportunities

Specialty Chemical / High Value Ingredients

- Cosmetic and Personal Care Functions
  - Anti-microbial/Anti-inflammatory/Anti-irritant/Anti-oxidant
  - Preservative
  - Solvents
  - Emulsions/surfactants
  - SPF Boosters
  - Thickeners
  - Silicone replacements/styling resins

- Biorefining sidestreams
  - As intermediates for other ingredients

- Industrial and Household Cleaning
  - Surfactants/detergents

- Perfume/Fragrance

- Pharmaceutical/Nutraceutical

- Food and Feed

Industrial Bio-Based Chemicals

- Renewable Chemicals for the Oil Patch
  - Drilling muds
  - Surfactants
  - Solvents
  - De-icers
  - Rust inhibitors

- Industrial Chemicals
  - Solvents
  - Coatings
Our Services

Business Development

Scientific

Technical

Engineering
Business Development Services

- **Business Planning**
  - Market research
  - Feasibility studies
  - Assist with site locations
  - Access to funding

- **Strategic Counsel**
  - Supply chain logistics
  - Market access
  - Regulatory issues

- **Collaboration & Networking**
  - Academia
  - Industry
  - Municipalities
  - Regulators

- **Industry Advocacy**
  - We are a champion for Alberta’s bioeconomy!
Technical Services
Primary Processing - Dry

- Seed cleaning
- Decortication
- Sorting
- Sieving
- Milling
- Grinding
- Tempering
Dry Fractionation

- Size reduction
- Fine and coarse fractions
- Uniform particle size
- Dry fraction enrichment
- Pelletizing
Secondary Processing - Wet

- Extraction
- Maceration
- Oilseed processing
- Distillation
- Centrifugation
- Filtration
- Dewatering and concentrating
Extrusion & Pelleting

Non-traditional uses

- Bio-plastics & natural fibers
- Bio-composites
- Extrusion-assisted solvent extraction of bio-actives

- Fuel Pellets
- Volume reduction of biomass
- Processing feedstock
Tertiary Processing - Fractionation

- Precipitation/Flocculation
- Ultrafiltration/Nanofiltration
- Chromatography
Analytical

- Laser particle size profiling
- Surface area and pore size analysis (BET)
- Chemical & enzymatic assays
- Pressurized extraction
- UHPLC, NIR, FTIR & GC
- Chromatography
- Tangential filtration
- Formulation
Processed Hemp

- Stalk
  - Hurd
  - Fibre

- Dust/Particulates

- Seeds
  - Hulls
  - Oil
  - Protein

BIO - INDUSTRIAL OPPORTUNITIES
Aquaponics

Biologically, aquaponics is an example of an artificial ecosystem or agro-ecosystem designed for food production.
Mini Aquaponics Systems
Rosemary Roots

Hydroponics  Aquaponics
Polyol (Ozonolysis) Pilot Plant

- **O_3** → Ozonolysis Reaction → **H_2** → Hydrogenation Reaction → **Ni/Mo** → Filtration → Spent Ni/Mo → Purification → Polyol → **ROH**

- **Oil** → Ozonolysis Reaction
- **EA** → Ozonolysis Reaction

**Images:**
- Ozonolysis Reaction
- Hydrogenation Reaction
- Filtration
- Purification
Polyol Products

Potential bio-based products

- Bio-Diesel
- Adhesives
- Lubricants
- Polyurethanes & polyesters
- Foam insulation
- Other products requiring high temperature and high pressure
The Bio-Industrial Opportunities Branch

• We provide clients business, scientific & engineering cost-effective assistance to develop new products and processes from concept to commercialization.

• Our extensive business network allows you to be connected to potential partners and collaborators within Alberta and outside the province.

• We foster an environment to allow companies to convert current waste streams to value-added products in a wide range of industry sectors.

• Our expertise includes:
  • Bio-based materials, fuels, lubricants and adhesives
  • Non-traditional use of extrusion technologies
  • Extraction and purification of bio-based materials

• We welcome the opportunity to discuss how we can assist your company!
Thank you!

For more information:

- **Phone**: (780) 644-8118
- **Email**: biobranch@gov.ab.ca
- **Website**: http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/All/bt14861